MINISTRY OF HEALTH OF UKRAINE
Kharkov National Medical University
Physiology department

STUDY GUIDE

Part II
PHYSIOLOGY OF VISCERAL SYSTEMS

Name_____

Faculty_____

Group _____ course _____

2020

MINISTRY OF HEALTH OF UKRAINE
Kharkov National Medical University
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STUDY GUIDE

Part II
PHYSIOLOGY OF VISCERAL SYSTEMS

Training tests of license exam "Krok 1"
with answers and explanations
for individual work of English-speaking students
for medical and dental faculties

Частина ІІ. «Фізіологія вісцеральних систем»

Тренувальні тести в форматі «Крок 1»
для самостійної підготовки студентів
з англомовною формою навчання
з відповідями та поясненнями
(для медичних та стоматологічного факультетів)

Затверджено
Вченою радою ХНМУ.
Протокол № 1.від 28.01.2021.

Харків
ХНМУ
2021

Study guide. Part II “Physiology of Visceral Systems”: Training tests of license exam ”Krok 1” with answers and explanations for individual work of English-speaking students (for medical and dental faculties) / compil. D. I. Marakushin, L. V. Chernobay, I. S. Karmazina et al. – Kharkov : KhNMU, 2021. – 120 p.

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Тренувальні тести в форматі «Крок 1» для самостійної підготовки студентів з англомовною формою навчання з відповідями та поясненнями (для медичних та стоматологічного факультетів). Частина ІІ. «Фізіологія вісцеральних систем» / упоряд. Д. І. Маракушин, Л. В. Чернобай, І. С. Кармазіна та ін. – Харків : ХНМУ, 2021. – 120 с.

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Dear Students!"

This Study Guide was created to help you to get ready for License exam "Krok 1", but it's not the only reason. In your future life as a doctor every day you will face different clinical situations and you will have to make a decision what to do. Each task in this manual is a little clinical situation which you have to solve and get the proper answer about diagnosis, research methods, and appropriate treatment, etc. So, in fact, it is the first step to achieve your dream to become a doctor. Physiology is a base of all medical sciences that's why whichever medical career you may choose you'll use your physiology knowledge anyway. Our subject may be difficult but we hope for you it will become interesting and one of your favorites and this Study Guide will help you to make a firm step towards your dream!

Good luck! Let's start working!

The strategy and algorithm of task solution

1. **Read the task carefully and while reading chose the key words, which are the most relevant for the solution!**
2. **Think about the mechanism and try to represent it schematically.**
3. **Choose one correct option.**
4. **Compare your answer with the correct one and read explanation attentively.**
5. **If you need to revise more information or work out the mechanism, follow the reference given in the explanation.**

For example:

The penetration of the irritable cell membrane for potassium ions has been increased during an experiment. What changes of membrane electric status can occur?

A. Action potential. *C. Depolarization.* *E. Local response.*
B. Hyperpolarization. *D. No changes.*

1. Read the task carefully!

2. Chose key words! They are **PENETRATION, POTASSIUM, INCREASED**

3. Positive after-potential (hyperpolarization, after-hyperpolarization) linked with changes (increased) in permeability of cell membrane for potassium ions.

4. So, chose correct option which is B. Hyperpolarization.

REFERENCES

1. Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elsevier, 2006.
2. USMLE Step 1 Lecture Notes. 2013, 2018 © by Kaplan, Inc.
3. Linda. S. Costanzo Physiology (fifth edition) / Linda. S. Costanzo. – Elsevier, 2014.
4. Kim E. Barret Medical Physiology: Examination & Board Review / Kim E. Barret, Susan M. Barman, Scott Boitano, Jane F. Reckelhoff. – © McGraw-Hill Education, 2018.
5. Widmaier, Eric P. Vander's Human Physiology: The Mechanisms of Body Function (thirteenth edition) / Widmaier, Eric P., Hershel Raff, Kevin T. Strang. – © The McGraw−Hill Companies, 2014.
6. Medical physiology: principles for clinical medicine / edited by Rodney A. Rhoades, David R. Bell. – 4th ed. – © Lippincott Williams & Wilkins, a Wolters Kluwer business, 2013.
7. Ganong′s review of medical physiology (23rd edition) / Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen L. Brooks. – McGrawHill Lange, 2010.
8. Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003.
9. Human physiology volume I (tenth edition) / C.C. Chatterjee.-Medical Allied Agency, Calcutta, 1985.
10. Human physiology (twelfth edition) / Stuart Ira Fox.- McGraw-Hill, 2011.
11. Human anatomy and physiology (seventh edition) / Elaine N. Marieb, Katja Hoehn. – Person Education. Inc. publishing as Benjamin Cummings, 2007.
12. Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016.
13. Human Physiology / E. Babsky, B. Khodorov, G. Kositsky, A. Zubkov. – Moskow : Mir Publishers, 1975.
14. Human physiology volume I / G.I. Kositsky. – Medicine, 1990.

PHYSIOLOGY OF BLOOD SYSTEM

Questions

Physical and chemical properties of blood

1. During total (with water) alimentary starvation the generalized edema has developed. Which of the pathogenic factors is dominant is this case?

A. Reduced osmotic pressure of blood plasma.
B. Increased osmotic pressure of interstitial fluid.
C. Reduced oncotic pressure of blood plasma.
D. *Increased oncotic pressure of interstitial fluid.*
E. *Reduced hydrostatic pressure of interstitial fluid.*

Notes:_____

2. The concentration of albumins in human blood sample is lower than normal. This leads to edema of tissues. What blood function is damaged?

A. Maintaining the -blood sedimentation system.
B. Maintaining the oncotic pressure of blood.
C. Maintaining the body temperature.
D. All answers are correct.
E. Maintaining the pH level.

Notes:_____

3. Osmotic pressure of a man's blood plasma is 350 mosmole/l (standard pressure is 300 mosmole/l). First of all it will result in high secretion of the following hormone:

A. Natriuretic. *B. Aldosteron.* *C. Vasopressin.* *D. Adrenocorticotropin.* *E. Cortisol.*

Notes:_____

4. After a surgery a 36-year-old woman was given an intravenous injection of concentrated albumin solution. This has induced intensified water movement in the following direction:

A. From the cells to the intercellular fluid.
B. From the capillaries to the intercellular fluid.
C. From the intercellular fluid to the capillarie.
D. From the intercellular fluid to the cells.
E. No changes of water movement will be observed.

Notes:_____

5. As a result of long-term starvation the glomerular filtration of a man was accelerated by 20 %. The most probable cause of filtration changes under such conditions is:

A. . Increased permeability of renal filter
B. . Fall of oncotic pressure of blood plasma
C. Rise of systemic arterial pressure.
D. Growth of filtration coefficient.
E. Increase of renal plasma flow.

Notes:_____

6. Packed cell volume of a man was 40% before the trauma. What packed cell volume will be observed 24 hours after blood loss of 750 ml?

A. 55 %. *B. 50 %.* *C. 45 %.* *D. 40 %.* *E. 30 %.*

Notes:_____

7. A patient is 44 years old. Laboratory examination of his blood revealed that content of proteins in plasma was 40 g/l. What influence will be exerted on the transcapillary water exchange?

A. Both filtration and reabsorption will be increase.
B. Both filtration and reabsorption will be decreased.
C. Filtration will be decreased, reabsorption – increased.
D. Filtration will be increased, reabsorption – decreased.
E. Exchange will stay unchanged

Notes:_____

8. A patient who has been treated for viral hepatitis B developed symptoms of hepatic insufficiency. What changes indicating disorder in protein metabolism are likely to be observed in this case?

A. Absolute hyperfibrinogenemia.
B. Absolute hyperglobulinemia.
C. Absolute hypoalbuminemia.
D. Absolute hyperalbuminemia.
E. Protein rate in blood will stay unchanged.

Notes:_____

9. To lose some weight a woman has been limiting the amount of products in her diet. 3 months later she developed edemas and her diuresis increased. What dietary component deficiency is the cause of this?

A. Proteins. *B. Fats.* *C. Vitamins.* *D. Minerals.* *E. Carbohydrates.*

Notes:_____

10. During acute hemorrhage the body loses not only fluid but also electrolytes. What substance solution can be used as a simple blood substitute?

A. Albumin.
B. Calcium chloride.
C. Sodium bromide.
D. Sodium nucleotide.
E. Sodium chloride.

Notes:_____

11. Examination of a man who had been working hard under higher temperature of the environment revealed abnormal quantity of blood plasma proteins. What phenomenon is the case?

A. Absolute hyperproteinemia. *C. Relative hyperproteinemia.* *E. Paraproteinemia.*
B. Absolute hypoproteinemia. *D. Dysproteinemia.*

Notes:_____

12. Toxic affection of liver results in dysfunction of protein synthesis. It is usually accompanied by the following kind of dysproteinemia:

A. Relative hypoproteinemia. *C. Absolute hypoproteinemia.* *E. Paraproteinemia.*
B. Relative hyperproteinemia. *D. Absolute hyperproteinemia.*

Notes:_____

13. Upon toxic damage of hepatic cells resulting in disruption of liver function the patient developed edemas. What changes of blood plasma are the main cause of edema development?

A. Decrease of albumin content. *D. Increase of albumin content.*
B. Increase of globulin content. *E. Decrease of globulin content.*
C. Decrease of fibrinogen content.

Notes:_____

Physiology of RBC

14. If strong oxidizers get into the bloodstream, a met-hemoglobin is formed. It is a compound, where iron (II) becomes iron (III). What has to be done to save the patient?

A. He has to be given pure oxygen. *D. Interchangeable hemotransfusion has to be done.*
B. Patient has to be exposed to the fresh air. *E. He has to be calmed down and put to bed.*
C. Respiratory centers have to be stimulated.

Notes:_____

15. A patient is diagnosed with chronic atrophic gastritis attended by deficiency of Castle's intrinsic factor. What type of anemia does the patient have?

A. Iron refractory anemia. *C. B_{12}-deficiency anemia.* *E. Hemolytic anemia.*
B. Iron-deficiency anemia. *D. Protein-deficiency anemia.*

Notes:_____

16. A man lost consciousness in a car with running engine where he had been waiting for a friend for a long time. What hemoglobin compound can be found in the blood of the patient?

A. Carbhemoglobin. *C. Carboxyhemoglobin.* *E. Oxyhemoglobin.*
B. Methemoglobin. *D. Deoxyhemoglobin.*

Notes:_____

17. A man permanently lives high in the mountains. What changes of blood characteristics can be found in his organism?

A. Decrease of hemoglobin content . *D. Erythroblasts in blood.*
B. Decrease of reticulocytes number. *E. Increase of erythrocytes number.*
C. Decrease of colour index of blood.

Notes:_____

18. A 32-year-old patient was admitted to the hospital with gross blood loss due to auto accident trauma. Ps – 110 Bpm, RR – 22 pm, BP – 100/60 mm Hg. What changes in the blood will occur in an hour after the blood loss?

A. Erythropenia. *C. Leukopenia.* *E. Hypochromia of erythrocytes.*
B. Hypovolemia. *D. Hypoproteinemia.*

Notes:_____

19. Examination of a pregnant woman revealed twice as much concentration of fibrinogen in blood plasma. What ESR can this woman have?

A. 0–5 mm/h. *B. 2–12 mm/h.* *C. 5–10 mm/h.* *D. 10–15 mm/h.* *E. 40–50 mm/h.*

Notes:_____

20. In a dysentery patient undergoing treatment in the contagious isolation ward, a significant increase in packed cell volume has been observed (60 %). What other value will be affected by this change?

A. Increasing blood viscosity. *D. Increasing volume of blood circulation.*
B. Increasing erythrocyte sedimentation rate (ESR). *E. Thrombocytopenia.*
C. Leukopenia.

Notes:_____

21. A man weighs 80 kg, after long physical activity his circulating blood volume is reduced down to 5.4 l, hematocrit makes up 50 %, whole blood protein is 80 g/l. These blood characteristics are determined first of all by:

A. Increased number of erythrocytes. *D. Increased dieresis.*
B. Increased protein concentration in plasm. *E. Water loss with sweat.*
C. Increased circulating blood volume.

Notes:_____

22. Examination of a 43 y.o. anephric patient revealed anemia symptoms. What is the cause of these symptoms?

A. Iron deficit. *C. Folic acid deficit.* *E. Enhanced destruction of erythrocytes.*
B. Vitamin B_{12} deficit. *D. Reduced synthesis of erythropoietins.*

Notes:_____

23. Examination of a patient, suffering from atrophic gastritis, revealed megaloblastic anemia. The anemia is likely to be caused by the deficiency of the following substance:

A. Iron. *B. Vitamin B_1.* *C. Vitamin B_6.* *D. Gastromucoproteid.* *E. Erythropoietins.*

Notes:_____

24. A 38-year-old woman was admitted to the admission-diagnostic department with uterine bleeding. What are the most likely changes of blood?

A. Leukopenia. *C. Increase of haematocrite rate.* *E. Polycythemia.*
B. Leucocytosis. *D. Reduction of haematocrite rate.*

Notes:_____

25. A blood drop has been put into a test tube with 0,3% solution of NaCl. What will happen with erythrocytes?

A. Shrinkage. *C. Osmotic haemolysis.* *E. Any changes will be observed.*
B. Mechanical haemolysis. *D. Biological haemolysis.*

Notes:_____

26. A 42 y.o. patient complains of pain in the epigastral area, vomiting; vomit masses have the colour of "coffee-grounds", the patient has also melena. Anamnesis records gastric ulcer. Blood formula: erythrocytes – $2{,}8 \times 10^{12}$/l, leukocytes – 8×10^{9}/l, Hb – 90 g/l. What complication is it?

A. Penetration. *B. Perforation.* *C. Pyloric stenosis.* *D. Haemorrhage.* *E. Canceration.*

Notes:_____

27. It is known that people who permanently live in highland have an increased concentration of erythrocytes per each blood volume unit. Owing to this fact blood can optimally fulfil the following function:

A. Maintenance of acid-base balance. *D. Amino acid transport.*
B. Maintenance of ionic equilibrium. *E. Haemostasis participation.*
C. Gas transport.

Notes:_____

28. Long-term starvation cure of a patient resulted in diminished ratio of albumins and globulins in plasma. What of the following will be result of these changes?

A. Decrease of hematocrit. *C. Decrease of ESR.* *E. Increase of ESR.*
B. Increase of hematocrit. *D. Hypercoagulation.*

Notes:_____

29. A 29-year-old patient was delivered to a hospital because of intoxication with carbon monoxide. Objectively: the patient presents with symptoms of severe hypoxia – evident dyspnea, cyanosis, tachycardia. What compound is produced as a result of intoxication with carbon monooxide?

A. Methemoglobin. *C. Oxyhemoglobin.* *E. Sulfhemoglobin.*
B. Carbhemoglobin. *D. Carboxyhemoglobin.*

Notes:_____

30. A patient is diagnosed with severe B_{12}-deficiency anemia resulting in disturbed hematopoiesis and appearance of atypical erythrocytes in the blood. The patient has history of total gastric resection. This diagnosis can be confirmed if the following cells are present in the peripheral blood:

A. Megalocytes. *B. Elliptocytes.* *C. Anulocytes.* *D. Microcytes.* *E. Normocytes.*

Notes:_____

Physiology of WBC

31. Blood sampling for bulk analysis is recommended to be performed on an empty stomach and in the morning. What changes in blood composition can occur if to perform blood sampling after food intake?

A. Reduced contents of erythrocytes. *D. Increased plasma proteins.*
B. Increased contents of erythrocytes. *E. Increased contents of leukocytes.*
C. Reduced contents of thrombocytes.

Notes:_____

32. In allergic disease, a dramatic increase in basophilic leukocyte number in patient' blood is observed. This phenomenon is due to the following basophil function:

A. Phagocytosis of immune complexes.
B. Phagocytosis of microorganisms and small particles.
C. Participation in blood clotting.
D. Participation of heparin and histamine in metabolism.
E. Immunoglobulin synthesis.

Notes:_____

33. ESR of a patient with pneumonia is 48 mm/h. What caused such changes?

A. Hypogammaglobulinemia. *C. Hypergammaglobulinemia.* *E. Erythrocytosis.*
B. Hypoproteinemia. *D. Hyperalbuminemia.*

Notes:_____

34. A 3-year-old child had eaten some strawberries. Soon he developed a rash and itching. What was found in the child's leukogram?

A. Neutrophilic leukocytosis. *C. Lymphocytosis.* *E. Hypolymphemia.*
B. Monocytosis. *D. Eosinophilia.*

Notes:_____

35. After an attack of bronchial asthma a patient had his peripheral blood tested. What changes can be expected?

A. Thrombocytopenia. B. Leukopenia. C. Eosinophilia. D. Lymphocytosis. E. Erythrocytosis.

Notes:_____

36. Blood count of an athlete is as follows: erythrocytes – $5{,}5 \times 10^{12}$/l, Hb – 180 g/l, leukocytes – 7×10^{9}/l, neutrophils – 64 %, basophils – 0,5 %, eosinophils – 0,5 %, monocytes – 8 %, lymphocytes – 27 %. First of all, such results indicate the stimulation of:

A. Leukopoiesis. B. Lymphopoiesis. C. Granulocytopoiesis. D. Immunogenesis. E. Erythropoiesis.

Notes:_____

37. A patient with skin mycosis has disorder of cellular immunity. The most typical characteristic of it is reduction of the following index:

A. B-lymphocytes. B. T-lymphocytes. C. Immunoglobulin G. D. Immunoglobulin E. E. Plasmocytes.

Notes:_____

38. Electrophoretic study of a blood serum sample, taken from the patient with pneumonia, revealed an increase in one of the protein fractions. Specify this fraction:

A. Albumins. B. α_1-globulins. C. α_2-globulins. D. β-globulins. E. γ-globulins.

Notes:_____

39. The cellular composition of exudate largely depends on the etiological factor of inflammation. What leukocytes are the first to get into the focus of inflammation caused by pyogenic bacteria?

A. Monocytes. C. Myelocytes. E. Eosinophilic granulocytes.
B. Basophils. D. Neutrophil granulocytes.

Notes:_____

40. After honey consumption a teenager had urticaria accompanied by leukocytosis. What type of leukocytosis is it in this case?

A. Lymphocytosis. C. Basophylic leukocytosis. E. Neutrophilic leukocytosis.
B. Monocytosis. D. Eosinophilic leukocytosis.

Notes:_____

41. Blood analysis of a patient showed signs of HIV infection (human immunodeficiency virus). Which cells does HIV-virus primarily affect?

A. Proliferating cells (stem hematoplastic cells).
B. Cells that contain receptor IgM (B-lymphocytes).
C. Cells that contain receptor T4 (T-helpers).
D. Specialized nervous cells (neurons).
E. Mast cells.

Notes:_____

42. Blood analysis of a 16-year-old girl suffering from the autoimmune inflammation of thyroid gland revealed multiple plasmatic cells. Such increase in plasmocyte number is caused by proliferation and differentiation of the following blood cells:

A. Tissue basophils. B. T-helpers. C. T-killers. D. T-supressors. E. B-lymphocytes.

Notes:_____

43. A 5 year old child is ill with measles. Blood analysis revealed increase of total number of leukocytes up to 13×10^9/l. Leukogram: basophils – 0, eosinophils – 1, myelocytes – 0, juvenile neutrophils – 0, band neutrophils – 2, segmented neutrophils – 41, lymphocytes – 28, monocytes – 28. Name this phenomenon:

A. Agranulocytosis. B. Lymphocytosis. C. Eosinopenia. D. Monocytosis. E. Neutropenia.

Notes:_____

44. Differentiation of B-lymphocytes into plasma cells leads to synthesis of immunoglobulins that ensure specific immune response of the body. Differentiation of B-lymphocytes takes place in the following organ of immune system:

A. Liver. B. Tonsils. C. Thymus. D. Thyroid gland. E. Red bone marrow.

Notes:_____

45. An inflammation can be characterized by hemocapillary dilation in the affected area, decreased blood circulation, and increased vessels permeability. What cells play the key role in this process?

A. Tissue basophils. B. Fibroblasts. C. Eosinophils. D. Macrophages. E. Plasma cells.

Notes:_____

46. The 30-year-old person has been stung by a bee. The stung area exhibits edema, hyperemia, and elevated temperature. What is initial pathogenetic factor of inflammatory edema in this case?

A. Disturbed lymphatic efflux.
B. Decrease of oncotic pressure.
C. Increase of osmotic pressure.
D. Increase of capillary blood pressure.
E. Increased of microvascular permeability.

Notes:_____

47. The patient has been suffering from bronchial asthma for 15 years. What changes in the patient's leukogram can be expected in this case?

A. Leukocytosis. *B. Leukopenia.* *C. Left shift.* *D. Eosinophilia.* *E. Basophilia.*

Notes:_____

Physiology of blood coagulation

48. A 3-year-old boy with pronounced hemorrhagic syndrome doesn't have antihemophilic globulin A (factor VIII) in the blood plasma. Hemostasis has been impaired at the following stage:

A. Conversion of prothrombin to thrombin.
B. Conversion of fibrinogen to fibrin.
C. Blood clot retraction.
D. External mechanism of prothrombinase activation.
E. Internal mechanism of prothrombinase activation.

Notes:_____

49. A 16 years old boy after an illness has diminished function of protein synthesis in liver as a result of vitamin K deficiency. It will cause disturbance of:

A. Anticoagulant generation. *C. Erythrocyte sedimentation rate.* *E. Osmotic blood pressure.*
B. Erythropoietin secretion. *D. Blood coagulation.*

Notes:_____

50. Punctata hemorrhage was found out in the patient after application of a tourniquet. With disfunction of what blood cells is it connected?

A. Neutrophiles. *B. Eosinophiles.* *C. Monocytes.* *D. Lymphocytes.* *E. Platelets.*

Notes:_____

51. A tooth extraction in a patient with chronic persistent hepatitis was complicated with prolonged hemorrhage. What is the reason for the haemorrhagic syndrome?

A. Decrease in fibrin production.
B. Decrease in thrombin production.
C. Increase in thromboplastin production.
D. Increase in fibrinogen synthesis.
E. Fibrinolysis intensification.

Notes:_____

52. A clinic observes a 49 year old patient with significant prolongation of coagulation time, gastrointestinal haemorrhages, subcutaneous hematomas. These symptoms might be explained by the deficiency of the following vitamin:

A. B_1. *B.* B_6. *C. H.* *D. K.* *E. E.*

Notes:_____

53. After implantation of a cardiac valve a young man constantly takes indirect anticoagulants. His state was complicated by hemorrhage. What substance content has decreased in blood?

A. Heparin. *B. Prothrombin.* *C. Haptoglobin.* *D. Creatin.* *E. Ceruloplasmin.*

Notes:_____

54. A patient is diagnosed with hereditary coagulopathy that characterized by factor VIII deficiency. Specify the phase of blood clotting during which coagulation will be disrupted in the given case:

A. Fibrin formation. *C. Thrombin formation.* *E. –.*
B. Thromboplastin formation. *D. Clot retraction.*

Notes:_____

55. After pancreatic surgery the patient developed hemorrhagic syndrome with disturbed 3rd stage of blood clotting. What will be the most likely mechanism of the hemostatic disorder?

A. Decrease of prothrombin synthesis. *D. Fibrin-stabilizing factor deficiency.*
B. Decrease of fibrinogen synthesis. *E. Qualitative abnormalities of fibrinogenesis.*
C. Fibrinolysis activation.

Notes:_____

56. A 60-year-old man suffering from chronic hepatitis frequently observes nasal and gingival hemorrhages, spontaneous hemorrhagic rashes on the skin and mucosa. Such presentations result from:

A. Decreased synthesis of prothrombin and fibrinogen.
B. Increased blood content of aminotransferases.
C. Decreased synthesis of serum albumins.
D. Increased blood content of macroglobulins.
E. Decreased blood content of cholinesterase.

Notes:_____

57. A patient visited a dentist to extract a tooth. After the tooth had been extracted, bleeding from the tooth socket continued for 15 minutes. Anamnesis states that the patient suffers from active chronic hepatitis. What phenomenon can extend the time of hemorrhage?

A. Decrease of fibrinogen content in blood. *D. Increased activity of anticoagulation system.*
B. Thrombocytopenia. *E. Decrease of albumine content in blood.*
C. Hypocalcemia.

Notes:_____

58. A patient, who has been suffering for a long time from intestine disbacteriosis, has increased hemorrhaging caused by disruption of posttranslational modification of blood-coagulation factors II, VII, IX, and X in the liver. What vitamin deficiency is the cause of this condition?

A. B_{12}. *B.* B_9. *C. C.* *D. K.* *E. P.*

Notes:

59. A patient is diagnosed with hereditary coagulopathy that is characterized by factor VIII deficiency. Specify the phase of blood clotting during which coagulation will be disrupted in the given case:

A. Thrombin formation. *C. Fibrin formation.* *E. –.*
B. Thromboplastin formation. *D. Clot retraction.*

Notes:

60. A patient complains of frequent gingival haemorrhages he has been experiencing since his childhood. Blood test revealed a deficiency in blood-coagulation factor VIII. This means that the patient has an impairment of:

A. Thrombin generation. *C. Prothrombinase generation.* *E. Thrombocyte aggregation.*
B. Fibrin generation. *D. Thrombocyte adhesion.*

Notes:

61. A patient has petechial hemorrhages on the gums, hard and soft palate, buccal mucosa. This is caused by the dysfunction of the following blood corpuscles:

A. Eosinophils. *B. Monocytes.* *C. Lymphocytes.* *D. Platelets.* *E. Erythrocytes.*

Notes:

62. There is an inhibited coagulation in the patients with bile ducts obstruction, bleeding due to the low level of absorption of a vitamin. What vitamin is in deficiency?

A. Carotene. *B. E.* *C. K.* *D. A.* *E. D.*

Notes:

63. A clinic observes a 49 year old patient with significant prolongation of coagulation time, gastrointestinal hemorrhages, subcutaneous hematomas. These symptoms might be explained by the deficiency of the following vitamin:

A. B_1. *B.* B_6. *C. H.* *D. K.* *E. E.*

Notes:

64. A patient with tissue trauma was taken a blood sample for the determination of blood clotting parameters. Specify the right sequence of extrinsic pathway activation.

A. III–IV–Xa. B. IV–VIII: TF–Xa. C. IV–VIIa–Xa. D. III–VIII: TF–Xa. E. III–VIIa–Xa.

Notes:_____

65. A 2-year-old child has got intestinal dysbacteriosis, which results in hemorrhagic syndrome. What is the most likely cause of hemorrhage of the child?

A. Activation of tissue thromboplastin. C. Vitamin K insufficiency. E. PP hypovitaminosis.
B. Fibrinogen deficiency. D. Hypocalcemia.

Notes:_____

66. A 29-year-old patient complains of frequent gingival hemorrhages. Blood test revealed the clotting factor II (prothrombin) deficiency. What phase of blood coagulation is impaired in this patient?

A. Clot retraction. C. –. E. Vascular-platelet haemostasis.
B. Fibrinolysis. D. Thrombin generation.
A. . B. . C. D. .

Notes:_____

Blood types

67. Blood group of a 30 year old man was specified before an operation. His blood is Rh-positive. Reaction of erythrocyte agglutination was absent with standard sera of 0$\alpha\beta$ (I), Aβ (II), Bα (III) groups. The blood under examination is of the following group:

A. 0αβ (I). B. Aβ (II). C. Bα (III). D. AB (IV). E. –.

Notes:_____

68. On blood grouping on the system ABO, standard serum of the I and II groups caused erythrocytes agglutination of the examined blood and serum group of the III didn't. What agglutinogens are in these erythrocytes?

A. A and B. B. A. C. B. D. D and C. E. C.

Notes:_____

69. It was established that agglutination of the recipient's blood erythrocytes had been caused by the standard sera from the I and II groups. Serum from the III group as well as anti-Rh serum hadn't provoke any agglutination. Which blood group and rhesus is allowed to be transfused this recipient?

A. Aβ (II) Rh-. B. Bα (III) R-. C. AB (IV), Rh-. D. 0αβ (I) Rh+. E. AB (IV), Rh+.

Notes:_____

70. A woman with III (B), Rh- blood group born a child with II (A) blood group. The child is diagnosed with hemolytic disease of newborn as a result of rhesus incompatibility. What blood group is the child's father likely to have?

A. I (0), Rh +. *B. II (A), Rh+.* *C. III (B), Rh+.* *D. I (0), Rh-.* *E. II (A), Rh-.*

Notes:_____

71. A pregnant woman had her blood group identified. Reaction of erythrocyte agglutination with standard serums of 0αβ (I), Bα (III) groups didn't proceed with standard serum of Aβ (II) group. The blood group under examination is:

A. 0αβ(I). *B. Aβ (II).* *C. Bα (III).* *D. AB (IV).* *E. –.*

Notes:_____

72. A pregnant woman underwent AB0 blood typing. Red blood cells were agglutinated with standard sera of the I and II blood groups, and were not agglutinated with the III group serum. What is the patient's blood group?

A. 0(I). *B. A(II).* *C. B(III).* *D. AB(IV).* *E. –.*

Notes:_____

73. Blood group of a 30 year old man was specified before an operation. His blood is Rh-positive. Reaction of erythrocyte agglutination was absent with standard sera of 0αβ(I), Aβ(II), Bα(III) groups. The blood under examination is of the following group:

A. 0αβ(I). *B. Aβ(II).* *C. Bα(III).* *D. AB (IV).* *E. –.*

Notes:_____

74. Before an operation a 30-yearold male patient had his blood typed. It turned out to be Rh-positive. Erythrocytes were not agglutinated by standard sera of 0(I), A(II), B(III) groups. According to the AB0 blood group system this blood is of the following type:

A. 0(I). *B. A(II).* *C. B(III).* *D. AB(IV).* *E. –.*

Notes:_____

75. In hemotransfusions it is recommended to transfuse only phenotype-matched blood. According to the AB0 system, blood group is determined by:

A. Proteins of blood serum.
B. Protein determinants of erythrocyte membranes.
C. Protein-polysaccharide components of leukocytes.
D. Carbohydrate determinants of leukocyte membranes.
E. Carbohydrate determinants of erythrocyte membranes.

Notes:_____

76. A woman with A (II), Rh-negative blood had a child with B (III), Rh-positive blood. The child was diagnosed with congenital anaemia of newborns. What is the most likely cause of its development?

A. AB0-incompatibility. *C. Hereditary chromosomal pathology.* *E. Intrauterine infection.*
B. Rhesus incompatibility. *D. Intrauterine intoxication.*

Notes:_____

77. Determining a patient's blood group with monoclonal test-reagents revealed positive agglutination reaction to anti-A and anti-B reagents, and negative reaction to anti-D. What blood group does this patient have?

A. I (0) Rh+. *B. II (A) Rh+.* *C. III (B) Rh+.* *D. IV (AB) Rh+.* *E. IV (AB) Rh-.*

Notes:_____

78. A pregnant woman underwent AB0 blood typing. Red blood cells were agglutinated with standard sera of the I and II blood groups, and were not agglutinated with the III group serum. What is the patient's blood group?

A. B(III). *B. 0(I).* *C. A(II).* *D. AB(IV).* *E. –.*

Notes:_____

79. When defining blood group according to the AB0 system, using salt solutions of monoclonal antibodies, agglutination didn't occur with any of the solutions. What blood group is it?

A. 0(I). *B. A(II).* *C. B(III).* *D. AB(IV).* *E. –.*

Notes:_____

80. A 25-year-old woman at her third pregnancy with impending miscarriage was brought to the hospital. What combination of Rh-factor of mother and the fetus can be the cause of this condition?

A. Mother (-), fetus (+). *C. Mother (-), fetus (-).* *E. –.*
B. Mother (+), fetus (+). *D. Mother (+), fetus (-).*

Notes:_____

81. ABO blood group is being determined. Erythrocyte agglutination occurred when standard sera of group I and group II were introduced into the blood being analyzed, while group III serum caused no agglutination. What agglutinogens do these erythrocytes have?

A. A. *B. B.* *C. D and C.* *D. C.* *E. A and B.*

Notes:_____

PHYSIOLOGY OF BLOOD SYSTEM

Answers

Physical and chemical properties of blood

1. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood/ – P. 682).*

Several conditions can lead to hypoproteinemia, a deficiency of plasma protein: extreme starvation or dietary protein deficiency, liver diseases that interfere with protein synthesis, kidney diseases that result in protein loss through the urine, and severe burns that result in protein loss through the body surface. As the protein content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure. The bloodstream loses more fluid to the tissues than it reabsorbs by osmosis. Thus, the tissues become edematous and a pool of fluid may accumulate in the abdominal cavity—a condition called ascites.

2. Correct answer is B. (*Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 694).*

Albumins are the smallest and most abundant plasma proteins. Because of their major contributions to viscosity and osmolarity, pathological changes in albumin concentration strongly influence blood pressure, flow, and fluid balance. As the albumin content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure. The bloodstream loses more fluid to the tissues than it reabsorbs by osmosis. Thus, the tissues become edematous.

3. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Chapter 75 Pituitary Hormones and Their Control by the Hypothalamus. – P. 928).*

Antidiuretic hormone (ADH) increases the reabsorption of water in collecting tubules and ducts of kidneys thus decreasing the osmolarity of blood and decreasing the diuresis (daily production of secondary urine). When the osmolarity of the blood increases (like, for example, from 300 to 350 mOsm/L), it is detected by hypothalamic neurons called osmoreceptors. The osmoreceptors trigger ADH release, and ADH promotes water conservation.

4. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 694).*

Albumins are the smallest and most abundant plasma proteins. Because of their major contributions to viscosity and osmolarity, changes in albumin concentration strongly influence blood pressure, flow, and fluid balance. As the albumin content of the blood plasma increases, so does its oncotic (colloid-osmotic) pressure that opposes filtration and increases reabsorption of fluid from tissues to capillaries.

5. Correct answer is B. (*Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 317).*

GFR = Kf × Net filtration pressure. Kf is filtration coefficient, and the net filtration pressure represents the sum of the hydrostatic and colloid osmotic forces that either favor or oppose filtration across the glomerular capillaries. These forces include (1) hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure, PG), which promotes filtration; (2) the hydrostatic pressure in Bowman's capsule (PB) outside the capillaries, which opposes filtration; (3) the colloid osmotic pressure of the glomerular capillary plasma proteins (pG), which opposes filtration; and (4) the colloid osmotic pressure of the proteins in Bowman's capsule (pB), which promotes filtration. Starvation leads to decrease of blood oncotic (colloid osmotic) pressure that usually opposes filtration, thus leading to increase of GFR.

6. Correct answer is E. (*Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 420, 426).*

Packed cell volume (PCV) or hematocrit is the percentage of blood that is (normally, 42 to 52 % in men and 37–47 % in women). After rapid hemorrhage, the body replaces the fluid portion of the plasma in 1 to 3 days, but this leaves a low concentration of red blood cells, so PCV in 24 hours after the blood loss will be lower than initial.

7. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*
Normal value of total protein in blood is 65–85 g/L. As that patient has 40 g/L, hypoproteinemia is concluded. As the protein content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure that normally opposes filtration and increases reabsorption of fluid from tissues to capillaries. Thus, when oncotic pressure falls, the filtration increases and reabsorption decreases.
8. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*
The liver produces as much as 4 g of plasma protein per hour, contributing all of the major proteins except γ-globulins. Albumins are the smallest and most abundant plasma proteins, constituting about 60% from total protein of blood. Failure of liver to produce sufficient plasma proteins leads to decreased plasma colloid osmotic pressure and the generalized edema that goes with this condition.
9. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*
Dietary protein deficiency leads to hypoproteinemia. As the protein content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure. The bloodstream loses more fluid to the tissues than it reabsorbs by osmosis. Thus, the tissues become edematous
10. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 298).*
The simplest blood substitute is isotonic 0.9 % solution of sodium chloride (saline solution). Isotonic solutions are important in clinical medicine because they can be infused into the blood without the danger of upsetting osmotic equilibrium between the intracellular and extracellular fluids
11. Correct answer is C. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium)/ compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 13).*
Hyperproteinemia - increase of the total contents of proteins in blood plasma. There are two types of hyperproteinemia - absolute and relative. Absolute hyperproteinemia – accumulation of the proteins in blood. It occurs in infection and inflammatory diseases (hyperproduction of immunoglobulins), rheumatic diseases (hyperproduction of C-reactive protein), some malignant tumors (myeloma) and others. Relative hyperproteinemia – the increase of the protein concentration but not the absolute amount of proteins. It occurs when organism loses water (diarrhea, vomiting, fever, intensive physical activity etc.).
12. Correct answer is C. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium)/ compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 13).*
Hypoproteinemia – decrease of the total contents of proteins in blood plasma. Absolute hypoproteinemia occurs in old people as well as in pathological states accompanying with the oppressing of protein synthesis (liver diseases) and activation of decomposition of tissue proteins (starvation, hard infectious diseases, state after hard trauma and operations, cancer); also occurs in kidney diseases, when the increased excretion of proteins via the urine takes place. Relative hypoproteinemia (rare) is the decrease in protein concentration but not the absolute amount of protein due to blood dilution.
13. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*
Albumins are the smallest and most abundant plasma proteins, constituting about 60 % from total protein of blood. Failure of liver to produce sufficient plasma proteins leads to decreased plasma colloid osmotic (oncotic) pressure and the generalized edema that goes with this condition. Edema develops as decrease of oncotic pressure leads to increase of filtration and decrease of reabsorption in capillaries

Physiology of RBC

14. Correct answer is D. *(Uwe Ackerman – PDQ Physiology (Pretty Darned Quick Series): 1st (first) Edition, Chapter 3 Blood. – P. 76).*

A variety of nitrites or oxidant agents can convert the ferrous iron (Fe^{++}) in hemoglobin to the ferric form, Fe^{+++}, thus forming methemoglobin. Methemoglobin cannot bind O_2 and that compound is irreversible, so as treatment the transfusion should be done, giving the patient new RBC with normal hemoglobin ale to bind oxygen

15. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 693).*

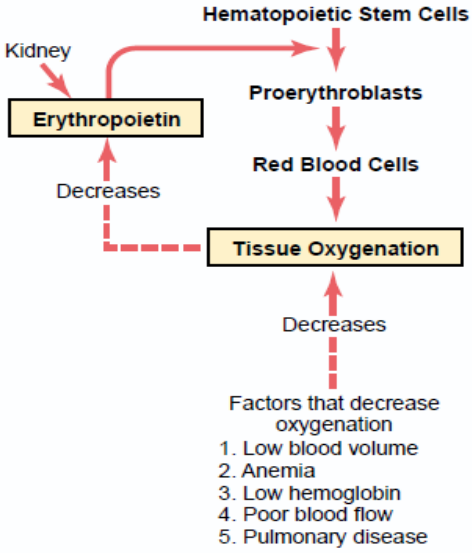
Megaloblastic (pernicious) anemia can result from a deficiency of vitamin B_{12}, but this vitamin is so abundant in meat that a B_{12} deficiency is rare except in strict vegetarians. More often, it occurs when glands of the stomach fail to produce a substance called intrinsic factor that the small intestine needs to absorb vitamin B_{12}. This becomes more common in old age because of atrophy of the stomach. Pernicious anemia can also be hereditary. It is treatable with vitamin B_{12} injections; oral B_{12} would be useless because the digestive tract cannot absorb it without intrinsic factor

16. Correct answer is C. *(Uwe Ackerman – PDQ Physiology (Pretty Darned Quick Series): 1st (first) Edition, Chapter 3 Blood. – P. 76).*

Car fumes contain carbon monoxide. Hemoglobin has a much higher affinity for carbonmonoxide (CO) than for O_2. Consequently, CO displaces O_2 and thus reduces the oxygen-carrying capacity of erythrocytes. Carbon monoxide and Hb form carbon monoxyhemoglobin, also called carboxyhemoglobin. That compound is reversible, treatment is giving oxygen to a patient

17. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity & Blood Clotting. – P. 422).*

At very high altitudes, where the quantity of oxygen in the air is greatly decreased, insufficient oxygen is transported to the tissues, and red cell production is greatly increased. In this case, it is not the concentration of red blood cells in the blood that controls red cell production, but the amount of oxygen transported to the tissues in relation to tissue demand for oxygen. The principal stimulus for red blood cell production in low oxygen states is a circulating hormone called erythropoietin.



18. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 420, 426).*

After hemorrhage, the body replaces the fluid portion of the plasma in 1 to 3 days, and the red blood cell concentration usually returns to normal within 3 to 6 weeks. 1 hour is not enough to restore even the fluid volume of blood, so hypovolemia will be seen

19. Correct answer is E. (*Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 11).*

ESR is erythrocyte sedimentation rate. Normal ESR for women is 2–15 mm/h, for men 1–10 mm/h. ESR increases in case of decrease of albumin content in blood, increase of globulins or fibrinogen content, advanced age, pregnancy, anemia, high cholesterol, kidney disease, thyroid disease, certain types of cancer, autoimmune diseases, inflammation. A low ESR test result may be due to hypofibrinogenemia, low plasma protein, leukocytosis, or a high white blood cell (WBC) count, sickle cell anemia. During pregnancy fibrinogen content of blood increases, so ESR also increases accordingly.

20. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 681).*

Packed cell volume (PCV) or hematocrit is the percentage of blood that is cells (normally, 42 to 52 % in men and 37–47 % in women). Viscosity is the resistance of a fluid to flow due to cohesion between its particles. Viscosity depends primarily on RBC and protein content of blood. Thus, increased PCV leads to increase of blood viscosity

21. Correct answer is E. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium)/ compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 21).*

Normal value of RBC is 4,0–5,2 × 10^{12}/l in men and 4,4–5,7 × 10^{12}/l in women. Normal value of blood protein is 65–85 g/L. Decrease of circulating blood volume together with normal values of RBC content and total protein after physical activity can be explained by water loss during profuse sweating.

22. Correct answer is D. (*Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 422).*

The principal stimulus for red blood cell production is a circulating hormone called erythropoietin (EPO). In the normal person, about 90 per cent of all erythropoietin is formed in the kidneys; the remainder is formed mainly in the liver. Anephric person doesn't have a kidney, thus he will have anemia resulting from decreased EPO production

23. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 693).*

Megaloblastic (pernicious) anemia can result from a deficiency of vitamin B_{12}, but this vitamin is so abundant in meat that a B_{12} deficiency is rare except in strict vegetarians. More often, it occurs when glands of the stomach fail to produce a mucoprotein called intrinsic factor that the small intestine needs to absorb vitamin B_{12}. This becomes more common in old age because of atrophy of the stomach. Pernicious anemia can also be hereditary. It is treatable with vitamin B_{12} injections; oral B_{12} would be useless because the digestive tract cannot absorb it without intrinsic factor

24. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 420, 426).*

After hemorrhage, the body replaces the fluid portion of the plasma in 1 to 3 days, and the red blood cell concentration usually returns to normal within 3 to 6 weeks. Packed cell volume (PCV) or hematocrit is the percentage of blood that is cells (normally, 42 to 52 % in men and 37–47 % in women). Thus, in person with uterine bleeding hematocrit will be decreased

25. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 298).*

Isotonic solution of sodium chloride is 0,9%. Solutions of sodium chloride with a concentration of less than 0.9 per cent are hypotonic and cause cells to swell. If a cell is placed into a hypotonic solution that hasa lower concentration of impermeant solutes (less than 282 mOsm/L), water will diffuse into the cell, causing it to swell; water will continue to diffuse into the cell and the cell might burst. That process is called osmotic hemolysis

26. Correct answer is D. *(Ciesla, Betty. Hematology in practice / Betty Ciesla. – Copyright © 2012 by F. A. Davis Company. 2nd ed. PART I • Basic Hematology Principles. – P. 24).*

Normal value of RBC is 4,0–5,2 × 10^{12}/l in men and 4,4–5,7 × 10^{12}/l in women, of WBC is 4–10 × 10^{9}/l, of hemoglobin 130–160 g/L for men and 120–140 g/L for women. Thus, that patient has anemia resulting from hemorrhage caused by gastric ulcer.

27. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 422).*

At very high altitudes, where the quantity of oxygen in the air is greatly decreased, insufficient oxygen is transported to the tissues, and red cell production is greatly increased. In this case, it is not the concentration of red blood cells in the blood that controls red cell production, but the amount of oxygen transported to the tissues in relation to tissue demand for oxygen. The principal stimulus for red blood cell production in low oxygen states is a circulating hormone called erythropoietin.

28. Correct answer is E. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov KhNMU, 2016. – P. 11).*

ESR is erythrocyte sedimentation rate. Normal ESR for women is 2–15 mm/h, for men 1–10 mm/h. ESR increases in case of decrease of albumin content in blood, increase of globulins or fibrinogen content, advanced age, pregnancy, anemia, high cholesterol, kidney disease, thyroid disease, certain types of cancer, autoimmune diseases, inflammation. A low ESR test result may be due to hypofibrinogenemia, low plasma protein, leukocytosis, or a high white blood cell (WBC) count, sickle cell anemia. Albumin-globulin ratio normally is 1,5–2,3, and decrease of that ratio shows that albumin content decreased. As albumins normally prevent sedimentation of RBC, decrease of their content causes increase of ESR

29. Correct answer is D. *(Uwe Ackerman - PDQ Physiology (Pretty Darned Quick Series): 1st (first) Edition, Chapter 3 Blood. – P. 76).*

Car fumes contain carbon monoxide. Hemoglobin has a much higher affinity for carbonmonoxide (CO) than for O_2. Consequently, CO displaces O_2 and thus reduces the oxygen-carrying capacity of erythrocytes. Carbon monoxide and Hb form carbon monoxyhemoglobin, also called carboxyhemoglobin. That compound is reversible, treatment is giving oxygen to a patient

30. Correct answer is A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 356).*

Intrinsic factor, a mucoprotein, is the "other" secretory product of the parietal cells. Intrinsic factor is required for absorption of vitamin B12 in the ileum, and its absence causes **pernicious (megaloblastic) anemia.** Intrinsic factor is the only *essential* secretion of the stomach. Thus, following gastrectomy (removal of the stomach), patients must receive injections of vitamin B_{12} to bypass the absorption defect caused by the loss of gastric intrinsic factor.

Physiology of WBC

31. Correct answer is E. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 28).*

Physiological leukocytosis is associated with natural functions and is caused by the redistribution of leucocytes between vessels of different organs and tissues. Leucocytes accumulated in the spleen, marrow and lungs are released from their depots and rapidly pass into the blood giving rise to leukocytosis. Digestive leukocytosis is one of types of physiological leukocytosis that normally occurs after meals

32. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 436).*

The mast cells and basophils play an exceedingly important role in some types of allergic reactions because the type of antibody that causes allergic reactions, the immunoglobulin E (IgE) type has a special propensity to become attached to mast cells and basophils. Then, when the specific antigen for the specific IgE antibody subsequently reacts with the antibody, the resulting attachment of antigen to antibody causes the mast cell or basophil to rupture and release exceedingly large quantities of histamine, bradykinin, serotonin, heparin, slow-reacting substance of anaphylaxis, and a number of lysosomal enzymes. These cause local vascular and tissue reactions that cause many, if not most, of the allergic manifestations.

33. Correct answer is C *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P.14).*

ESR is erythrocyte sedimentation rate. Normal ESR for women is 2–15 mm/h, for men 1–10 mm/h. ESR increases in case of decrease of albumin content in blood, increase of globulins or fibrinogen content, advanced age, pregnancy, anemia, high cholesterol, kidney disease, thyroid disease, certain types of cancer, autoimmune diseases, inflammation. A low ESR test result may be due to hypofibrinogenemia, low plasma protein, leukocytosis, or a high white blood cell (WBC) count, sickle cell anemia. During pregnancy fibrinogen content of blood increases, so ESR also increases accordingly.

34. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 436).*

Eosinophils have a special propensity to collect in tissues in which allergic reactions occur, such as in the peribronchial tissues of the lungs in people with asthma and in the skin after allergic skin reactions. This is caused at least partly by the fact that many mast cells and basophils participate in allergic reactions. The mast cells and basophils release an eosinophil chemotactic factor that causes eosinophils to migrate toward the inflamed allergic tissue. The eosinophils are believed to detoxify some of the inflammation-inducing substances released by the mast cells and basophils and probably also to phagocytize and destroy allergen-antibody complexes, thus preventing excess spread of the local inflammatory process.

35. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 436).*

Eosinophils have a special propensity to collect in tissues in which allergic reactions occur, such as in the peribronchial tissues of the lungs in people with asthma and in the skin after allergic skin reactions. This is caused at least partly by the fact that many mast cells and basophils participate in allergic reactions. The mast cells and basophils release an eosinophil chemotactic factor that causes eosinophils to migrate toward the inflamed allergic tissue. The eosinophils are believed to detoxify some of the inflammation-inducing substances released by the mast cells and basophils and probably also to phagocytize and destroy allergen-antibody complexes, thus preventing excess spread of the local inflammatory process.

36. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 685).*

Normal value of RBC is $4{,}0–5{,}2 \times 10^{12}$/l in men and $4{,}4–5{,}7 \times 10^{12}$/l in women, of WBC is $4–10 \times 10^{9}$/l, of hemoglobin 130–160 g/L for men and 120–140 g/L for women. The main stimulus for RBC production is erythropoietin that is released more in conditions of hypoxia. One of reasons of hypoxia is an abrupt increase in the body's oxygen consumption. If a lethargic person suddenly takes up tennis or aerobics, for example, the muscles consume oxygen more rapidly and create a state of hypoxemia that stimulates erythropoiesis. Endurance-trained athletes commonly have RBC counts as high as $5{,}5–6{,}5 \times 10^{12}$/l.

37. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 440).*

Two basic but closely allied types of acquired immunity occur in the body. In one of these the body develops circulating antibodies, which are globulin molecules in the blood plasma that are capable of attacking the invading agent. This type of immunity is called humoral immunity or B-cell immunity (because B lymphocytes produce the antibodies). The second type of acquired immunity is achieved through the formation of large numbers of activated T lymphocytes that are specifically crafted in the lymph nodes to destroy the foreign agent. This type of immunity is called cell-mediated immunity or T-cell immunity (because the activated lymphocytes are T lymphocytes)

38. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 684).*

The γ-globulins, also called antibodies, come from plasma cells—connective tissue cells that are descended from white blood cells called B lymphocytes. They represent humoral link of immunity that is active in case of infections, like in case of pneumonia

39. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 431, 435).*
It is mainly the neutrophils and tissue macrophages that attack and destroy invading bacteria, viruses, and other injurious agents. The neutrophils are mature cells that can attack and destroy bacteria even in the circulating blood. Neutrophils possess diapedesis, ameboid movement and chemotaxis, thus they are able to move fast to origin of inflammation. When neutrophils and macrophages engulf large numbers of bacteria and necrotic tissue, essentially all the neutrophils and many, if not most, of the macrophages eventually die. After several days, a cavity is often excavated in the inflamed tissues that contains varying portions of necrotic tissue, dead neutrophils, dead macrophages, and tissue fluid. This mixture is commonly known as pus.
40. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 436).*
Eosinophils have a special propensity to collect in tissues in which allergic reactions occur, such as in the peribronchial tissues of the lungs in people with asthma and in the skin after allergic skin reactions. This is caused at least partly by the fact that many mast cells and basophils participate in allergic reactions. The mast cells and basophils release an eosinophil chemotactic factor that causes eosinophils to migrate toward the inflamed allergic tissue. The eosinophils are believed to detoxify some of the inflammation-inducing substances released by the mast cells and basophils and probably also to phagocytize and destroy allergen-antibody complexes, thus preventing excess spread of the local inflammatory process.
41. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 447).*
It is the helper T cells that are inactivated or destroyed by the human immunodeficiency virus (HIV), which leaves the body almost totally unprotected against infectious disease, therefore leading to the now well-known debilitating and lethal effects of AIDS. Some of the specific regulatory functions of T-helpers are the following: stimulation of growth and proliferation of cytotoxic T cells and suppressor T cells, stimulation of B-cell growth and differentiation to form plasma cells and antibodies, activation of the macrophage system, feedback stimulatory effect on the helper cells themselves.
42. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 443).*
Plasmocytes or plasma cells are formed from B-lymphocytes. Before exposure to a specific antigen, the clones of B lymphocytes remain dormant in the lymphoid tissue. On entry of a foreign antigen, macrophages in the lymphoid tissue phagocytize the antigen and then present it to adjacent B lymphocytes. In addition, the antigen is presented to T cells at the same time, and activated helper T cells are formed. These helper cells also contribute to extreme activation of the B lymphocytes. Those B lymphocytes specific for the antigen immediately enlarge and take on the appearance of lymphoblasts, some of which further differentiate to form plasmablasts – precursors of plasma cells. The plasmablasts then begin to divide giving in 4 days a total population of about 500 cells for each original plasmablast. The mature plasma cell then produces gamma globulin antibodies at an extremely rapid rate. In turn, the antibodies are secreted into the lymph and carried to the circulating blood. This process continues for several days or weeks until finally exhaustion and death of the plasma cells occur.
43. Correct answer is D. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 29).*
Normal leukogram has following indexes: metamyelocytes = 0–1 %, stab (band) neutrophils = 1–6 %, segmented neutrophils = 47–72 %, basophils = 0–1 %, eosinophils = 0,5–5 %, lymphocytes = 18–37 %, monocytes = 3–11 %. Thus, that child has increased monocytes content called monocytosis, usually seen in case of viral infections and inflammation

44. Correct answer is E. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 33).*
Fetal stem cells remain in the bone marrow to differentiate into B cells. They are also undergone to the selection and differentiation, much like as T cells. Self-tolerant B cells go on to produce surface receptors for antigens, divide, and produce immunocompetent B cell clones. These cells disperse throughout the body, colonizing the same organs as T cells. They are abundant in the lymph nodes, spleen, bone mar-row, and mucous membranes
45. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 450).*
Basophils release *histamine,* as well as smaller quantities of *bradykinin* and *serotonin. Histamine* is released into the circulation and causes body-wide vasodilation as well as increased permeability of the capillaries with resultant marked loss of plasma from the circulation. An occasional person who experiences this reaction dies of circulatory shock within a few minutes unless treated with epinephrine to oppose the effects of the histamine.
46. Correct answer is E *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium)/ compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 40)*
Basophils are real "factories" for production of BAS. Their large granules contain *heparin, histamine, serotonin, kallikrein, bradykinin* and others. Most of these substances are important factors in regulation of *capillaries permeability* and *microcirculation* in the inflammatory focus.
The basophils and mast cells play an exceedingly important role in some types of *allergic reactions* (reactions of hypersensitivity of immediate type).
47. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 450).*
Asthma often occurs in the "allergic" type of person accompanied by eosinophilia. In such a person, the allergen-reagin reaction occurs in the bronchioles of the lungs. Here, an important product released from the mast cells is believed to be the *slow-reacting substance of anaphylaxis,* which causes spasm of the bronchiolar smooth muscle. Consequently, the person has difficulty breathing until the reactive products of the allergic reaction have been removed. Administration of antihistaminics has less effect on the course of asthma because histamine does not appear to be the major factor eliciting the asthmatic reaction.

Physiology of blood coagulation

48. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 462–463).*
Factor VIII is the factor that is missing in a person who has hemophilia A, for which reason it is called antihemophilic factor A. Factors XII, XI, IX and VIII together with high molecular weight kininogen and prekallikrein participate in intrinsic mechanism of prothrombinase (prothrombin activator) generation
49. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*
Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency of these coagulation factors in the blood can lead to serious bleeding tendencies.
50. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 465).*
Thrombocytopenia means the presence of very low numbers of platelets in the circulating blood. People with thrombocytopenia have a tendency to bleed, as do hemophiliacs, except that the bleeding is usually from many small venules or capillaries, rather than from larger vessels as in hemophilia. As a result, small punctate hemorrhages occur throughout all the body tissues. The skin of such a person displays many small, purplish blotches, giving the disease the name thrombocytopenic purpura.

51. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 460, 464).*
With few exceptions, almost all the blood-clotting factors are formed by the liver. Therefore, diseases of the liver such as hepatitis, cirrhosis, and acute yellow atrophy can sometimes depress the clotting system so greatly that the patient develops a severe tendency to bleed. Prothrombin is formed continually by the liver, and It is continually being used throughout the body for blood clotting. If the liver fails to produce prothrombin, in a day or so prothrombin concentration in the plasma falls too low to provide normal blood coagulation.
52. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*
Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency of these coagulation factors in the blood can lead to serious bleeding tendencies.
53. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 466).*
When an indirect anticoagulant, such as warfarin, is given to a patient, the plasma levels of prothrombin and Factors VII, IX, and X, all formed by the liver, begin to fall, indicating that warfarin has a potent depressant effect on liver formation of these compounds. Warfarin causes this effect by competing with vitamin K for reactive sites in the enzymatic processes for formation of prothrombin and the other three clotting factors, thereby blocking the action of vitamin K.
54. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 46–463).*
Factor VIII is the factor that is missing in a person who has hemophilia A, for which reason it is called antihemophilic factor A. Factors XII, XI, IX and VIII together with high molecular weight kininogen and prekallikrein participate in intrinsic mechanism of prothrombinase generation. Prothrombinase is also called prothrombin activator or thromboplastin
55. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 457–466).*
Blood clotting have 3 stages – 1) vascular-platelet hemostasis (prephase of clotting); 2) coagulation hemostasis (consisting of prothrombinase generation, formation of thrombin, and formation of fibrin), and 3) clot retraction and fibrinolysis (after-phase of clotting). Due to large trauma of tissues during operations in abdominal cavity the coagulation cascade is activated and the widespread clotting triggers significant increase of fibrinolytic system activity that may lead to hemorrhages in postoperative period.
56. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 460).*
Prothrombin is formed continually by the liver, and it is continually being used throughout the body for blood clotting. If the liver fails to produce prothrombin, in a day or so prothrombin concentration in the plasma falls too low to provide normal blood coagulation. Fibrinogen is formed in the liver, and liver disease can decrease the concentration of circulating fibrinogen, as it does the concentration of prothrombin, pointed out above.
57. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 460).*
Fibrinogen is formed in the liver, and liver disease can decrease the concentration of circulating fibrinogen, as it does the concentration of prothrombin. As only conversion of fibrinogen to fibrin leads to formation of the clot and is the target of coagulation, decrease of fibrinogen content causes insufficiency of clotting and leads to bleedings.
58. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*
One of causes of depressed formation of clotting factors by the liver is vitamin K deficiency. Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency of these coagulation factors in the blood can lead to serious bleeding tendencies. Vitamin K is continually synthesized in the intestinal tract by bacteria, so that vitamin K deficiency seldom occurs in the normal person as a result of vitamin K absence from the diet (except in neonates before they

establish their intestinal bacterial flora). However, in case of disbacteriosis the microflora of intestine is disturbed and not able to produce vitamin K in adequate quantities leading to bleedings

59. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 462–463).*

Factor VIII is the factor that is missing in a person who has hemophilia A, for which reason it is called antihemophilic factor A. Factors XII, XI, IX and VIII together with high molecular weight kininogen and prekallikrein participate in intrinsic mechanism of prothrombinase generation. Prothrombinase is also called prothrombin activator or thromboplastin.

60. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 462–463).*

Factor VIII is the factor that is missing in a person who has hemophilia A, for which reason it is called antihemophilic factor A. Factors XII, XI, IX and VIII together with high molecular weight kininogen and prekallikrein participate in intrinsic mechanism of prothrombinase generation. Prothrombinase is also called prothrombin activator or thromboplastin.

61. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 465).*

People with disorders of platelets or their decreased content (thrombocytopenia) have a tendency to bleed, as do hemophiliacs, except that the bleeding is usually from many small venules or capillaries, rather than from larger vessels as in hemophilia. As a result, small punctate hemorrhages occur throughout all the body tissues. The skin of such a person displays many small, purplish blotches, giving the disease the name thrombocytopenic purpura.

62. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*

One of causes of depressed formation of clotting factors by the liver is vitamin K deficiency. Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency of these coagulation factors in the blood can lead to serious bleeding tendencies. Vitamin K is continually synthesized in the intestinal tract by bacteria, so that vitamin K deficiency seldom occurs in the normal person as a result of vitamin K absence from the diet (except in neonates before they establish their intestinal bacterial flora). However, in gastrointestinal disease, vitamin K deficiency often occurs as a result of poor absorption of fats from the gastrointestinal tract. The reason is that vitamin K is fat-soluble and ordinarily is absorbed into the blood along with the fats. One of the most prevalent causes of vitamin K deficiency is failure of the liver to secrete bile into the gastrointestinal tract (which occurs either as a result of obstruction of the bile ducts or as a result of liver disease). Lack of bile prevents adequate fat digestion and absorption and, therefore, depresses vitamin K absorption as well.

63. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*

One of causes of depressed formation of clotting factors by the liver is vitamin K deficiency. Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency of these coagulation factors in the blood can lead to serious bleeding tendencies

64. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 461–462).*

The extrinsic pathway for initiating the formation of prothrombin activator begins with a traumatized vascular wall or traumatized extravascular tissues that come in contact with the blood. Traumatized tissue releases a complex of several factors called tissue factor or tissue thromboplastin (Factor III). Factor III further complexes with blood coagulation Factor VII and, in the presence of calcium ions, acts enzymatically on Factor X to form activated Factor X (Xa).

65. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 464).*

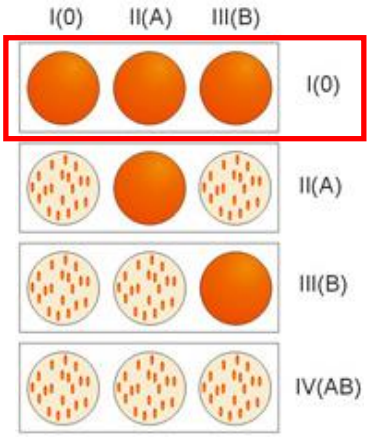
One of causes of depressed formation of clotting factors by the liver is vitamin K deficiency. Vitamin K is necessary for liver formation of five of the important clotting factors: prothrombin, Factor VII, Factor IX, Factor X, and protein C. In the absence of vitamin K, subsequent insufficiency

of these coagulation factors in the blood can lead to serious bleeding tendencies. Vitamin K is continually synthesized in the intestinal tract by bacteria, so that vitamin K deficiency seldom occurs in the normal person as a result of vitamin K absence from the diet (except in neonates before they establish their intestinal bacterial flora). However, in case of disbacteriosis the microflora of intestine is disturbed and not able to produce vitamin K in adequate quantities leading to bleedings.

66. Correct answer is D

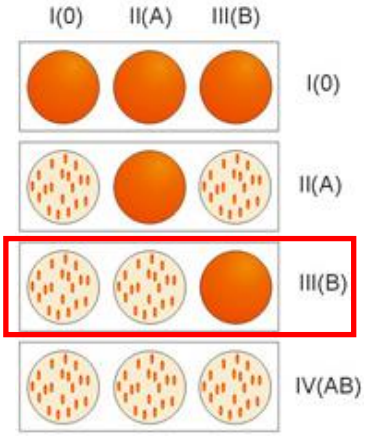
Coagulation hemostasis consists of 3 stages – 1) prothrombinase generation, 2) formation of thrombin, and 3) formation of fibrin. The prothrombin activator, in the presence of sufficient amounts of ionic Ca++, causes conversion of prothrombin to thrombin. Thrombin then causes polymerization of fibrinogen molecules into fibrin fibers *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 459).*

Blood Types



67. Correct answer is A. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*

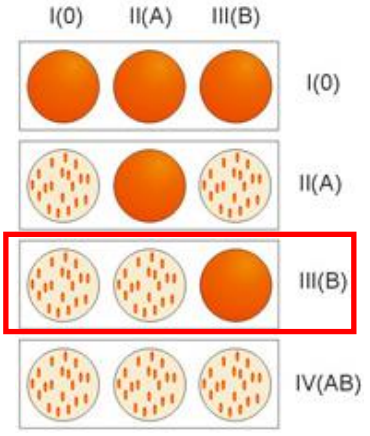
When standard sera are used for blood typing you have to represent exactly that serum of II group containts β agglutinins and reacts with RBCs of groups possessing B agglutinogens (III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of groups which content A agglutinogens (II and IV). RBCs of I group possess no agglutinogens and never can agglutinate with any sera. In contrast erythrocytes of IV group with sera of all groups I, II and III. As no agglutination occurred with any of sera it means that examined blood doesn't have neither A antigen, nor B antigen, so this blood belongs to I type.



68. Correct answer is C. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*

When standard sera are used for blood typing, serum of II group containts β agglutinins and reacts with RBCs of groups possessing B agglutinogens (III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of groups which content A agglutinogens (II and IV). RBCs of I group possess no agglutinogens and never can agglutinate with any sera. In contrast erythrocytes of IV group with sera of all groups I, II and III.

As there was no agglutination with standard serum of III group, the examined blood has no A agglutinogen. Agglutination with the standard sera of I and II groups reveals presence of B agglutinogens on the membrane of examined erythrocytes. Thus, examined erythrocytes belong to B (III) type.



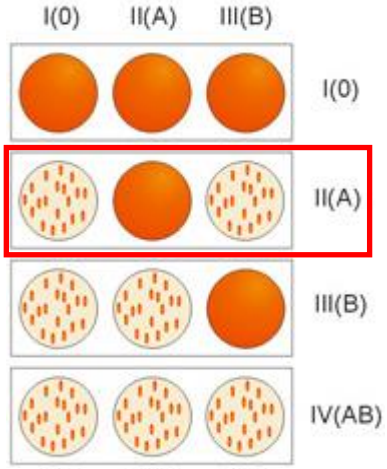
69. Correct answer is B. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov: KhNMU, 2016. – P. 39).*

Standard serum of II group containts β agglutinins and reacts with RBCs of groups which have B agglutinogens on their surface (groups III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of the groups which content A agglutinogens (II and IV). RBCs of I group don't express agglutinogens and never agglutinate with any sera. In contrast erythrocytes of IV group with sera of all groups I, II and III. Thus, examined erythrocytes belong to B (III) type.

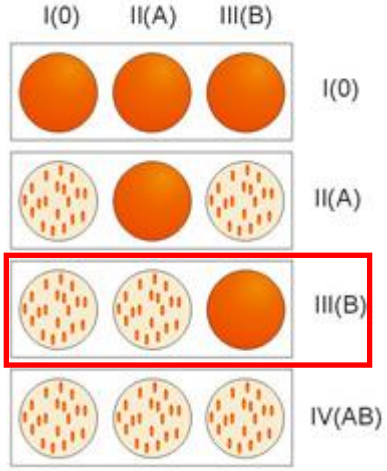
Absence of agglutination with anti-Rh serum indicates that Rh is negative.

70. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 451–454).*
Hemolytic disease of newborns (HDN, erythroblastosis fetalis) is a disease of fetus and newborn child characterized by agglutination and phagocytosis of the fetus's red blood cells. In most instances of erythroblastosis fetalis, the mother is Rh negative and the father Rh positive. The baby has inherited the Rh-positive antigen from the father, and the mother develops anti-Rh agglutinins from exposure to the fetus's Rh antigen. In turn, the mother's agglutinins diffuse through the placenta into the fetus and cause red blood cell agglutination. In ABO system, if mother has III (B), Rh– blood group, then child got A antigen from his father. Thus, father's blood type is II (A), Rh+ or IV (AB), Rh+.

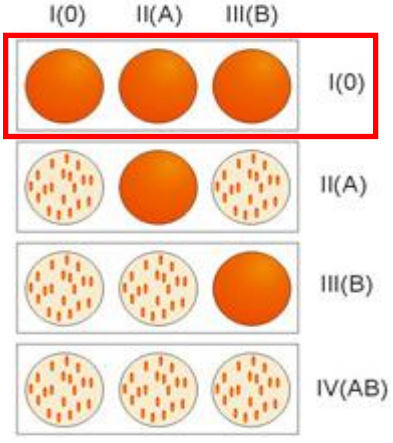
71. Correct answer is B. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*
When standard sera are used for blood typing you have to represent exactly that serum of II group contents β agglutinins and reacts with RBCs of groups possessing B agglutinogens (III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of groups which content A agglutinogens (II and IV). RBCs of I group possess no agglutinogens and never can agglutinate with any sera. In contrast erythrocytes of IV group with sera of all groups I, II and III. As no agglutination occurred with II group it means that examined blood doesn't have B antigen, only A, **so this blood belongs to II type**.



72. Correct answer is C. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*
Standard serum of II group containts β agglutinins and reacts with RBCs of groups which have B agglutinogens on their surface (groups III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of the groups which content A agglutinogens (II and IV). RBCs of I group don't express agglutinogens and never agglutinate with any sera. In contrast erythrocytes of IV group with sera of all groups I, II and III. **Thus, examined erythrocytes belong to B (III) type.**
Absence of agglutination with anti-Rh serum indicates that Rh is negative.



73. Correct answer is A. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*
Standard serum of II group containts β agglutinins and reacts with RBCs of groups which have B agglutinogens on their surface (groups III and IV). A serum of III group has α agglutinins and reacts with erythrocytes of the groups which content A agglutinogens (II and IV). **RBCs of I group don't express agglutinogens and never agglutinate with any sera.** In contrast erythrocytes of IV group with sera of all groups I, II and III. Thus, examined erythrocytes belong to **0αβ(I)** type.



74. Correct answer is A. Look explanation for Task 73.

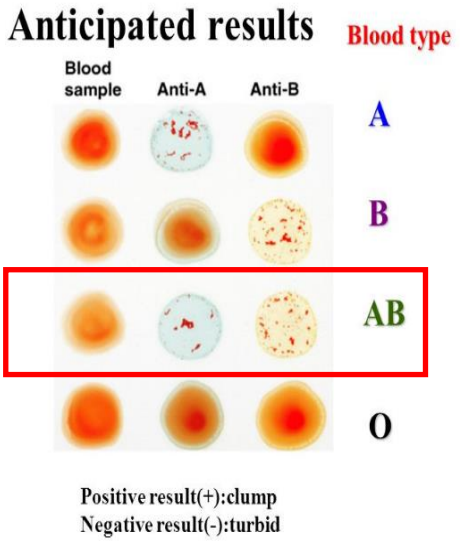
75. Correct answer is E. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 37).*

Two antigens – type A and type B – occur on the surfaces of the red blood cells in a large proportion of human beings. Antigens that are present on the surface of RBCs membrane are called agglutinogens; their name originates from of erythrocytes clumping (agglutination) in transfusion of mismatched blood. Because of the way these agglutinogens are inherited, people may have 1) neither of them on their cells, 2) they may have one – A type or B type, or 3) they may have both simultaneously. The antigens are glycoproteins and glycolipids – membrane proteins and phospholipids with short carbohydrate chains bond to themю Difference between A and B antigens is in terminal carbohydrates.

76. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 451–454).*

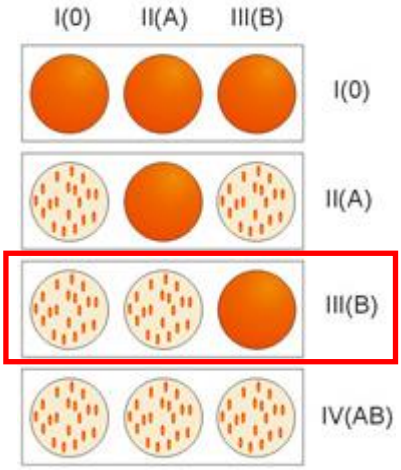
Hemolytic disease of newborns (HDN, erythroblastosis fetalis) is a disease of fetus and newborn child characterized by agglutination and phagocytosis of the fetus's red blood cells, resulting from **rhesus incompatibility** between mother and fetus. . In most instances of erythroblastosis fetalis, the mother is Rh negative and the father Rh positive. The baby has inherited the Rh-positive antigen from the father, and the mother develops anti-Rh agglutinins from exposure to the fetus's Rh antigen. In turn, the mother's agglutinins diffuse through the placenta into the fetus and cause red blood cell agglutination.

77. Correct answer is E *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*



A person's ABO blood type can be determined by placing one drop of blood in a pool of anti-A serum and another drop in a pool of anti-B serum. Blood type AB exhibits conspicuous agglutination in both antisera; type A or B agglutinates only in the corresponding antiserum; and type O does not agglutinate in either one. Anti-A reagent is actually the solution of α agglutinins, correspondently Anti-B is the solution of β ones. Blood cells become clumped if they possess the antigens for the antibodies (top row left, second row right, third row both) but otherwise remain uniformly mixed. Thus, type A agglutinates only in anti-A; type B agglutinates only in anti-B; **type AB agglutinates in both**; and type O agglutinates in neither of them. If agglutination occurs with anti-D reagent, it means that person's blood has D antigen, thus the person is Rh positive; if **no agglutination occurs with anti-D – person is Rh negative.**

78. Correct answer is A. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers: D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*



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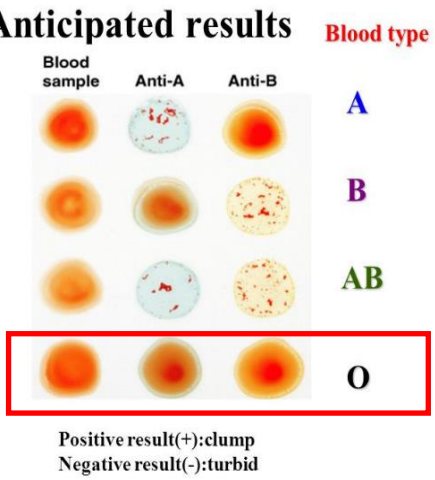
Absence of agglutination with anti-Rh serum indicates that Rh is negative.

79. Correct answer is A. *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P. 39).*



A person's ABO blood type can be determined by placing one drop of blood in a pool of anti-A serum and another drop in a pool of anti-B serum. Blood type AB exhibits conspicuous agglutination in both antisera; type A or B agglutinates only in the corresponding antiserum; and type O does not agglutinate in either one. Anti-A reagent is actually the solution of α agglutinins, correspondently Anti-B is the solution of β ones. Blood cells become clumped if they possess the antigens for the antibodies (top row left, second row right, third row both) but otherwise remain uniformly mixed. Thus, **type A agglutinates only in anti-A; type B agglutinates only in anti-B;** type AB agglutinates in both; and type O agglutinates in neither of them.

80. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P. 451–454).*

Hemolytic disease of newborns (HDN, erythroblastosis fetalis) is a disease of fetus and newborn child characterized by agglutination and phagocytosis of the fetus's red blood cells. In most instances of erythroblastosis fetalis, **the mother is Rh negative** and the father Rh positive. The **baby has inherited the Rh-positive antigen from the father**, and the mother develops anti-Rh agglutinins from exposure to the fetus's Rh antigen. In turn, the mother's agglutinins diffuse through the placenta into the fetus and cause red blood cell agglutination.

81. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VI Blood Cells, Immunity, and Blood Clotting. – P.. 451–454).*

explanation for Task 78.

PHYSIOLOGY OF HEART & CIRCULATION

Questions

Physiological properties of myocardium. Cardiac cycle

1. Examination of a person revealed that minute volume of heart is 3 500 mL, systolic volume is 50 mL. What is the frequency of cardiac contraction?

A. 90 bpm. *B. 50 bpm.* *C. 80 bpm.* *D. 60 bpm.* *E. 70 bpm.*

Notes:_____

2. A person has steady HR not exceeding 40 bpm. What is the pacemaker of the heart rhythm in this person?

A. Atrioventricular node. *C. Sinoatrial node.* *E. Branches of His' bundle.*
B. His' bundle. *D. Purkinye' fibers.*

Notes:_____

3. The process of heart transplantation determined the viability of myocardial cells. The determination of what myocardium parameter is the most important?

A. Concentration of Ca-ions in myofibrils. *D. Rest potential of cardiomyocytes.*
B. Concentration of Ca-ions in heart. *E. Concentration of oxygen in heart vessels.*
C. Heart temperature.

Notes:_____

4. The electrocardiogram demonstrated that the duration of man's heart cycle is 1 sec. What is the heart rate per minute?

A. 50. *B. 60.* *C. 70.* *D. 80.* *E. 100.*

Notes:_____

5. While preparing a patient to the operation the heart chambers' pressure was measured. In one of them the pressure changed during one heart cycle from 0 to 120 mm Hg. What chamber of heart was it?

A. Left atrium. *B. Left ventricle.* *C. Right atrium.* *D. Right ventricle.* *E. –.*

Notes:_____

6. An isolated cell of human heart automatically generates excitation impulses with frequency 60 times per minute. What structure does this cell belong to?

A. Ventricle. *B. Sinoatrial node.* *C. Atrioventricular node.* *D. His' bundle.* *E. Atrium.*

Notes:_____

7. Examination of an isolated cardiomyocyte revealed that it didn't generate excitation impulses automatically. This cardiomyocyte was obtained from:

A. Sinoatrial node. *C. Ventricles.* *E. His' bundle.*
B. Purkinje's fibers. *D. Atrioventricular node.*

Notes:_____

8. A cardiac electric stimulator was implanted to a 75 year old man with heart rate of 40 bpm. Thereafter the heart rate raised up to 70 bpm. The electric stimulator has undertaken the function of the following heart part:

A. His' bundle branches. *C. His' bundle fibel's.* *E. Atrioventricular node.*
B. Sinoatrial node. *D. Purkinje's fibers.*

Notes:_____

9. In a healthy adult speed of the excitement conduction through the atrioventricular node is 0,02–0,05 m/sec. Atrioventricular delay enables:

A. Simultaneity of both atria contractions.
B. Simultaneity of both ventricles contractions.
C. Sufficient force of atrial contractions.
D. Sufficient force of ventricular contractions.
E. Sequence of atrial and ventricular contractions.

Notes:_____

10. During phonocardiogram registration it was ascertained that the duration of the first heart sound twice exceeds the norm. It is most likely that patient has the following organ affected:

A. Cardiomyocytes of heart atriums. *D. Atrioventricular valves.*
B. Cardiomyocytes of ventricles. *E. Semilunar valves.*
C. Cardiomyocytes of atriums.

Notes:_____

11. An isolated cell of human heart automatically generates excitement impulses with frequency of 60 times per minute. This cell was taken from the following heart structure:

A. Atrium. *B. Ventricle.* *C. Sinoatrial node.* *D. Atrioventricular node.* *E. His' bundle.*

Notes:_____

12. During ventricular systole, the cardiac muscle does not respond to additional stimulation because it is in the phase of:

A. Hyperexcitability. *C. Absolute refractoriness.* *E. There is no correct answer.*
B. Subnormal excitability. *D. Relational refractoriness.*

Notes:_____

13. During examination the doctor performs auscultation to assess the functioning of the patient's mitral valve. Where can the sound of this valve be auscultated?

A. At the edge of the sternum in the 2nd intercostal space on the right.
B. At the edge of the sternum over the 5th costal cartilage on the right.
C. At the apex of the heart.
D. At the edge of the sternum in the 2nd intercostal space on the left.
E. At the edge of the sternum over the 5th costal cartilage on the left.

Notes:_____

14. Auscultation reveals that in the patient's II intercostal space along the parasternal line on the right the II heart sound is better heard than the I heart sound. What valve produces this sound when closing?

A. Bicuspid valve.
B. Bicuspid and tricuspid valves.
C. Tricuspid valve.
D. Semilunar aortic valve.
E. Semilunar pulmonary valve.

Notes:_____

15. An isolated heart was used to study excitation conduction velocity in different areas of the heart. What area had the lowest velocity of excitation conduction?

A. Atrioventricular node. *C. Ventricular myocardium.* *E. Purkinje fibers.*
B. Atrial myocardium. *D. His bundle.*

Notes:_____

16. An animal experiment is aimed at studding of cardiac cycle. All the heat valves are closed. What phase of cardiac cycle is characterized by this status?

A. Protodiastolic period. *C. Isometric contraction.* *E. Reduced filling.*
B. Asynchronous contraction. *D. Rapid filling.*

Notes:_____

17. Systemic blood pressure of a person equals 120/65 mm Hg. Blood ejection into the aorta occurs when left ventricular pressure exceeds:

A. 120 mm Hg. *B. 65 mm Hg.* *C. 90 mm Hg.* *D. 10 mm Hg.* *E. 100 mm Hg.*

Notes:_____

ElectroCardioGraphy

18. Electrocardiogram of a man showed absence of P-wave in all leads. What part of the conducting system is blocked?

A. Common branch of the bundle of His.
B. Atrioventricular node.
C. Sinu-atrial node.
D. Branches of the bundle of His.
E. Purkinje's fibers.

Notes:_____

19. ECG study showed that the T-waves were positive in the standard extremity leads, their amplitude and duration were normal. The right conclusion would be that the following process runs normally in the heart ventricles:

A. Depolarization. *B. Repolarization.* *C. Excitement.* *D. Contraction.* *E. Relaxation.*

Notes:_____

20. Processes of repolarization are disturbed in ventricular myocardium in examined person. It will cause amplitude abnormalities of configuration and duration of the wave:

A. P. *B. Q.* *C. R.* *D. S.* *E. T.*

Notes:_____

21. A patient has delayed conduction of excitement through the atrioventricular node. What changes of ECG will be observed?

A. Prolongation of Q-S interval.
B. Negative T wave.
C. S-T-segment displacement.
D. Prolongation of P-Q interval.
E. Prolongation of Q-T interval.

Notes:_____

22. ECG of a patient shows prolongation of T-wave. This is caused by deceleration in ventricles of:

A. Depolarization and repolarization.
B. Depolarization.
C. Repolarization.
D. Contraction.
E. Relaxation.

Notes:_____

23. ECG of a patient with hyperfunction of thyroid gland showed heart hurry. It is indicated by depression of the following ECG element:

A. QRS complex. *B. R–R interval.* *C. P–Q interval.* *D. P–Q segment.* *E. P–T interval.*

Notes:_____

24. ECG of a patient showed that RR interval equaled 1,5 s, heart rate equaled 40 bpm. What is the cardiac pacemaker?

A. Sinus node. *C. His' bundle.* *E. Right branch of His' bundle.*
B. Atrioventricular node. *D. Left branch of His' bundle.*

Notes:_____

25. A 50 y.o. man abruptly felt palpitation, heart ache, strong weakness, rise of arterial pressure. His pulse is irregular and deficient. ECG shows no P wave and different R-R intervals. What cardiac rate abnormality is it?

A. Respiratory arrhythmia. *C. Paroxysmal tachycardia.* *E. Sinus extrasystole.*
B. Ciliary arrhythmia. *D. Atrioventricular heart block.*

Notes:_____

26. A 15-year-pld teenager complains of lack of air, general weakness, palpitation. Heart rate is 130 bpm., BP is 100/60 mm Hg. ECG: QRS complex has normal shape and duration. The number of P waves and ventricular complexes is equal, T waves merges with P wave. What type of cardiac arrhythmia is observed in the teenager?

A. Paroxysmal atrial tachycardia. *C. Sinus extrasystole.* *E. Sinus tachycardia.*
B. Atrial thrill. *D. Atrial fibrillation.*

Notes:_____

27. The patient's ECG shows that in the second lead from the extremities the P waves are positive. Their amplitude is 0.1 mV (norm is 0.05–0.25 mV), duration – 0.1 sec (norm is 0.07–0.10 sec). It can be concluded that the following process occurs normally in the cardiac atria:

A. Activation. *B. Relaxation.* *C. Depolarization.* *D. Repolarization.* *E. Contraction.*

Notes:_____

28. A 67-year-old man was delivered to the cardiology unit with complaints of periodical pain in the heart, dyspnea after even insignificant physical exertion, cyanosis, and edemas. ECG revealed additional contractions of the heart ventricles. Name this type of rhythm disturbance:

A. Tachycardia. *B. Flutter.* *C. Fibrillation.* *D. Extrasystole.* *E. Bradycardia.*

Notes:_____

29. Electrocardiogram of a young man reveals deviation of his electrical axis of heart at the left. This phenomenon can be caused by:

A. Dilation of the right ventricle. *C. Asthenic body type.* *E. Hypersthenic body type.*
B. Dilation of the right atrium. *D. Dilation of the left atrium.*

Notes:_____

30. ECG of a 46-year-old patient shows an increase the QRS duration. It might be caused by:

A. Increased ventricular activation time. *D. Conduction disturbances in the AV node.*
B. Increased atrial and ventricular excitability. *E. Increased atrial excitability.*
C. Increased atrial activation time.

Notes:

31. A patient has a first-degree atrioventricular block accompanied by the prolongation of P-Q interval up to 0,25 s. Under such conditions the following myocardial function will be disturbed:

A. Excitability. *B. Conduction.* *C. Automatism.* *D. Contractibility.* *E. –.*

Notes:

32. ECG of a patient shows that T-waves in the second standard extremity lead are positive, their amplitude and duration are normal. It would be true that the following process is taking its normal course in the cardiac ventricles:

A. Excitement. *B. Contraction.* *C. Depolarization.* *D. Relaxation.* *E. Repolarization.*

Notes:

33. A patient complains of palpitation after stress. The pulse is 104 bpm, P-Q = 0,12 seconds, there are no changes of QPS complex. What type of arrhythmia does the patient have?

A. Ciliary arrhythmia. *C. Sinus tachycardia.* *E. Extrasystole.*
B. Sinus bradycardia. *D. Sinus arrhythmia.*

Notes:

34. ECG of a patient displays an abnormally long R wave (up to 0,18 s). This is caused by a decrease in the conduction velocity of the following heart structures:

A. Right ventricle. *B. Left ventricle.* *C. Atrio-ventricular node.* *D. Atria.* *E. Ventricles.*

Notes:

35. A 67-year-old man was delivered to a cardiology department with complaints of periodical pains in his heart, dyspnea caused by even slight exertion, cyanosis and edemas. ECG shows additional excitations of heart ventricles. Name this type of rhythm disturbance:

A. Fibrillation. *B. Bradycardia.* *C. Tachycardia.* *D. Flutter.* *E. Extrasystole.*

Notes:

The Laws of Hemodynamics

36. A 56 year old patient suffering from cardiac insufficiency has edema of feet and shins, edematous skin is pale and cold. What is the leading mechanism of edema pathogenesis?

A. Drop of oncotic pressure in capillaries.
B. Rise of hydrostatic pressure in venules.
C. Increase of capillary permeability.
D. Disorder of lymph outflow.
E. Positive water balance.

Notes:_____

37. A hypertensive glucose solution was introduced to a patient. It will intensify water movement:

A. From the capillaries to the intercellular liquid.
B. There will be no changes of water movement.
C. From the intercellular liquid to the cells.
D. From the cells to the intercellular liquid.
E. From the intercellular liquid to the capillaries.

Notes:_____

38. Blood minute volume of a 30 year old woman at rest is 5 l/m. What blood volume is pumped through the pulmonary vessels per minute?

A. 3,75 l. *B. 1,5 l.* *C. 2,5 l.* *D. 2,0 l.* *E. 5 l.*

Notes:_____

39. A patient is 44 years old. Laboratory examination of his blood revealed that content of proteins in plasma was 40 g/l. What influence will be exerted on the trans-capillary water exchange?

A. Exchange will stay unchanged.
B. Filtration will be decreased, reabsorption- increased.
C. Filtration will be increased, reabsorption-decreased.
D. Both filtration and reabsorption will be increased.
E. Both filtration and reabsorption will be decreased.

Notes:_____

40. A patient under test was subjected to a moderate physical stress. His minute blood volume amounted 10 l/min. What blood volume was pumped through his lung vessels every minute?

A. 4 l/min. *B. 5 l/min.* *C. 6 l/min.* *D. 7 l/min.* *E. 10 l/min.*

Notes:_____

41. In elderly person the change in heart force and vessels physical properties were detected; they can be clearly observed on graphic recording of carotid pulse waves. What method was applied?

A. Rheography. *B. Plethysmography.* *C. Phlebography.* *D. Sphygmography.* *E. Myography.*

Notes:_____

42. An experiment was conducted to study major indicators of hemodynamics. What hemodynamics indicator would be the same for both systemic and pulmonary circulation?

A. Diastolic blood pressure. *C. Linear blood flow velocity.* *E. Vascular resistance.*
B. Volumetric blood flow rate. *D. Mean arterial pressure.*

Notes:_____

43. A 40-year-old man with impaired venous patency in the low limbs developed edemas. What mechanism plays the main role in the development of disturbance?

A. Elevated filtration pressure.
B. Hypoproteinemia.
C. Decreased gradient of osmotic pressure between blood and tissue.
D. Positive fluid balance.
E. Disturbed humoral regulation of water-mineral balance.

Notes:_____

Regulation of cardiac activity and blood pressure

44. Vagus branches that innervate heart are being stimulated in course of an experiment. As a result of it the excitement conduction from atria to the ventricles was brought to a stop. It is caused by electrophysical changes in the following structures:

A. His' bundle. *B. Atria.* *C. Atrioventricular node.* *D. Sinoatrial node.* *E. Ventricles.*

Notes:_____

45. The calcium canals of cardiomyocytes have been blocked on an isolated rabbit's heart. What changes in the heart's activity can happen as a result?

A. Decreased heart beat rate.
B. Heart stops in systole.
C. Decreased force of the contraction.
D. Decreased rate and force heart beat.
E. Heart stops in diastole.

Notes:_____

46. After the trauma, the patient's right *n. vagus* was damaged. Which violation of the cardiac activity is possible in this case?

A. Violation of the automatism of an atrio-ventricular node.
B. Violation of the automatism of a Kiss-Fleck node.
C. Block of a conductivity in the atrio-ventricular node.
D. Violation of conductivity in the right auricle.
E. Arrhythmia.

Notes:_____

47. The heart rate and the systemic arterial blood pressure of a man have increased due to voluntary respiratory delay for 40 c. Realization of what regulation mechanism caused these changes?

A. –.
B. Conditioned parasympathetic reflexes.
C. Conditioned sympathetic reflexes.
D. Unconditioned parasympathetic reflexes.
E. Unconditioned sympathetic reflex.

Notes:_____

48. Accelerated frequency of the heart rate and increased blood pressure were marked in the sportsman on the start before the competitions. Influence of what parts of the CNS can explain these changes?

A. Medulla.
B. Mesencephalon.
C. Diencephalon.
D. Hypothalamus.
E. Cortex of the large hemispheres.

Notes:_____

49. Arterial hypertension is caused by the stenosis of the renal arteries in the patient. Activation of what system is the main link in the pathogenesis of this form of hypertension?

A. Sympathoadrenal.
B. Renin-angiotensin.
C. Parasympathetic.
D. Hypothalamic-pituitary.
E. Kallikrein-kinin.

Notes:_____

50. On experiment on the dog the peripheral part of *nervus vagus* of the neck was irritated. What changes of the heart function would be observed?

A. Increased contraction force and rate.
B. Increased myocardial excitability.
C. Increased contraction force.
D. Increased atrioventricular conduction.
E. Decreased contraction rate.

Notes:_____

51. While emotional excitement the heart rate in a 30-year-old person run up to 112 Bpm. What part of the conducting system of the heart caused it?

A. Purkinje's fibers.
B. Synoatrial node.
C. His bundle.
D. His bundle branches.
E. Intraventricular node.

Notes:_____

52. A peripheral segment of *vagus nerve* on a dog's neck was being stimulated in course of an experiment. The following changes of cardiac activity could be mean while observed:

A. Heart rate and heart force amplification.
B. Enhancement of atrioventricular conduction.
C. Heart rate fall.
D. Heart hurry.
E. Increased excitability of myocardium.

Notes:_____

53. A patient who suffers from severe disorder of water-salt metabolism experienced cardiac arrest in diastole. What is the most probable mechanism of cardiac arrest in diastole?

A. Hypernatremia. *C. Hypokaliemia.* *E. Hyperkaliemia.*
B. Hyponatremia. *D. Organism dehydratation.*

Notes:_____

54. Short-term physical activity resulted in reflex amplification of heart rate and raise of systemic arterial pressure. What receptors activation was the main cause of pressor reflex realization?

A. Vascular chemoreceptors. *D. Hypothalamus thermoreceptors.*
B. Vascular volume receptors. *E. Vascular baroreceptors.*
C. Proprioreceptors of active muscles.

Notes:_____

55. A 63 y.o. man with collapse symptoms was delivered to the emergency hospital. A doctor chose noradrenaline in order to prevent hypotension. What is the action mechanism of this medication?

A. Activation of dopamine receptors. *D. Activation of α_1-adrenoreceptors.*
B. Block of M-cholinoreceptors. *E. Activation of β-adrenoreceptors.*
C. Activation of serotonin receptors.

Notes:_____

56. An aged man had raise of arterial pressure under a stress. It was caused by activation of:

A. Functions of thyroid gland. *D. Hypophysis function.*
B. Sympathoadrenal system. *E. Parasympathetic nucleus of vagus.*
C. Functions of adrenal cortex.

Notes:_____

57. An animal with aortic valve insufficiency got hypertrophy of its left heart ventricle. Some of its parts have local contractures. What substance accumulated in the myocardiocytes caused these contractures?

A. Lactic acid. *B. Potassium.* *C. Carbon dioxide.* *D. Sodium.* *E. Calcium.*

Notes:_____

58. Systemic arterial pressure of an adult dropped from 120/70 to 90/50 mm Hg that led to reflectory vasoconstriction. The vasoconstriction will be maximal in the following organ:

A. Heart. *B. Kidneys.* *C. Adrenals.* *D. Brain.* *E. Bowels.*

Notes:_____

59. The minute blood volume in a patient with transplanted heart has increased as a result of physical activity. What regulative mechanism is responsible for these changes?

A. Sympathetic unconditioned reflexes.
B. Parasympathetic conditioned reflexes.
C. Parasympathetic unconditioned reflexes.
D. Sympathetic conditioned reflexes.
E. Catecholamines.

Notes:_____

60. In response to a change in body position from horizontal to vertical blood circulation system develops reflectory pressor reaction. Which of the following is its compulsory component?

A. Decrease in the circulating blood volume.
B. Systemic constriction of the venous vessels.
C. Systemic dilatation of the arterial resistive vessels.
D. Increase in the heart rate.
E. Weakening of the pumbing ability of heart.

Notes:_____

61. Introduction of a big dose of histamine to an experimental animal caused abrupt drop of arterial pressure as a result of:

A. Increase of heart rate.
B. Decrease of heart rate.
C. Decrease of heart rate and force.
D. Dilatation of resistance vessels.
E. Constriction of resistance vessels.

Notes:_____

62. Vagus branches that innervate heart are being stimulated during an experiment. This caused reduction of heart rate due to the intensification of the following process (through the cell membrane of cardiac pacemaker):

A. Calcium and potassium ion yield. *C. Potassium ion yield.* *E. Calcium ion yield.*
B. Potassium ion entry. *D. Calcium ion entry.*

Notes:_____

63. A patient with kidney disease has high blood pressure, especially the diastolic one. Hypersecretion of what biologically active substance causes blood pressure rise?

A. Adrenaline. *B. Noradrenaline.* *C. Vasopressin.* *D. Catecholamines.* *E. Renin.*

Notes:_____

64. A month after surgical constriction of rabbit's renal artery the considerable increase of systematic arterial pressure was observed. What of the following regulation mechanisms caused the animal's pressure change?

A. Adrenaline. *B. Vasopressin.* *C. Angiotensin-II.* *D. Noradrenaline.* *E. Serotonin.*

Notes:_____

65. Introduction of a local anesthetic to a patient resulted in the development of anaphylactic shock. What is the leading mechanism of blood circulation disturbance?

A. Activation of sympathoadrenal system.
B. Reduction of contractile myocardium function.
C. Decrease of vascular tone.
D. Hypervolemia.
E. Pain.

Notes:_____

66. While a 24 year old woman was waiting for tooth extraction, tonus of sympathetic part of autonomic nervous system rose. What reaction will the patient display?

A. Miotic pupils.
B. Bronchus constriction.
C. Increased frequency of heartbeat.
D. Hyperperistalsis.
E. Hypersecretion of digestive juices.

Notes:_____

67. In course of an experiment the peripheral segment of *vagus nerve* of an animal was stimulated. The following changes of heart activity were observed:

A. Increase of frequency and force of heartbeat.
B. Increased excitability of myocardium.
C. Increased conduction of excitement through myocardium.
D. Increased force of heartbeat.
E. Reduced heart rate.

Notes:_____

68. On the 2nd day after myocardium infarction the patient's systolic arterial pressure abruptly dropped down to 60 mm Hg. This was accompanied by tachycardia up to 140 bpm, dyspnea, loss of consciousness. What is the leading mechanism in the pathogenesis of this shock?

A. Decrease of circulating blood volume.
B. Paroxysmal tachycardia.
C. Decrease of stroke volume.
D. Intoxication by the products of necrotic degeneration.
E. Anaphylactic reaction to myocardial proteins.

Notes:_____

69. A patient was stung by a bee. Examination revealed that his left hand was hot, pink, edematic, there was a big red blister on the site of sting. What is the leading mechanism of edema development?

A. Injury of vessels caused by the sting.
B. Drop of oncotic pressure in tissue.
C. Drop of osmotic pressure in tissue.
D. Increased vessel permeability.
E. Reduced vessel filling.

Notes:_____

70. A 49 year old woman spent a lot of time standing. As a result of it she got leg edema. What is the most likely cause of the edema?

A. Decrease in hydrostatic pressure of blood in veins.
B. Decrease in hydrostatic pressure of blood in arteries.
C. Increase in hydrostatic pressure of blood in veins.
D. Increase in oncotic pressure of blood plasma.
E. Increase in systemic arterial pressure.

Notes:_____

71. Atria of an experimental animal were superdistended by blood that resulted in decreased reabsorption of *Na*+ and water in renal tubules. This can be explained by the influence of the following factor upon kidneys:

A. Vasopressin. *B. Angiotensin.* *C. Renin.* *D. Natriuretic hormone.* *E. Aldosterone.*

Notes:_____

72. During fighting a man had a cardiac arrest as a result of a hard blow to the upper region of anterior abdominal wall. Which of the described mechanisms might have provoked the cardiac arrest?

A. Parasympathetic conditioned reflexes.
B. Parasympathetic unconditioned reflexes.
C. Sympathetic conditioned reflexes.
D. Sympathetic unconditioned reflexes.
E. Peripheric reflexes.

Notes:_____

73. A 35-year-old man developed acute heart failure while running for a long time. What changes in ionic composition can be observed in the cardiac muscle?

A. Reduction of Na^+ and Ca^{2+} ions in the myocardium cells.
B. Reduction of Na^+ and Ca^{2+} ions in the extracellular space.
C. Accumulation of Na^+ and Ca^{2+} ions in the myocardium cells.
D. Reduction of K^+ and Mg^{2+} ions in the extracellular space.
E. Accumulation of K^+ and Mg^{2+} ions in the myocardium cells.

Notes:_____

74. A patient with a pathology of the cardiovascular system developed edemata of the lower extremities. What is the mechanism of cardiac edema development?

A. Increased hydrostatic pressure at the arterial end of the capillary.
B. Increased hydrostatic pressure at the venous end of the capillary.
C. Increased oncotic pressure.
D. Reduced osmotic pressure.
E. Lymph efflux disorder.

Notes:_____

75. Experimental stimulation of the sympathetic nerve branches that innervate the heart caused the increase in force of heart contraction because the membrane of typical cardiomyocytes permitted an increase in:

A. Potassium ion entry. *C. Calcium ion exit.* *E. Calcium and potassium ions exit.*
B. Potassium ion exit. *D. Calcium ion entry.*

Notes:_____

76. A 16-year-old female patient has fainted after quickly changing her body position from horizontal to vertical one. Which process from the ones listed below has caused the loss of consciousness in the first place?

A. Increasing venous return. *D. Increasing central venous pressure.*
B. Decreasing venous return. *E. Decreasing oncotic pressure of blood plasma.*
C. Increasing arterial pressure.

Notes:_____

77. Dentists commonly practice local anaesthetization by applying Novocain solution with 0,1 % adrenalin solution. The added adrenalin induces:

A. Arterial pressure drop. *C. Local vasoconstriction.* *E. Decrease in vascular resistance.*
B. Arterial pressure rise. *D. Local vasodilatation.*

Notes:_____

78. As a result of a rapid change from horizontal to vertical body position a 16-year-old girl lost consciousness. What is the reason for it?

A. Heart rate decrease. *C. Decreased venous return.* *E. –.*
B. . Arterial pressure rise *D. Increased venous return.*

Notes:_____

79. In course of an experiment researchers stimulate a branch of a sympathetic nerve that innervates heart. What changes in cardiac activity should be registered?

A. Decrease in heart force. *C. Increase in heart force.* *E. Increase in heart rate and heart force.*
B. Increase in heart rate. *D. Increase in arterial pressure.*

Notes:_____

80. A student who unexpectedly met his girlfriend developed an increase in systemic arterial pressure. This pressure change was caused by the intensified realization of the following reflexes:

A. Unconditional parasympathetic. *D. Conditional parasympathetic.*
B. Unconditional sympathetic. *E. Conditional sympathetic and parasympathetic.*
C. Conditional sympathetic.

Notes:_____

81. Experimental stimulation of the peripheral segment of the vagus nerve at a cat will result in the following changes:

A. Dilated pupils. *C. Increased heart rate.* *E. Bronchiectasis.*
B. Decreased heart rate. *D. Increased respiratory rate.*

Notes:_____

82. In the solution being used for perfusing the isolated heart of rat, the K^+ concentration has been increased to 8 mmol/l. What changes in the heart are to be expected?

A. There will be no changes. *C. Heart rate increase.* *E. Heart force increase.*
B. Diastolic arrest. *D. Systolic arrest.*

Notes:_____

83. A patient with hypertensic crisis has increased content of angiotensin II in blood. Angiotensin pressor effect is based on:

A. Activation of kinin-kallikrein system. *D. Activation of biogenic amine synthesis.*
B. Prostaglandin hypersecretion. *E. Vasopressin production stimulation.*
C. Contraction of arteriole muscles.

Notes:_____

84. Patient's systolic blood pressure is 90 mm Hg, diastolic – 70 mm Hg. Such blood pressure is caused by decrease of the following factor:

A. Pumping ability of the left heart. *C. Aortic compliance.* *E. Vascular tone.*
B. Pumping ability of the right heart. *D. Total peripheral resistance.*

Notes:_____

85. Due to blood loss the circulating blood volume of the patient decreased. How will it affect the blood pressure in this patient?

A. Systolic pressure will decrease while diastolic will increase.
B. Only systolic pressure will decrease.
C. Diastolic pressure will decrease while systolic will increase.
D. Systolic and diastolic pressure will decrease.
E. Only diastolic pressure will decrease.

Notes:_____

86. Vascular endothelium is characterized by high metabolic activity and synthesizes vasoactive substances. Among these substances there is a potent vasodilator synthesized from L-arginine. Name this vasodilator.

A. Bradykinin. B. Histamine. C. Nitrogen oxide. D. Adrenaline. E Acetylcholine. .

Notes:_____

87. A test animal receives electrical impulses that irritate the sympathetic nerve that innervates blood vessels of the skin. What reaction will it cause in the blood vessels?

A. Arterial and venous constriction. *C. Venous dilation.* *E. Arterial dilation.*
B. Arterial and venous dilation. *D. No reaction.*

Notes:_____

88. During the prestart period an athlete develops increased frequency and force of cardiac contraction. These changes are caused by intensification of the following reflex responses:

A. Sympathetic unconditioned. *D. Parasympathetic unconditioned.*
B. Parasympathetic conditioned. *E. Sympathetic conditioned.*
C. Peripheral.

Notes:_____

89. After a traffic accident a man presents with severe blood loss, consciousness disturbance, low blood pressure, as well as compensatory activation of the renin-angiotensin system, which results in:

A. Hyperproduction of aldosterone. *D. Intensification of heart contractions.*
B. Increased blood coagulation. *E. Hyperproduction of vasopressin.*
C. Intensification of erythropoiesis.

Notes:_____

90. In the course of experiment the vagus nerve of the test animal was severed, which resulted in the animal developing constant tachycardia. What effect of parasympathetic nervous system on cardiac performance is demonstrated by this experiment?

A. Stimulatio. B. Inhibition. C. Mixed effect. D. Paradoxical response. E. Stimulus summation.

Notes:_____

91. It is necessary to decrease pumping ability of the patient's heart. What membrane cytoreceptors must be blocked to achieve this effect?

A. β-adrenergic receptors.
B. Nicotinic acetylcholine receptors.
C. Muscarinic acetylcholine receptors.
D. α-adrenergic receptors.
E. α-and β-adrenergic receptors.

Notes:_____

92. A 40-year-old person developed elevated blood pressure after an emotional excitement. What is the likely cause of this effect?

A. Increased sympathetic nervous system tone.
B. Increased parasympathetic nervous system tone.
C. Arteriolar dilation.
D. Decreased cardiac contraction frequency.
E. Hyperpolarization of cardiomyocytes.

Notes:_____

93. What changes can be expected to occur in the isolated heart of a toad, if excessive amount of calcium chloride is introduced into its perfusate?

A. Increased cardiac contraction force and frequency.
B. Increased cardiac contraction force.
C. Diastolic cardiac arrest.
D. Decreased cardiac contraction force.
E. Increased cardiac contraction frequency.

Notes:_____

94. A patient has elevated blood pressure due to increased vascular tone. To lower the blood pressure in this case it is necessary to prescribe the blockers of:

A. α-Adrenoreceptors.
B. Muscarinic acetylcholine receptors.
C. α- and β-adrenoreceptors.
D. Histamine H1 receptors.
E. β-adrenoreceptors.

Notes:_____

95. Domestic accident has resulted in a significant blood loss in the patient, which was accompanied by a drop in blood pressure. What hormones ensure quick restoration of the blood pressure caused by a blood loss?

A. Cortisol.
B. Oxytocin.
C. Aldosterone.
D. Adrenaline, vasopressin.
E. Reproductive hormones.

Notes:_____

PHYSIOLOGY OF HEART & CIRCULATION

Answers

Physiological properties of myocardium. Cardiac cycle

1. Correct answer is E. *(Stuart Ira Fox Human physiology, ninth edition. – P. 426).*
Cardiac output can be calculated using following formula: Cardiac output = stroke volume × heart rate, if CO and SV are known, so HR = CO / SV.

2. Correct answer is A. *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 120).*
The A-V nodal fibers discharge at an intrinsic rhythmical rate of 40 to 60 times per minute.

3. Correct answer is D *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 57).*
Electrical potentials exist across the membranes of virtually all cells of the body. In addition, some cells, such as nerve and muscle cells, are capable of generating rapidly changing electrochemical impulses at their membranes, and these impulses are used to transmit signals along the nerve or muscle membranes. In still other types of cells, such as glandular cells, macrophages, and ciliated cells, local changes in membrane potentials also activate many of the cells' functions.

4. Correct answer is B. *(Stuart Ira Fox Human physiology, ninth edition. – P. 397).*
At the average heart rate of 75 bpm, each cardiac cycle lasts 0,8 second, using following formula R-R interval (sec) = 60 second per minute / 75 bpm = 0,8 sec. If duration of R-R interval is known so 1 = 60 sec / x, x = 60 /1 = 60 bpm.

5. Correct answer is B. *(Kaplan Medical. USMLE. Step 1. Lecture notes. Physiology. Section V. Peripheral circulation. – P. 86).*
The ejection of blood begins when ventricular pressure exceeds arterial pressure and forces the semilunar valves open. The pressure peaks at 120 mmHg in the left ventricle and 25 mmHg in the right. Blood spurts out of each ventricle rapidly at first *(rapid ejection)* and then flows out more slowly under less pressure *(reduced ejection).*

Pressures in the Pulmonary Circulation		Pressures in the Systemic Circulation	
Right ventricle	25/0 mm Hg	Left ventricle	120/0 mm Hg
Pulmonary artery	25/8 mm Hg	Aorta	120/80 mm Hg
Mean pulm. art.	15 mm Hg	Mean art. blood p	93 mm Hg
Capillary	7–9 mm Hg	Capillary: skeletal renal glomerular	30 mm Hg 45–50 mm Hg
Pulmonary venous	5 mm Hg	Peripheral veins	15 mm Hg
Left atrium	5–10 mm Hg	Right atrium (central venous)	0 mm Hg
Pressure gradient	15–5 = 10 mm Hg	Pressure gradient	93–0 = 93 mm Hg

6. Correct answer is B. *(Physiology of visceral system) / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 76).*
Under normal conditions automaticity of all low-lying parts of the conductive system is suppressed by more frequent impulses arriving from the **sinuatrial node which is 60–80 per minute.**

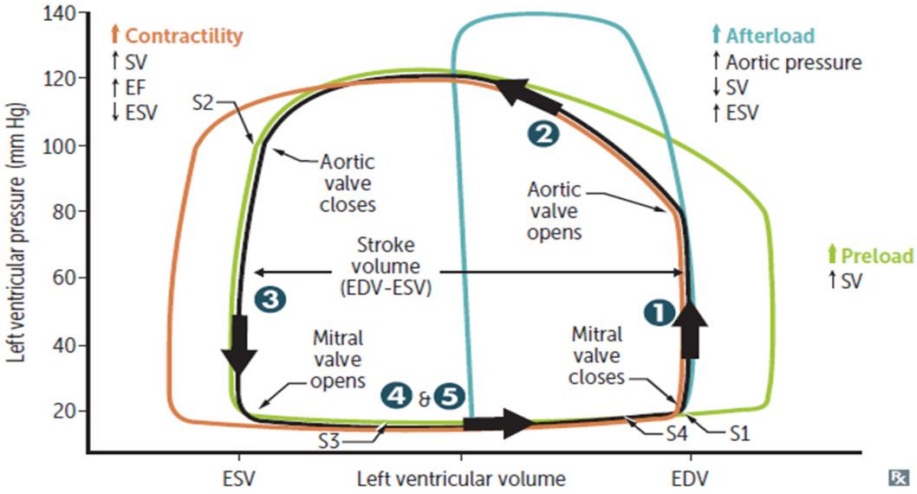
7. Correct answer is C. *(Physiology of visceral system) / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 75–76).*
The specialized excitatory and conductive system of the heart that controls cardiac contractions includes: 1) *sinus node* (also called *sinoatrial* or *S-A node*), in which the normal rhythmical impulse is generated; 2) *internodal pathways* that conduct the impulse from the sinus node to the atrioventricular (A-V) node; 3) *A-V node*, in which the impulse from the atria is delayed before passing into the ventricles; 4) *A-V bundle of His*, which conducts the impulse from the atria into the ventricles; 5) l*eft* and *right branches of His bundle*, which conduct the cardiac impulse to all parts of the ventricles. The significance of the following structures is to generate impulses automatically and to conduct them along conduction system structures of the heart.

8. Correct answer is B. *(Physiology of visceral system) / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 75–76).*
Under normal conditions automaticity of all low-lying parts of the conductive system is suppressed by more frequent impulses arriving from the **sinuatrial node which is 60–80 per minute**
9. Correct answer is E. *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 118–119).*
Cardiac impulse does not travel from the atria into the ventricles too rapidly; this delay allows time for the atria to empty their blood into the ventricles before ventricular contraction begins. It is primarily the *A-V node* and its *adjacent conductive fibers* that delay this transmission into the ventricles. Then there is a delay of another 0.09 second in the A-V node itself before the impulse enters the *penetrating portion of the A-V bundle*, where it passes into the ventricles. A final delay of another 0.04 second occurs mainly in this penetrating A-V bundle, which is composed of multiple small fascicles passing through the fibrous tissue separating the atria from the ventricles. Thus, the total delay in the A-V nodal and A-V bundle system is about 0.13 second.This, in addition to the initial conduction delay of 0.03 second from the sinus node to the A-V node, makes a total delay of 0.16 second before the excitatory signal finally reaches the contracting muscle of the ventricles.
10. Correct answer is D. *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 110).*
When the ventricles contract, one first hears a sound caused by closure of the A-V valves. The vibration is low in pitch and relatively long-lasting and is known as the *first heart sound.* When the aortic and pulmonary valves close at the end of systole, one hears a rapid snap because these valves close rapidly, and the surroundings vibrate for a short period. This sound is called the *second heart sound.*
11. Correct answer is C. *(Physiology of visceral system) / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 75–76).*
Under normal conditions automaticity of all low-lying parts of the conductive system is suppressed by more frequent impulses arriving from the **sinuatrial node which is 60–80 per minute.**
12. Correct answer is C. *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 105–106).*
Cardiac muscle is refractory to restimulation during the action potential. Therefore, the refractory period of the heart is the interval of time, during which a normal cardiac impulse cannot re-excite an already excited area of cardiac muscle. The normal refractory period of the ventricle is 0.25 to 0.30 second, which is about the duration of the prolonged plateau action potential. There is an additional *relative refractory period* of about 0.05 second during which the muscle is more difficult than normal to excite but nevertheless can be excited by a very strong excitatory signal. The refractory period of atrial muscle is much shorter than that for the ventricles (about 0.15 second for the atria compared with 0.25 to 0.30 second for the ventricles).
13. Correct answer is C. *(Arthur C. Guyton, John E. Hall., 11th edition, Chapter 23. – P. 271).*
When the ventricles contract, one first hears a sound caused by closure of the A-V valves. The vibration is low in pitch and relatively long-lasting and is known as the *first heart sound.* The mitral area is over the apex of the left ventricle, which is the portion of the heart nearest the surface of the chest.
14. Correct answer is D. *(Arthur C. Guyton, John E. Hall., 11th edition, Chapter 23. – P. 270–271).*
The aortic area is upward along the aorta in II intercostal space along the parasternal line on the right *(Guyton and Hall, 11th edition, Chapter 23. – P.. 270–271).*
15. Correct answer is A *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 75–76).*
A *certain delay in propagation of excitation* occurs in the atrioventricular node since its muscle fibers are not very thick and have a special connection between them. As a result, excitation reaches the atrioventricular node and cardiac conducting myocytes (or the Purkinje fibers) only after atrial musculature has contracted and blood has been pumped from the atria to the ventricles. Consequently, the *atrioventricular delay (0,02–0,05 m/sec) ensures the necessary sequence or coordination' of the atrial and ventricular contractions*.
16. Correct answer is C. *(Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18. – P. 735–736).*
The atria repolarize, relax, and remain in diastole for the rest of the cardiac cycle. The ventricles depolarize, generate the QRS complex, and begin to contract. Pressure in the ventricles rises sharply

and reverses the pressure gradient between atria and ventricles. The AV valves close as ventricular blood surges back against the cusps. Heart sound S1 occurs at the beginning of this phase and is produced mainly by the left ventricle; the right ventricle is thought to make little contribution. Causes of the sound are thought to include the tensing of ventricular tissues, acceleration of the ventricular wall, turbulence in the blood as it surges against the closed AV valves, and impact of the heart against the chest wall. This phase is called *isovolumetric* because even though the ventricles contract, they do not eject blood yet, and there is no change in their volume. This is because pressures in the aorta (80 mmHg) and pulmonary trunk (10 mmHg) are still greater than the pressures in the respective ventricles and thus oppose the opening of the semilunar valves. **The myocytes exert force, but with all four valves closed, the blood cannot go anywhere.**

17. Correct answer is C *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 152).*

When ventricular pressure becomes greater than aortic pressure (greater than 80 mm Hg), the **aortic valve opens.** Now blood is rapidly ejected from the left ventricle into the aorta through the open aortic valve, driven by the pressure gradient between the left ventricle and the aorta.



ElectroCardioGraphy

18: **Correct answer is C.** *(Stuart Ira Fox Human physiology, ninth edition, p. 405, Guyton and Hall, 11th edition. – P. 123).*

The P wave is caused by electrical potentials generated by SA node and then the **atria depolarize** before atrial contraction begins.

19. Correct answer is B. *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 730).*

The T wave is generated by ventricular repolarization immediately before diastole. The ventricles take longer to repolarize than to depolarize; the T wave is therefore smaller and more spread out than the QRS complex, and it has a rounder peak. Even in cases where the T wave is taller than the QRS complex, it can be recognized by its relatively rounded peak.

20. Correct answer is E. *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 730).*

The T wave is generated by ventricular repolarization immediately before diastole. The ventricles take longer to repolarize than to depolarize; the T wave is therefore smaller and more spread out than the QRS complex, and it has a rounder peak. Even in cases where the T wave is taller than the QRS complex, it can be recognized by its relatively rounded peak.

21. Correct answer is C. *(Ganong's Review of medical physiology, 23 edition, Chapter 30, Table 30–2).*

In ECG PR interval shows atrial depolarization and conduction through AV node.

22. Correct answer is C. *(Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18. – P. 730).*

The T wave is generated by ventricular repolarization immediately before diastole. The ventricles take longer to repolarize than to depolarize; the T wave is therefore smaller and more spread out than the QRS complex, and it has a rounder peak. Even in cases where the T wave is taller than the QRS complex, it can be recognized by its relatively rounded peak.

23. Correct answer is B. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 159).*

There are several methods for determining heart rate. Count the number of small boxes for a typical R-R interval. Divide this number into 1 500 to determine heart rate. In the image, the number of small boxes for the R-R interval is 21.5. The heart rate is 1 500/21.5, which is 69.8.

24. Correct answer is B. *(Arthur C. Guyton, John E. Hall., 11th edition. – P. 120).*

The A-V nodal fibers discharge at an intrinsic rhythmical rate of 40 to 60 times per minute.

25. Correct answer is B. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 106).*

Ciliary arrhythmia (Greek arrhythmia lack of a rhythm; synonym: *atrial fibrillation, fibrillation of auricles, arrhythmia perpetua, pulsus perpetuus irregularis, delirium cordis, fibrillatio et tachysystolia atriorum*). **Atrial fibrillation Characteristics** • Rhythms: Irregularly irregular • Rates: Atrial – usually greater than 400 beats/minute; ventricular – varies from 100 to 150 beats/minute but can be lower • P waves: Absent, • R-R intervals: Wide variation

26. Correct answer is E. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 82).*

Sinus tachycardia Characteristics • Rhythms: Regular • Rates: Both equal, generally 100 to 160 beats/minute • PR interval: Normal • QRS complex: Normal • T wave: Normal • QT interval: Shortened.

27. Correct answer is C. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 158).*

P wave is the first deflection and is normally a positive (upward) waveform. It indicates atrial depolarization.

28. Correct answer is D. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 82).*

A premature ventricular contraction (PVC) – also known as a premature ventricular complex, ventricular premature contraction (VPC), ventricular premature beat (VPB), or ventricular extrasystole (VES) Premature ventricular contraction Characteristics • Rhythms: Irregular during PVC; underlying rhythm may be regular • Rates: Patterned after underlying rhythm • P wave: Absent • PR interval: Unmeasurable • QRS complex: Wide and bizarre • T wave: Opposite direction from QRS complex • QT interval: Unmeasurable • Other: Possible compensatory pause.

29. Correct answer is E

30. Correct answer is A. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 45).*

The QRS complex follows the P wave and **represents depolarization of the ventricles**. Immediately after the ventricles depolarize, as represented by the QRS complex, they contract. That contraction ejects blood from the ventricles and pumps it through the arteries, creating a pulse.

31. Correct answer is B. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 45).*

The PR interval tracks the atrial impulse from the atria through the AV node, bundle of His, and right and left bundle branches. When evaluating a PR interval, look especially at its duration. Changes in the PR interval indicate an altered impulse formation or a conduction delay, as seen in AV block. A normal PR interval has the following characteristics (amplitude, configuration, and deflection aren't measured): • location – from the beginning of the P wave to the beginning of the QRS complex • duration – 0.12 to 0.20 second**.**

32. Correct answer is E. *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 730).*

The T wave is generated by ventricular repolarization immediately before diastole. The ventricles take longer to repolarize than to depolarize; the T wave is therefore smaller and more spread out than the QRS complex, and it has a rounder peak. Even in cases where the T wave is taller than the QRS complex, it can be recognized by its relatively rounded peak.

33. Correct answer is C. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 82).*

Sinus tachycardia Characteristics • Rhythms: Regular • Rates: Both equal, generally 100 to 160 beats/minute • PR interval: Normal • QRS complex: Normal • T wave: Normal • QT interval: Shortened**.**

34. Correct answer is E. *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 730).*

The **QRS complex** consists of a small downward deflection (Q), a tall sharp peak (R), and a final downward deflection (S). It marks the firing of the AV node and the onset of ventricular depolarization. Its complex shape is due to the different sizes of the two **ventricles** and the different times required for them to depolarize.

35. Correct answer is E. *(ECG interpretation made incredibly easy! – 5th ed. Lippincott Williams & Wilkins. – P. 82).*

A premature ventricular contraction (PVC) – also known as a premature ventricular complex, ventricular premature contraction (VPC), ventricular premature beat (VPB), or ventricular **extrasystole** (VES) Premature ventricular contraction Characteristics • Rhythms: Irregular during PVC; underlying rhythm may be regular • Rates: Patterned after underlying rhythm • P wave: Absent • PR interval: Unmeasurable • QRS complex: Wide and bizarre • T wave: Opposite direction from QRS complex • QT interval: Unmeasurable • Other: Possible compensatory pause.

The Laws of Hemodynamics

36. Correct answer is B. *(Stuart Ira Fox Human physiology, ninth edition. – P. 763).*

Increased capillary filtration results from increases in capillary BP or permeability. Poor venous return, for example, causes pressure to back up into the capillaries. Congestive heart failure and incompetent heart valves can impede venous return from the lungs and cause pulmonary edema. Systemic edema is a common problem when a person is confined to a bed or wheelchair, with insufficient muscular activity to promote venous return.

37. Correct answer is D

38. Correct answer is E. *(Saladin K.S. Anatomy and physiology. – 3rd edition, 2003. – P. 736).*

Both ventricles eject the same amount of blood even though pressure in the right ventricle is only about one fifth the pressure in the left. Blood pressure in the pulmonary trunk is relatively low, so the right ventricle does not need to generate very much pressure to overcome it. It is essential that both ventricles have the same output. If the right ventricle pumped more blood into the lungs than the left side of the heart could handle on return, blood would accumulate in the lungs and cause pulmonary hypertension and edema.

39. Correct answer is C. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 121).*

Normal amount of plasma proteins 65–85g/l. The pressure created by the concentration of colloidal proteins in the blood is called the blood colloidal osmotic pressure (BCOP) that normally equals 25–30 mm Hg. **Reduction of plasma proteins content leads to reduction of oncotic pressure of blood and resulting in intensification of water filtration**.

40. Correct answer is E. *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 736).*

Both ventricles eject the same amount of blood even though pressure in the right ventricle is only about one fifth the pressure in the left. Blood pressure in the pulmonary trunk is relatively low, so the right ventricle does not need to generate very much pressure to overcome it. It is essential that both ventricles have the same output. If the right ventricle pumped more blood into the lungs than the left side of the heart could handle on return, blood would accumulate in the lungs and cause pulmonary hypertension and edema.

41. Correct answer is D. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 101).*

The method of graph recording of arterial pulse is called sphygmography**.**

42. Correct answer is B. *(Saladin K.S. Anatomy and physiology.– 3rd edition. – 2003. – P. 736).*

Both ventricles eject the same amount of blood even though pressure in the right ventricle is only about one fifth the pressure in the left. Blood pressure in the pulmonary trunk is relatively low, so the right ventricle does not need to generate very much pressure to overcome it. It is essential that

both ventricles have the same output. If the right ventricle pumped more blood into the lungs than the left side of the heart could handle on return, blood would accumulate in the lungs and cause pulmonary hypertension and edema.

43. Correct answer is *A* *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 168).*

An increase in interstitial fluid volume is called **edema** (swelling). By definition, edema forms when the volume of interstitial fluid (due to filtration out of the capillaries) exceeds the ability of the lymphatics to return it to the circulation. Thus, edema can form when there is increased filtration or when lymphatic drainage is impaired (see the Table).

Cause	Examples
↑ P_c (capillary hydrostatic pressure)	Arteriolar dilation Venous constriction Increased venous pressure Heart failure Extracellular fluid volume expansion
↓π_c (capillary oncotic pressure)	Decreased plasma protein concentration Severe liver failure (failure to synthesize protein) Protein malnutrition Nephrotic syndrome (loss of protein in urine)
↑ K_f (hydraulic conductance)	Burn Inflammation (release of histamine; cytokines)
Impaired lymphatic drainage	Standing (lack of skeletal muscle compression of lymphatics) Removal or irradiation of lymph nodes Parasitic infection of lymph nodes

Regulation of cardiac activity and blood pressure

44. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 76).*

The A-V node and its adjacent conductive fibers conduct and delay transmission of impulses into the ventricles. The A-V node is located in the posterior wall of the right atrium immediately behind the tricuspid valve.

45. Correct answer is D. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 105, 114).*

In cardiac muscle, the action potential is caused by opening of two types of channels: 1) the same fast sodium channels as those in skeletal muscle and 2) another entirely different population of slow calcium channels, which are also called calcium-sodium channels. **Deficiency of calcium ions causes cardiac flaccidity, similar to the effect of high potassium**.

46. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 121).*

Right *n. vagus* controls mainly right atrium and SA node. Left *n. vagus* control AV node, His bundle and all contractile myocardium. So irritation of right nerve causes bradycardia. Effects of left nerve lead to decrease of contractility and conductibility.

47. Correct answer is E. *(Saladin K.S. Anatomy and physiology.– 3rd edition. – 2003. – P. 736).*

A **chemoreflex** is an autonomic response to changes in blood chemistry, especially its pH and concentrations of O_2 and CO_2. It is initiated by chemoreceptors within small organs called **aortic bodies** and **carotid bodies,** located in the aortic arch, subclavian arteries, and external carotid arteries. The primary role of chemoreflexes is to adjust respiration to changes in blood chemistry, but they have a secondary role in stimulating vasomotion. Hypoxemia (O_2 deficiency), hypercapnia (CO_2 excess), and acidosis (low blood pH) stimulate the chemoreceptors and act through the vasomotor center to cause widespread vasoconstriction. This increases overall BP, thus increasing perfusion of the lungs and the rate of gas exchange. Chemoreceptors also stimulate one's breathing, so increased ventilation of the lungs matches their increased perfusion.

48. Correct answer is E. *(Ackermann PDQ Physiology. – P. 102–103).*
Central nervous system mechanisms function to initiate, coordinate, and anticipate autonomic responses. They also provide set points and adapt them to circumstances when that is warranted by Hierarchy of Central Autonomic Control **Limbic cortex and amygdala** – these very high centers function both as a brake on automatic responses that may accompany emotional states, such as fear, rage, embarrassment, or sexual desire, and as direct activators of the system. The latter is seen prominently in two circumstances: (1) in the responses of blood pressure, sweat glands, or genitalia to dreams and fantasies and (2) in the volitional control of resting autonomic functions during states of deep meditation. In this state, metabolic rate, heart rate, arterial blood pressure, and distribution of blood flow can all be modified by application of conscious mental effort. Autonomic responses that are coordinated at this high CNS level are physically and emotionally complete whole-body responses in that they include the subjective feelings of fear, joy, pleasure, and pain.
49. Correct answer is B. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 201–202).*
The renin-angiotensin-aldosterone mechanism has a major effect upon the cardiovascular system. Renin is an enzyme, although because of its importance in the renin-angiotensin-aldosterone pathway, some sources identify it as a hormone. Specialized cells in the kidneys found in the juxtaglomerular apparatus respond to decreased blood flow by secreting renin into the blood. Renin converts the plasma protein angiotensinogen, which is produced by the liver, into its active form - angiotensin I. Angiotensin I circulates in the blood and is then converted into angiotensin II in the lungs. This reaction is catalyzed by the enzyme angiotensin-converting enzyme (ACE). Angiotensin II is powerful vasoconstrictor substance. As little as *one millionth* of a gram can increase the arterial pressure of a human being 50 mm Hg or more. The effect of angiotensin II is to constrict powerfully the small arterioles. The real importance of angiotensin II is that it normally acts on many of the arterioles of the body at the same time to increase the *total peripheral resistance*, thereby increasing the arterial pressure.
50. Correct answer is E. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 112–113).*
Vagus nerve releases Ach and through cholinergic M_2 Gi – protein- coupled receptors causing negative effects to the heart: decreased chronotropy, inotropy, dromotropy and bathmotropy
51. Correct answer is B. *(Saladin K.S. Anatomy and physiology. – 3rd edition. – 2003. – P. 738)***.**
Tachycardia is a persistent, resting adult heart rate above 100 bpm. It can be caused by emotional and physical stress, anxiety, drugs, heart disease, or fever. Heart rate also rises to compensate to some extent for a drop in stroke volume. Thus, the heart races when the body has lost a significant quantity of blood or when there is damage to the myocardium. *(Saladin K.S. Anatomy and physiology. – 3rd edition. – 2003. – P. 738).*
52. Correct answer is C. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 11–113).*
Vagus nerve releases Ach and through cholinergic M_2 Gi – protein- coupled receptors causing negative effects to the heart: decreased chronotropy, inotropy, dromotropy and bathmotropy.
53. Correct answer is E. *(Saladin K.S. Anatomy and physiology. – 3rd edition. – 2003. – P. 739, 924).*
In hyperkalemia the membrane potential becomes less negative, therefore in first phase of hyperkalemia it is easier to induce stimuli. The excitability is increased, arrhythmias can occur, patients have paresthesias. In severe hyperkalemia is the membrane potential even less negative, sodium channels stay inactive and second phase of hyperkalemia comes with muscle weakness, paralysis, bradycardia and QRS widening on ECG. In case of extreme hyperkalemia the whole process can end with ventricular fibrillation or the heart stops in diastole (asystole).
54. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 129).*
Physical loading results in activation of sympathetic division of cardiovascular center caused by stimulation of proprioreceptors of active muscles.
55. Correct answer is D. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016 – P. 129).*
Circulating Norepinephrine Causes:

- Increased heart rate (although only transiently) and increased inotropy (β_1-adrenoceptor mediated) are the direct effects norepinephrine on the heart.
- Vasoconstriction occurs in most systemic arteries and veins thus increasing blood pressure (postjunctional α_1 adrenoceptors)

56. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016 – P. 142).*
The catecholamines epinephrine and norepinephrine are released by the adrenal medulla, and enhance and extend the body's sympathetic or "fight-or-flight" response. They increase heart rate and force of contraction, while temporarily constricting blood vessels of organs not essential for flight-or-fight responses and redirecting blood flow to the liver, muscles, and heart.
57. Correct answer is E A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 140).*
An excess of calcium ions causes effects almost exactly opposite to those of potassium ions, causing the heart to go toward spastic contraction. This is caused by a direct effect of calcium ions to initiate the cardiac contractile process.
58. Correct answer is E. *(Bonanno FG. Physiopathology of shock. Journal of Emergencies, Trauma and Shock. 2011;4(2):222-232. doi:10.4103/0974 – 2700.82210.).*
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3132363/
The cardiovascular system responds to hypotension and hypovolemic shock by increasing the heart rate, increasing myocardial contractility and constricting peripheral blood vessels as result of the direct stimulation via the sympathetic system on heart and vessels by the cardiac and vasomotor centers in the reticular activating substance of lower pons and medulla oblongata. The sympathetic system releases catecholamines (noradrenaline and adrenaline) that will cause different effect on vessels of different organs according to type of adrenergic receptors that are predominant in those vessels. Brain is the most protected organ as there is the absence of direct sensitivity in the brain vessels to vasoconstricting catecholamines (predominance of α_2- and β_2-receptors instead of α1 as in systemic circulation arterioles); heart also has high protection due to abundant β2-receptors in coronary vessels. Thus, during the blood is shifted, literally squeezed, by the mechanism of vasoconstriction from skin and soft tissues first and from visceral organs to follow (gut, liver and lungs with kidney dysfunction) toward heart and brain. Vessels of skin and intestine have almost no β_2-receptors, only α1, making them the first victims of the sympathetic vasoconstriction during hemorrhage, aiming to divert by squeeze the blood toward more important organs and safeguard prioritized functions. Thus, **maximal vasoconstriction will be seen in skin, mucosa and gut (bowels),** and minimal – in brain and heart.
59. Correct answer is E. (*Physiology. Pre-test. Self-Assessment and Review. –14th Edition. – P. 173).*
Cardiac allografts are denervated such that the sympathetic nervous system is disconnected from the heart, and thus heart activity is not regulated by neural mechanisms but only by hormonal and in case of physical activity by **catecholamines**.
60. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016 .– P. 130).*
The transition from horizontal to vertical position (*orthostasis*) leads to changes in hydrostatic pressure in the vascular system. The action of gravity makes it difficult to return blood to the heart from the veins to even healthy individuals with paralyzed leg muscles, additional delay of 300 to 800 ml of blood. As a result, venous return and thus cardiac stroke volume are reduced. Consequently, falls impulses from mechanoreceptors of the aorta, carotid sinus, pulmonary artery trunk, leading to an increase in heart rate not more than 20 beats/min. In case of failure of compensatory responses to orthostatic stress developing orthostatic circulatory disorders, dangerous for the brain may develop. Subjectively, it is shown as a dizziness, "darkening " in the eyes, maybe even loss of consciousness.
61. Correct answer is D. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 142).*
Histamine via H_2 receptors produces relaxation of vascular smooth muscle that is independent of the endothelium.
62. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 122).*
Acetylcholine (ACh) released from the vagus nerve binds to the muscarinic (M_2) receptor, leading to the activation, and dissociation of inhibitory G protein heterotrimers. The resulting βγ-dimer

directly activates the G protein coupled inward rectifying potassium (GIRK) channel. Once the ion channel is activated, K^+ ions flow out of the cell and cause it to hyperpolarize. In its hyperpolarized state, the neuron cannot fire action potentials as quickly, which slows the heartbeat slowing pacemaker depolarization, and sinus rate.

63. Correct answer is E. *(Arthur C. Guyton, John E. Hall. 11th edition. . – P. 201–202).*

The renin-angiotensin-aldosterone mechanism has a major effect upon the cardiovascular system. Renin is an enzyme, although because of its importance in the renin-angiotensin-aldosterone pathway, some sources identify it as a hormone. Specialized cells in the kidneys found in the juxtaglomerular apparatus respond to decreased blood flow by secreting renin into the blood. Renin converts the plasma protein angiotensinogen, which is produced by the liver, into its active form - angiotensin I. Angiotensin I circulates in the blood and is then converted into angiotensin II in the lungs. This reaction is catalyzed by the enzyme angiotensin-converting enzyme (ACE). Angiotensin II is powerful vasoconstrictor substance. As little as *one millionth* of a gram can increase the arterial pressure of a human being 50 mm Hg or more. The effect of angiotensin II is to constrict powerfully the small arterioles. The real importance of angiotensin II is that it normally acts on many of the arterioles of the body at the same time to increase the *total peripheral resistance*, thereby increasing the arterial pressure.

64. Correct answer is C. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 201–202).*

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65. Correct answer is C *(Physiology of visceral systems: manual for second-year students of medical faculty (English-medium) / compilers : D.I. Marakushin, L.V. Chernobay, I.S. Karmazina etc. – Kharkov : KhNMU, 2016. – P.40).*

Basophils are real "factories" for production of BAS. Their large granules contain *heparin, histamine, serotonin, kallikrein, bradykinin* and others. Most of these substances are important factors in regulation of *capillaries permeability* and *microcirculation* in the inflammatory focus.

The basophils and mast cells play an exceedingly important role in some types of *allergic reactions* (reactions of hypersensitivity of immediate type).

66. Correct answer is C. *(Saladin K.S. Anatomy and physiology.– 3rd edition. – 2003. – P. 739, 924).*

Effects of sympathetic supply to the heart:

Adrenalin and noradrenalin stimulate heat activity and cause positive regulatory effects:

a) Positive inotropic effect - increasing strength of heart contractions;

b) **Positive chrono-tropic effect - increasing heartbeat rate;**

c) Positive dromo-tropic effect - increasing heart conductibility;

d) Positive bathmo-tropic effect - increasing excitability of heart muscle.

Norepinephrine increases permeability of cardiac fiber membrane to Na^+ and Ca^{2+}.

67. Correct answer is E. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 122).*

Acetylcholine (ACh) released from the vagus nerve binds to the muscarinic (M_2) receptor, leading to the activation, and dissociation of inhibitory G protein heterotrimers. The resulting βγ-dimer directly activates the G protein coupled inward rectifying potassium (GIRK) channel. Once the ion channel is activated, K^+ ions flow out of the cell and cause it to hyperpolarize. In its hyperpolarized state, the neuron cannot fire action potentials as quickly, which slows the heartbeat slowing pacemaker depolarization, and sinus rate.

68. Correct answer is C *(Kaplan Medical, Lecture notes, USMLE Step 1, 2017, Physiology. – P. 106).*

Factors Affecting Systolic Pressure

• Systolic blood pressure is the highest pressure in the systemic arteries during the cardiac cycle.

• The main factor determining systolic blood pressure on a beat-to-beat basis is stroke volume.

• An increase in stroke volume increases systolic blood pressure and a decrease in stroke volume decreases systolic blood pressure.

• Systolic blood pressure is also directly related to ventricular contractility. In addition, the rate of pressure change in the aorta is directly related to contractility. Thus, if contractility increases, then the rate of pressure and the absolute level of aortic pressure increases, and vice-versa.
• In chronic conditions, a decrease in the compliance of the systemic arteries (age-related arteriosclerosis) also increases systolic blood pressure.

69. Correct answer is D. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 39).*

Basophils are real "factories" for production of BAS. Their large granules contain *heparin*, ***histamine***, *serotonin, kallikrein, bradykinin* and others. Most of these substances are important factors in regulation of ***capillaries permeability*** and microcirculation in the inflammatory focus. The basophils and mast cells play an exceedingly important role in some types of ***allergic reactions*** (reactions of hypersensitivity of immediate type). The immunoglobulin E (IgE) type has a special propensity to become attached to mast cells and basophils. Then, during the successive reactions with the specific IgE, the resulting attachment of antigen to antibody causes the mast cell or basophil to rupture and release exceedingly large quantities of histamine, bradykinin, serotonin, heparin, slow-reacting substance of anaphylaxis, and a number of lysosomal enzymes. These cause local vascular and tissue reactions that cause many, if not most, of the allergic manifestations.

70. Correct answer is C. *(Stuart Ira Fox Human physiology. – Ninth edition. – P. 763).*

Increased capillary filtration results from increases in capillary BP or permeability. Poor venous return, for example, causes pressure to back up into the capillaries. Congestive heart failure and incompetent heart valves can impede venous return from the lungs and cause pulmonary edema. Systemic edema is a common problem when a person is confined to a bed or wheelchair, with insufficient muscular activity to promote venous return.

71. Correct answer is D. *(Stuart Ira Fox Human physiology. – Ninth edition. . – P. 436).*

Rise in arterial pressure or increased venous return for any other reason leads to increased urine production (increased water and sodium excretion) due to the following mechanism: ↑ VR → stretch receptors of left atrium, aortic arc and carotid sinus are stimulated → activate sensory fibers of vagus nerve to the HPT and inhibit ADH secretion and stimulate release of ANP from atria leading to increased excretion of sodium and water.

72. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 121).*

Pain from the trigger zones (sensitive areas) e.g. larynx, **epigastrium,** pericardium and tests produces sever decrease in HR and even cardiac arrest. These areas are richly supplied by parasympathetic fibers.

73. Correct answer is C *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 140).*

An excess of calcium ions causes effects almost exactly opposite to those of potassium ions, causing the heart to go toward spastic contraction. This is caused by a direct effect of calcium ions to initiate the cardiac contractile process.

74. Correct answer is B. *(Stuart Ira Fox Human physiology. – Ninth edition. – P. 763).*

Increased capillary filtration results from increases in capillary BP or permeability. Poor venous return, for example, causes pressure to back up into the capillaries. Congestive heart failure and incompetent heart valves can impede venous return from the lungs and cause pulmonary edema. Systemic edema is a common problem when a person is confined to a bed or wheelchair, with insufficient muscular activity to promote venous return.

75. Correct answer is D. (*Saladin K.S. Anatomy and physiology. – 3rd edition. – 2003. – P. 739, 924).*

Stimulation of the sympathetic nerves releases the hormone *norepinephrine* at the sympathetic nerve endings. The sequence of the developing events is as follows: stimulation of myocardial ß-receptors by catecholamines activates the intracellular enzyme adenylate cyclase which accelerates the reaction of 3,3-cyclic adenosine monophosphate formation (cAMP). cAMP activates phosphorylase that causes the breakdown of intramuscular glycogen and production of glucose (energy source for the contracting myocardium). In addition, phosphorylase is required for activation of Ca^{2+} ions that realize excitation-contraction coupling in the myocardium to increase a positive inotropic catecholamine action. Besides, catecholamines increase cell membrane

permeability to Ca^{2+} ions facilitating their increased passage from the intercellular spaces into the cell, on the one hand, and mobilization of Ca^{2+} ions from the intracellular depot, on the other.

Effects of sympathetic supply to the heart:

Adrenalin and noradrenalin stimulate heat activity and cause positive regulatory effects:

a) Positive inotropic effect - increasing strength of heart contractions;

b) Positive chrono-tropic effect - increasing heartbeat rate;

c) Positive dromo-tropic effect - increasing heart conductibility;

d) Positive bathmo-tropic effect - increasing excitability of heart muscle.

Norepinephrine increases permeability of cardiac fiber membrane to Na^+ and Ca^{2+}.

76. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 130).*

The transition from horizontal to vertical position (*orthostasis*) leads to changes in hydrostatic pressure in the vascular system. The action of gravity makes it difficult to return blood to the heart from the veins to even healthy individuals with paralyzed leg muscles, additional delay of 300 to 800 ml of blood. As a result, venous return and thus cardiac stroke volume are reduced. Consequently, falls impulses from mechanoreceptors of the aorta, carotid sinus, pulmonary artery trunk, leading to an increase in heart rate not more than 20 beats/min. In case of failure of compensatory responses to orthostatic stress developing orthostatic circulatory disorders, dangerous for the brain may develop. Subjectively, it is shown as a dizziness, "darkening " in the eyes, maybe even loss of consciousness.

77. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 129).*

Circulating Norepinephrine Causes:

- Increased heart rate (although only transiently) and increased inotropy (β_1-adrenoceptor mediated) are the direct effects norepinephrine on the heart.
- Vasoconstriction occurs in most systemic arteries and veins (postjunctional α_1-adrenoceptors).

78. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 130).*

The transition from horizontal to vertical position (*orthostasis*) leads to changes in hydrostatic pressure in the vascular system. The action of gravity makes it difficult to return venous blood to the heart from the veins to even healthy individuals with paralyzed leg muscles, additional delay of 300 to 800 ml of blood. As a result, venous return and thus cardiac stroke volume are reduced. Consequentl,y falls impulses from mechanoreceptors of the aorta, carotid sinus, pulmonary artery trunk, leading to an increase in heart rate not more than 20 beats/min. In case of failure of compensatory responses to orthostatic stress developing orthostatic circulatory disorders, dangerous for the brain may develop. Subjectively, it is shown as a dizziness, "darkening " in the eyes , maybe even loss of consciousness.

79. Correct answer is E. *(Saladin K.S. Anatomy and physiology.– 3rd edition. – 2003. – P. 739, 924).*

Stimulation of the sympathetic nerves releases the hormone *norepinephrine* at the sympathetic nerve endings. The sequence of the developing events is as follows: stimulation of myocardial ß-receptors by catecholamines activates the intracellular enzyme adenylate cyclase which accelerates the reaction of 3,3-cyclic adenosine monophosphate formation (cAMP). cAMP activates phosphorylase that causes the breakdown of intramuscular glycogen and production of glucose (energy source for the contracting myocardium). In addition, phosphorylase is required for activation of Ca^{2+} ions that realize excitation-contraction coupling in the myocardium to increase a positive inotropic catecholamine action. Besides, catecholamines increase cell membrane permeability to Ca^{2+} ions facilitating their increased passage from the intercellular spaces into the cell, on the one hand, and mobilization of Ca^{2+} ions from the intracellular depot, on the other.

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b) Positive chrono-tropic effect – increasing heartbeat rate;

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d) Positive bathmo-tropic effect – increasing excitability of heart muscle.

Norepinephrine increases permeability of cardiac fiber membrane to Na^+ and Ca^{2+}.

80. Correct answer is C. *(Ackermann PDQ Physiology. – P. 102–103).*
Central nervous system mechanisms function to initiate, coordinate, and anticipate autonomic responses. They also provide set points and adapt them to circumstances when that is warranted by Hierarchy of Central Autonomic Control **Limbic cortex and amygdala -** these very high centers function both as a brake on automatic responses that may accompany emotional states, such as fear, rage, embarrassment, or sexual desire, and as direct activators of the system. The latter is seen prominently in two circumstances: (1) in the responses of blood pressure, sweat glands, or genitalia to dreams and fantasies and (2) in the volitional control of resting autonomic functions during states of deep meditation. In this state, metabolic rate, heart rate, arterial blood pressure, and distribution of blood flow can all be modified by application of conscious mental effort. Autonomic responses that are coordinated at this high CNS level are physically and emotionally complete whole-body responses in that they include the subjective feelings of fear, joy, pleasure, and pain.
81. Correct answer is B *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 160).*
The **parasympathetic** outflow is the effect of the vagus nerve on the SA node to decrease the heart rate.
82. Correct answer is B. *(Saladin K.S. Anatomy and physiology. – 3rd edition. – 2003. P. 739, 924).*
In hyperkalemia the membrane potential becomes less negative, therefore, in first phase of hyperkalemia it is easier to induce stimuli. The excitability is increased, arrhythmias can occur, patients have paresthesias. In severe hyperkalemia is the membrane potential even less negative, sodium channels stay inactive and second phase of **hyperkalemia comes with muscle weakness, paralysis, bradycardia and QRS widening on ECG**. In case of extreme hyperkalemia the whole process can end with ventricular fibrillation or the heart stops in diastole (asystole).
83. Correct answer is C. *(Arthur C. Guyton, John E. Hall. – 11th edition. – P. 201–202).*
Angiotensin II is powerful vasoconstrictor substance. As little as *one millionth* of a gram can increase the arterial pressure of a human being 50 mm Hg or more. The effect of angiotensin II is to constrict powerfully the small arterioles. The real importance of angiotensin II is that it normally acts on many of the arterioles of the body at the same time to increase the *total peripheral resistance*, thereby increasing the arterial pressure.
84. Correct answer is A. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 99).*
The systolic pressure is the higher value (typically around 120 mm Hg) and reflects the arterial pressure resulting from the ejection of blood during ventricular contraction, or systole (left ventricle). The diastolic pressure is the lower value (usually about 80 mm Hg) and represents the arterial pressure of blood during ventricular relaxation, or diastole (left ventricle).
85. Correct answer is D *(Kaplan Medical, Lecture notes, USMLE Step 1, 2017, Physiology. – P. 106).*
The main factor determining systolic blood pressure on a beat-to-beat basis is stroke volume depending on blood volume also.
Diastolic blood pressure (DBP) is directly related to the volume of blood left in the aorta at the end of diastole.
86. Correct answer is C. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 133).*
NO is synthesized from arginine in a reaction catalyzed by nitric oxide synthase (NO synthase, NOS). The NO that is formed in the endothelium diffuses to smooth muscle cells, where it activates soluble guanylyl cyclase, producing cyclic 3,5-guanosine monophosphate , which in turn mediates the relaxation of vascular smooth muscle. NO is inactivated by hemoglobin.
87. Correct answer is A. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 133).*
Sympathetic noradrenergic fibers end on blood vessels in all parts of the body to mediate vasoconstriction. When the sympathetic nerves are cut (sympathectomy), the blood vessels dilate. In most tissues, vasodilation is produced by decreasing the rate of tonic discharge in the vasoconstrictor nerves, although in skeletal muscles it can also be produced by activating the sympathetic cholinergic vasodilator system. Venoconstriction and a decrease in the stores of blood in the venous reservoirs usually accompany increases in arteriolar constriction, although changes in the capacitance vessels do not always parallel changes in the resistance vessels. In the presence of

an increase in sympathetic nerve activity to the heart and vasculature, there is usually an associated decrease in the activity of vagal fibers to the heart. Conversely, a decrease in sympathetic activity causes vasodilation, a fall in blood pressure, and an increase in the storage of blood in the venous reservoirs. There is usually a concomitant decrease in heart rate, but this is mostly due to stimulation of the vagal innervation of the heart

88. Correct answer is E. *(Ackermann PDQ Physiology. – P. 102–103).*

Central nervous system mechanisms function to initiate, coordinate, and anticipate autonomic responses. They also provide set points and adapt them to circumstances when that is warranted by Hierarchy of Central Autonomic Control. **Limbic cortex and amygdala -** these very high centers function both as a brake on automatic responses that may accompany emotional states, such as fear, rage, embarrassment, or sexual desire, and as direct activators of the system. The latter is seen prominently in two circumstances: (1) in the responses of blood pressure, sweat glands, or genitalia to dreams and fantasies and (2) in the volitional control of resting autonomic functions during states of deep meditation. In this state, metabolic rate, heart rate, arterial blood pressure, and distribution of blood flow can all be modified by application of conscious mental effort. Autonomic responses that are coordinated at this high CNS level are physically and emotionally complete whole-body responses in that they include the subjective feelings of fear, joy, pleasure, and pain.

89. Correct answer is A. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 143).*

The renin-angiotensin-aldosterone mechanism has a major effect upon the cardiovascular system. Renin is an enzyme, although because of its importance in the renin-angiotensin-aldosterone pathway. Specialized cells in the kidneys found in the juxtaglomerular apparatus respond to decreased blood flow by secreting renin into the blood. Renin converts the plasma protein angiotensinogen, which is produced by the liver, into its active form – angiotensin I. Angiotensin I circulates in the blood and is then converted into angiotensin II in the lungs. This reaction is catalyzed by the enzyme angiotensin-converting enzyme (ACE). Angiotensin II is a powerful vasoconstrictor, greatly increasing blood pressure. It also stimulates the release of aldosterone, a hormone produced by the adrenal cortex. Aldosterone increases the reabsorption of sodium into the blood by the kidneys. Since water follows sodium, this increases the reabsorption of water. This in turn increases blood volume, raising blood pressure. Angiotensin II also stimulates the thirst center in the hypothalamus, so an individual will likely consume more fluids, again increasing blood volume and pressure.

90. Correct answer is B. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 123).*

Vagus tone: During rest vagus nerve continuously discharges and sends inhibitory impulses to the heart to suppress the high rhythm of S-A node (from 110–120 beat / min to 70 beat/ min), this is called ***vagus tone***.

Mechanism of vagus tone: at the rest state the tone of parasympathetic nervous system little bit higher that sympathetic; this is the cause of maintenance of HR and ABP at the optimal range.

Receptors: baroreceptors (or pressure receptors) are localized in carotid sinus and aortic arch.

Afferents: through sinus nerve which is a branch of glossopharyngeal nerve (IX) and aortic nerve which is a branch of vagus nerve (X).

Centre: Cardiac Inhibitory Center.

Efferent: vagus nerve which reduces the high rhythm of SA node.

Proof: Cutting of both vagi in animal result in rise of HR (from 70 to 120 bpm). Stimulation of the cut end of vagus leads to reduction of HR.

Vagus toneis higher: In man more than women, in athletes more than in nonathletic, and in adult more than children.

Physiological significance of vagus tone: Vagus tone rduces HR from 120 to 70 beat/min. This reduction in HR is a reserve to be used at times of need as in muscular exercise.

91. Correct answer is A. (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 124–125).*

Stimulation of the sympathetic nerves releases the hormone *norepinephrine* at the sympathetic

nerve endings stimulating myocardial ß-adrenergic receptors resulting in positive regulatory effects:

a) Positive inotropic effect – increasing strength of heart contractions;

b) Positive chrono-tropic effect – increasing heartbeat rate;

c) Positive dromo-tropic effect – increasing heart conductibility;

d) Positive bathmo-tropic effect – increasing excitability of heart muscle.

Thus blockage of ß1-adrenergic receptors will result in reduction of the pumping ability of the patient's heart.

92. Correct answer is A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 160).*

Emotional excitement results in increasing of sympathetic nervous system tone. The **sympathetic** outflow has four components: an effect on the SA node to increase heart rate, an effect on cardiac muscle to increase contractility and stroke volume, an effect on the arterioles to produce vasoconstriction and increase TPR, and an effect on veins to produce venoconstriction and decrease unstressed volume.

93. Correct answer is A *(Saladin K.S. Anatomy and physiology 3rd edition, 2003. – P. 739, 924).*

Stimulation of the sympathetic nerves releases the hormone *norepinephrine* at the sympathetic nerve endings. The sequence of the developing events is as follows: stimulation of myocardial ß-receptors by catecholamines activates the intracellular enzyme adenylate cyclase which accelerates the reaction of 3,3-cyclic adenosine monophosphate formation (cAMP). cAMP activates phosphorylase that causes the breakdown of intramuscular glycogen and production of glucose (energy source for the contracting myocardium). In addition, phosphorylase is required for activation of Ca^{2+} ions that realize excitation-contraction coupling in the myocardium to increase a positive inotropic catecholamine action. Besides, catecholamines increase cell membrane permeability to Ca^{2+} ions facilitating their increased passage from the intercellular spaces into the cell, on the one hand, and mobilization of Ca^{2+} ions from the intracellular depot, on the other.

Effects of sympathetic supply to the heart:

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d) Positive bathmo-tropic effect – increasing excitability of heart muscle.

94. Correct answer is A *(Kaplan Medical, Lecture notes, USMLE Step 1, 2017, Physiology. – P. 115).*

To lower the blood pressure in this case it is necessary to prescribe the blockers of α-Ad-renoreceptors. Norepinephrine (NE) released from sympathetic nerves has a tonic influence on arteriolar tone (a receptors) in resting skeletal muscle and skin vasculature in a thermo-neutral environment.

95. Correct answer is D *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 164).*

Adrenaline and vasopressin are the hormones ensure quick restoration of the blood pressure caused by a blood loss.

Stimulation of the sympathetic nerves releases the hormone *norepinephrine* at the sympathetic nerve endings stimulating myocardial ß-adrenergic receptors resulting in positive regulatory effects increasing HR and contractility and also stimulating alpha adrenergic receptors of vessels increasing vascular tone and blood pressure.

Antidiuretic hormone (vasopressin), which increases water reabsorption in collecting ducts. By increasing total body water, these effects complement the increases in Na+ reabsorption (caused by aldosterone and Na+-H+ exchange), thereby increasing ECF volume, blood volume, and blood pressure.

PHYSIOLOGY OF RESPIRATION SYSTEM

Questions

External respiration. Mechanism of inspiration and expiration

1. Lung of premature infant is presented on electronic photomicrography of biopsy material. Collapse of the alveolar wall caused by the deficiency of surfactant was revealed. Dysfunction of what cells of the alveolar wall caused it?

A. Alveolocytes type I. *C. Secretory cells.* *E. Alveolocytes type II.*
B. Alveolar macrophagcs. *D. Fibroblasts.*

Notes:_____

2. A patient after pathological process has a thickened alveolar membrane. The direct consequence of the process will be the reduction of:

A. Diffuse lung capacity. *C. Minute respiratory capacity.* *E. Oxygen capacity of blood.*
B. Reserve expiratory capacity. *D. Alveolar lung ventilation.*

Notes:_____

3. Intrapleural pressure is being measured in a person. In what phase does a person hold his breath if the pressure is – 25 cm of water?

A. Forced expiration. *C. –.* *E. Quiet expiration.*
B. Quiet inspiration. *D. Forced inspiration.*

Notes:_____

4. Part of alveoli of a preterm infant didn't spread because of enhanced elastic recoil of lungs. How can this recoil be reduced?

A. By fluid suction from the respiratory tracts. *D. By artificial pulmonary ventilation.*
B. By glucose introduction. *E. By pure oxygen inhalation.*
C. By surfactant introduction.

Notes:_____

5. A man's intrapleural pressure is being measured. In what phase did the man hold his breath, if his pressure is – 7,5 mm Hg?

A. Forced expiration. *B. Quiet inspiration.* *C. –.* *D. Quiet expiration.* *E. Forced inspiration.*

Notes:_____

6. A doctor asked a patient to breath out fully after taking a normal breath. What muscles contract during such exhalation?

A. Abdominal muscles. *C. Pectoral muscles.* *E. Diaphragm.*
B. Trapezius muscles. *D. External intercostal muscles.*

Notes:_____

7. Lungs of a preterm infant have areas of atelectasis (pulmonary collapse). The main cause is:

A. Underdeveloped inspiration muscles.
B. Diminished force of surface tension of lungs.
C. Surfactant deficiency.
D. Increased viscous resistance.
E. Surfactant excess.

Notes:_____

8. A young woman who entered a production department where it strongly smelt of paints and varnishes had a bronchospasm. This reflex was caused by irritation of the following receptors:

A. Juxtaglomerular.
B. Peripheral chemoreceptors.
C. Irritant.
D. Pleura receptors.
E. Central chemoreceptors.

Notes:_____

9. A man has trauma of greater pectoral muscle. What index' decrease will it cause?

A. Functional residual lung capacity.
B. Residual volume.
C. Expiratory reserve volume.
D. Inspiratory reserve volume.
E. Respiratory volume.

Notes:_____

10. A female patient, having visited the factory premises with lots of dust in the air for the first time, has got cough and burning pain in the throat. What respiratory receptors, when irritated, cause this kind of reaction?

A. Thermoreceptors.
B. Juxtacapillary (J) receptors.
C. Irritant receptors.
D. Stretch receptors of lungs.
E. Proprioreceptors of respiratory muscles.

Notes:_____

11. A patient has a trauma of sternocleidomastoid muscle. This caused a decrease in value of the following indicator of external respiration:

A. Residual volume.
B. Inspiratory reserve volume.
C. Expiratory reserve volume.
D. Respiratory capacity.
E. Functional residual lung capacity.

Notes:_____

12. Work in a mine is known to cause inhalation of large amount of coal dust. Inhaled coal dust can be detected in the following pulmonary cells:

A. . Pericapillary cells
B. Secretory endothelial cells.
C. Capillary endothelial cells.
D. Alveolar macrophages.
E. Respiratory epithelial cells.

Notes:_____

13. Alveolar space of acinus was invaded by bacteria that interacted with the surfactant. This led to the activation of the cells that are localized in the alveolar walls and on the surface. Name these cells:

A. Alveolocytes type II. *C. Endothelial cells.* *E. Alveolocytes type I.*
B. Alveolar macrophages. *D. Clara cells.*

Notes:_____

14. A patient demonstrates sharp decrease of pulmonary surfactant activity. This condition can result in:

A. Alveolar tendency to recede. *D. Increased pulmonary ventilation.*
B. Decreased airways resistance. *E. Hyperoxemia.*
C. Decresed work of expiratory muscles.

Notes:_____

Indexes of external respiration

15. Child asked you to puff up the balloon as much as possible for a one exhalation. What air volume will you use?

A. Vital volume of the lungs. *C. Backup volume of the inspiration.* *D. Inspiration volume.*
B. Total volume of the lungs. *E. Functional residual volume.*

Notes:_____

16. The alveolar ventilation of the patient is 5 L/min, the breath frequency is 10 per/min, and the tidal volume is 700 ml. What is the patient's dead space ventilation?

A. 0,7 L/min. *B. 4,3 L/min.* *C. –.* *D. 2,0 L/min.* *E. 1,0L/min.*

Notes:_____

17. A man took a quiet expiration. Name an air volume that is meanwhile contained in his lungs:

A. Expiratory reserve volume. *C. Residual volume.* *E. Respiratory volume.*
B. Functional residual capacity. *D. Vital lung capacity.*

Notes:_____

18. Lung ventilation in a person is increased as a result of physical activity. Which of the following indices of the external respiration is much higher than in a state of rest?

A. Inspiratory reserve volume. *C. Total lung capacity.* *E. Vital capacity of lungs.*
B. Expiratory reserve volume. *D. Respiratory volume.*

Notes:_____

19. A patient has a traumatic injury of sternocleidomastoid muscle. This has resulted in decrease in the following value:

A. Residual volume. *C. Inspiratory reserve volume.* *E. Respiratory volume.*
B. Expiratory reserve volume. *D. Functional residual lung capacity.*

Notes:_____

20. Analysis of the experimental spirogram of a 55-year-old person revealed a decrease in tidal volume and respiratory amplitude compared to the situation of ten years ago. The change in these indicators is caused by:

A. Physical build of a person. *D. Decreased force of respiratory muscle contraction.*
B. Height of a person. *E. Gas composition of the air.*
C. Body mass of a person.

Notes:_____

21. During recording of a spirogram a patient calmly exhaled. How do we call the volume of air remaining in the lungs?

A. Functional residual capacity. *C Expiratory reserve volume. .* *E. Vital capacity of lungs.*
B. Pulmonary residual volume. *D. Tidal volume.*

Notes:_____

22. During training session in the laboratory the students were performing spirography on themselves. What indicator CANNOT be measured with this method?

A. Functional residual capacity. *D. Vital capacity.*
B. Respiratory rate. *E. Respiratory minute volume.*
C. Maximal breathing capacity.

Notes:_____

Regulation of respiration

23. A group of mountain climbers went through the blood analysis at the height of 3000 m. It revealed decrease of HCO_3^- to 15 micromole/l (standard is 22–26 μmole/l). What is the mechanism of HCO_3^- decrease?

A. Intensification of acidogenesis. *D. Decrease of bicarbonate reabsorption in kidneys.*
B. Hypoventilation. *E. Decrease of ammoniogenesis.*
C. Hyperventilation.

Notes:_____

24. Vagi of an experimental animal were cut on both sides. What respiration changes will be observed?

A. It will become shallow and frequent. *D. It will become deep and infrequent.*
B. It will become shallow and infrequent. *E. It will become deep and frequent.*
C. No changes will be observed.

Notes:_____

25. A 35 year old man got an injury that caused complete disruption of spinal cord at the level of the first cervical segment. What respiration changes will be observed?

A. No changes will be observed.
B. It will become infrequent and deep.
C. Thoracic respiration will be maintained, diaphragmal respiration will disappear.
D. It will come to a standstill.
E. Diaphragmal respiration will be maintained, thoracic respiration will disappear.

Notes:_____

26. A patient has a transverse disruption of spinal cord below the IV thoracic segment. What changes of respiration will it cause?

A. Respiration will stop.
B. Respiration will become less frequent.
C. Respiration will become deeper.
D. Respiration will become more frequent.
E. Respiration will stay unchanged.

Notes:_____

27. If a man has an attack of bronchiospasm it is necessary to reduce the effect of vagus on smooth muscles of bronchi. What membrane cytoreceptors should be blocked for this purpose?

A. N-cholinoreceptors.
B. M-cholinoreceptors.
C. α-adrenoreceptors.
D. β-adrenoreceptors.
E. α- and β-adrenoreceptors.

Notes:_____

28. Voluntary breath-holding caused increase of respiration depth and frequency. The main factor stimulating these changes of external respiration is:

A. Decreased concentration of H^+ in blood.
B. Decreased tension of O_2 in blood.
C. Decreased tension of CO_2 in blood.
D. Increased tension of CO_2 in blood.
E. Increased tension of O_2 in blood.

Notes:_____

29. A patient has a transverse laceration of spinal cord below the VI thoracal segment. How will it change the character of breathing?

A. It will stop.
B. It will become more rare.
C. It will become more deep.
D. It will become more frequent.
E. It won't change essentially.

Notes:_____

30. A man has been holding his breath for 60 seconds. After that the respiratory minute volume has increased up to 12 L. What blood change is the main reason for the increase of respiratory minute volume?

A. Increase of pH. *C. Increase of pCO.* *E. Increase of pO_2.*
B. Decrease of pO_2. *D. Decrease of pCO_2.*

Notes:_____

31. During auscultation a 26-eyar-old patient was asked to breathe deep. After 10 breaths the patient lost consciousness, which is associated with the development of the following condition:

A. Carbon dioxide acidosis. *D. Reduced oxygen capacity of blood.*
B. Respiratory alkalosis. *E. Erythropenia.*
C. Polycythemia.

Notes:_____

32. The air in a room has increased concentration of carbonic acid. What respiratory changes (depth and rate) will be observed in a person after entering this room?

A. Decrease in depth. *C. Increase in rate.* *E. Increase in depth and rate.*
B. Decrease in rate. *D. Increase in depth.*

Notes:_____

33. A man is in the state of rest. He has been forcing himself to breath deeply and frequently for 3–4 minutes. What effect will it have upon acid-bace balance of the organism?

A. Metabolic alkalosis. *C. Respiratory acidosis.* *E. There will be no change in acid-base balance.*
B. Metabolic acidosis. *D. Respiratory alkalosis.*

Notes:_____

34. There is a strict time limit for people to stay at a height of 8 000 m above sea level without oxygen cylinders. Specify the life-limiting factor in this case:

A. Humidity rate. *C. Earth gravity.* *E. Partial pressure of oxygen in air.*
B. Temperature. *D. Rate of ultraviolet radiation.*

Notes:_____

35. A group of students who were climbing up a mountain presented with euphoria, tachypnea, tachycardia. Specify the immediate reason for hypocapnia accompanying mountain sickness:

A. Erythrocytosis. *C. Increase in heart rate.* *E. Decrease in respiration depth.*
B. Anaemia. *D. Increase in respiration rate and depth.*

Notes:_____

36. When water affects mucous membrane of the inferior nasal meatuses, this causes "diver reflex" that provokes:

A. Bronchospasm. *C. Reflectory hyperpnea.* *E. Cough.*
B. Reflectrory dyspnea. *D. Reflectory apnea.*

Notes:

37. To assess the effectiveness of breathing in patients, the indicator of functional residual capacity is used. It includes the following volumes:

A. Inspiratory reserve volume, tidal volume, residual volume.
B. Inspiratory reserve volume and tidal volume.
C. Inspiratory reserve volume and residual volume.
D. Expiratory reserve volume and tidal volume.
E. Expiratory reserve volume and residual volume.

Notes:

38. The carotid bodies on both sides were removed in a test animal. Which of the listed factors WILL NOT be able to cause hyperventilation in the test animal?

A. Physical exertion. *C. Hypercapnia.* *E. Hypoxia.*
B. Increase of core temperature. *D. Acidosis.*

Notes:

39. Electrical activity of neurons is being measured. They fire prior to and at the beginning of inhalation. Where are these neurons situated?

A. Diencephalon. *C. Medulla oblongata.* *E. Cerebral cortex.*
B. Mesencephalon. *D. Spinal cord.*

Notes:

40. A victim of a traffic accident has lost thoracic respiration but retains diaphragmal. The spinal cord is most likely to be damaged at:

A. XI–XII cervical segments. *C. I–II lumbar segments.* *E. VI–VII cervical segments.*
B. I–II cervical segments. *D. I–II sacral segments.*

Notes:

41. Spasm of smooth muscle of bronchi developed in the patient. Usage of activators of what membrane cytoreceptors is physiologically valid to decrease attack?

A. α- and ß-adrenoreceptors. *C. ß-adrenoreceptors.* *E. N-cholinoreceptors.*
B. α-adrenoreceptors. *D. M-cholinoreceptors.*

Notes:_____
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42. After hyperventilation an athlete developed a brief respiratory arrest. It occurred due to the following changes in the blood:

A. Decrease of CO_2 pressure. *C. Increase of CO_2 pressure.* *E. Decrease of O_2 pressure.*
B. Increase of CO_2 and O_2 pressure. *D. Decrease of pH.*

Notes:_____
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PHYSIOLOGY OF RESPIRATION SYSTEM

Answers

External respiration. Mechanism of inspiration and expiration

1. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 849, 855).*

Surfactant is a detergent-like lipoprotein that forms a thin film on the insides of the alveoli and bronchiole that decreases surface tension and prevents collapse of alveoli. Surfactant is produced by alveolocytes type II.

2. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 497–498).*

Main function of alveolar (respiratory) membrane is to provide adequate diffusion of oxygen from the alveolus into the red blood cell and diffusion of carbon dioxide in the opposite direction. Rate of diffusion of gases through alveolar membrane is inversely proportional to the thickness of the membrane, and any factor that increases the thickness to more than two to three times normal can interfere significantly with normal respiratory exchange of gases

3. Correct answer is D *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 176).*

Intrapleural pressure changes in different phases of respiratory cycle: quiet inspiration = -6 mm Hg (-7,5 mm of H_2O), quiet expiration = -3 mm Hg (-5 mm of water), forced inspiration = -20 mm Hg (-25 mm of water) and forced expiration = 0 – +3 mm Hg.

4. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 849, 855).*

Surfactant is a detergent-like lipoprotein that forms a thin film on the insides of the alveoli and bronchiole that decreases surface tension and prevents collapse of alveoli. Surfactant is produced by alveolocytes type II. Deficiency of surfactant in newborns causes respiratory distress syndrome that is treated by surfactant introduction.

5. Correct answer is B *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 176).*

Intrapleural pressure changes in different phases of respiratory cycle: quiet inspiration = -6 mm Hg (-7,5 mm of H_2O), quiet expiration = -3 mm Hg (-5 mm of water), forced inspiration = -20 mm Hg (-25 mm of water) and forced expiration = 0 – +3 mm Hg.

6. Correct answer is A (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 177–178).*

Respiratory muscles include: for quiet inspiration = external intercostal and diaphragm; for forced inspiration = external intercostal, diaphragm, pectoral, scalene, sternocleidomastoid; quiet expiration is passive – doesn't require any muscles; for forced expiration = internal intercostal and abdominal. For breathing out fully it's necessary to contract abdominal muscles.

7. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 849, 855).*

Surfactant is a detergent-like lipoprotein that forms a thin film on the insides of the alveoli and bronchiole that decreases surface tension and prevents collapse of alveoli. Surfactant is produced by alveolocytes type II. Deficiency of surfactant in newborns causes respiratory distress syndrome that is treated by surfactant introduction.

8. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elsevier, 2006. Unit VII Respiration. – P. 517–521).*

The epithelium of the trachea, bronchi, and bronchioles is supplied with sensory nerve endings called pulmonary irritant receptors that are stimulated by many incidents (dust, strong smell, etc.). Their irritation causes coughing and sneezing, and may also cause bronchial constriction in such diseases as asthma and emphysema.

9. Correct answer is D (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 177–178).*
Respiratory muscles include: for quiet inspiration = external intercostal and diaphragm; for forced inspiration = external intercostal, diaphragm, pectoral, scalene, sternocleidomastoid; quiet expiration is passive – doesn't require any muscles; for forced expiration = internal intercostal and abdominal. Trauma of pectoral muscle will decrease forced inspiration (inspiratory reserve volume).
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12. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elsevier, 2006. Unit VII Respiration. – P. 517–521).*
The epithelium of the trachea, bronchi, and bronchioles is supplied with sensory nerve endings called pulmonary irritant receptors that are stimulated by many incidents (dust, strong smell, etc.). Their irritation causes coughing and sneezing, and may also cause bronchial constriction in such diseases as asthma and emphysema.
13. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 849).*
Alveolar macrophages (dust cells) wander the lumens of the alveoli and the connective tissue between them. They are the last line of defense against inhaled matter. In lungs that are infected or bleeding, the macrophages also phagocytize bacteria and loose blood cells
14. Correct answer is A. (*Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 849).*
Alveolar macrophages (dust cells) wander the lumens of the alveoli and the connective tissue between them. They are the last line of defense against inhaled matter. In lungs that are infected or bleeding, the macrophages also phagocytize bacteria and loose blood cells

Indexes of external respiration

15. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 856).*
Vital volume (vital capacity) of lungs is the amount of air that can be exhaled with maximum effort after maximum inspiration (tidal volume TV + inspiratory reserve volume IRV + expiratory reserve volume ERV)
16. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 856).*
Vital volume (vital capacity) of lungs is the amount of air that can be exhaled with maximum effort after maximum inspiration (tidal volume TV + inspiratory reserve volume IRV + expiratory reserve volume ERV).
17. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 856).*

Vital volume (vital capacity) of lungs is the amount of air that can be exhaled with maximum effort after maximum inspiration (tidal volume TV + inspiratory reserve volume IRV + expiratory reserve volume ERV).

18. Correct answer is D (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 199).*

During physical exercises sympathetic nervous system causes dilation of bronchi, therefore, respiratory volume (tidal volume) that a person inhales and exhales increases.

19. Correct answer is C (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 177–178).*

Respiratory muscles include: for quiet inspiration = external intercostal and diaphragm; for forced inspiration = external intercostal, diaphragm, pectoral, scalene, sternocleidomastoid; quiet expiration is passive – doesn't require any muscles; for forced expiration = internal intercostal and abdominal. Trauma of pectoral muscle will decrease forced inspiration (inspiratory reserve volume).

20. Correct answer is D (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 179).*

Tidal volume is the amount of air inhaled or exhaled in one respiratory cycle during quiet respiration. Inhalation is an active process that uses inspiratory muscles (diaphragm and external intercostal), which can weaken with age.

21. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 856).*

After a quiet expiration in lungs the functional residual capacity is left - amount of air remaining in the lungs after a normal tidal expiration (residual volume RV + expiratory reserve volume ERV)

22. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 476).*

The spirometer cannot be used in a direct way to measure the functional residual capacity, because the air in the residual volume of the lungs cannot be expired into the spirometer, and this volume constitutes about one half of the functional residual capacity. To measure functional residual capacity, the spirometer must be used in an indirect manner, usually by means of a helium dilution method

Regulation of respiration

23. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 861).*

At high altitudes, the partial pressures of all atmospheric gases including O_2 are lower. The O_2 gradient from air to blood is proportionately less, and less O_2 diffuses into the blood. This causes increase of respiratory rate and depth (hyperventilation) and leads to increased elimination of CO_2, that is shown in decrease of HCO_3- in blood

24. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 516).*

Stretch receptors of the walls of the bronchi and bronchioles transmit signals through the vagi into the dorsal respiratory group of neurons when the lungs become overstretched. These signals "switch off" the inspiratory center and thus stop further inspiration. Thus, if nn. vagi are cut, respiration will become deeper and also less frequent (to maintain adequate O_2 and CO_2 concentrations)

25. Correct answer is D. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 200)/*

Spinal cord innervates respiratory muscles: C3-C5 = diaphragm, Th2-Th6 – external intercostal muscles, Th1-Th6 – internal intercostal muscles. Complete disruption of spinal cord at C1 leads to absence of innervation of all respiratory muscles, thus respiration will stop.

26. Correct answer is E. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 200)*

Spinal cord innervates respiratory muscles: C3-C5 = diaphragm, Th2-Th6 – external intercostal muscles, Th1-Th6 – internal intercostal muscles. Complete disruption of spinal cord below Th4 saves the innervation of inspiratory muscles, thus respiration will not change significantly.

27. Correct answer is B. *(Kaplan Medical USMLE Step 1 Pharmacology Lecture Notes. – P. 57).*
Spasm of smooth muscle of bronchi is a parasympathetic effect caused by activation of M_3 cholinergic receptors. Thus, it can be relieved by blockage of M_3-cholinergic receptors or by activation of $ß_2$-adrenoreceptors
28. Correct answer is D. *(Kaplan Medical USMLE Step 1 Pharmacology Lecture Notes. – P. 57).*
Spasm of smooth muscle of bronchi is a parasympathetic effect caused by activation of M_3 cholinergic receptors. Thus, it can be relieved by blockage of M_3-cholinergic receptors or by activation of $ß_2$-adrenoreceptors
29. Correct answer is E. *(Kaplan Medical USMLE Step 1 Pharmacology Lecture Notes. – P. 57).*
Spasm of smooth muscle of bronchi is a parasympathetic effect caused by activation of M_3 cholinergic receptors. Thus, it can be relieved by blockage of M_3-cholinergic receptors or by activation of $ß_2$-adrenoreceptors
30. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 517–518).*
After breath holding there are decrease of O_2 and increase of $_{CO2}$ and H+ in blood. CO_2 is the main stimulator of respiration because it stimulates both central chemoreceptors (in medulla) and peripheral chemoreceptors (in aortic and carotid body) leading to increase of respiration rate and depth. The same effect is seen when H+ ions increase. O_2 concentration stimulates only peripheral chemoreceptors, thus its effect on respiration is less
31. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 517–518).*
Increase of respiratory rate and depth (hyperventilation) leads to increased elimination of CO_2 that leads to decrease of H+ in blood and causes respiratory alkalosis (H+ binds with HCO_3- to form carbonic acid that dissociates into CO_2 and H_2O). Alkalosis and hypocapnia cause constriction of vessels in brain leading to loss of consciousness
32. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 517–518).*
Carbonic acid dissociates into CO_2 that is the main stimulator of respiration because it stimulates both central chemoreceptors (in medulla) and peripheral chemoreceptors (in aortic and carotid body) leading to increase of respiration rate and depth.
33. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 517–518).*
Carbonic acid dissociates into CO_2 that is the main stimulator of respiration because it stimulates both central chemoreceptors (in medulla) and peripheral chemoreceptors (in aortic and carotid body) leading to increase of respiration rate and depth.
34. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 861).*
At high altitudes, the partial pressures of all atmospheric gases including O_2 are lower. The O_2 gradient from air to blood is proportionately less, and less O2 diffuses into the blood. At height of 8 000 m above the sea level partial pressure of O_2 is so low that staying without oxygen cylinders will lead to hypoxia
35. Correct answer is D. (*Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 861).*
At high altitudes, the partial pressures of all atmospheric gases including O_2 are lower. The O_2 gradient from air to blood is proportionately less, and less O_2 diffuses into the blood. This causes increase of respiratory rate and depth (hyperventilation) and tachycardia, and leads to increased elimination of CO_2 (hypocapnia).
36. Correct answer is D (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 200)*
Diver reflex (apnoe reflex) is apnea caused by closure of larynx by epiglottis to prevent passage of water into the airways when the water triggers receptors of lower nasal meatus.

37. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 22 The Respiratory System. – P. 856).*

Functional residual capacity is the amount of air remaining in the lungs after a normal tidal expiration (residual volume RV + expiratory reserve volume ERV).

38. Correct answer is E *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 229).*

There are peripheral chemoreceptors for **O_2, CO_2, and H+** in the carotid bodies located at the bifurcation of the common carotid arteries and in the aortic bodies above and below the aortic arch. Information about arterial PO_2, PCO_2, and pH is relayed to the DRG via CN IX and CN X, which orchestrates an appropriate change in breathing rate.

The most important responsibility of the peripheral chemoreceptors is to detect changes in arterial PO_2.

39. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit VII Respiration. – P. 514).*

Neurons that fire right before and in the beginning of inspiration belong to dorsal respiratory group of the medulla oblongata (inspiratory center)

40. Correct answer is E *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 200).*

Spinal cord innervates respiratory muscles: C3-C5 = diaphragm, Th2-Th6 – external intercostal muscles, Th1-Th6 – internal intercostal muscles. Complete disruption of spinal cord below Th4 saves the innervation of inspiratory muscles, thus respiration will not change significantly.

41. Correct answer is C. *(Kaplan Medical USMLE Step 1 Pharmacology Lecture Notes. – P. 57).*

Spasm of smooth muscle of bronchi is a parasympathetic effect caused by activation of M_3 cholinergic receptors. Thus, it can be relieved by inhibition of M_3-cholinergic receptors or by activation of $ß_2$-adrenoreceptors.

42. Correct answer is A (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 198).*

The corrective homeostatic response to acidosis is ***hyperventilation***, "blowing off" CO_2 faster than the body produces it. This shifts the carbonic acid reaction to the left:

$$CO_2 + H_2O \leftarrow H_2CO_3 \leftarrow HCO_3^- + H^+$$

The CO_2 at the left is expired in the breath. The H^+ on the right is consumed as this reaction proceeds toward the left, and as H^+ concentration declines, the pH rises.

PHYSIOLOGY OF DIGESTION SYSTEM

Questions

Digestion in the mouth

1. The digestion system is a part of general system of discharge in an organism. Which from the listed functions does digestion system fulfill?

A. Motor. *B. Secretory.* *C. Excretory.* *D. Protective.* *E. Incretory.*

Notes:_____

2. A college entrant constantly experiences "dry mouth" before entrance examination. Which regulation mechanism from the named below basically causes this condition?

A. Humoral. *C. Conditioned-reflex.* *E. Local-reflex.*
B. Unconditioned-reflex. *D. Paracrine.*

Notes:_____

3. During the examination of the group of people enzymatic activity of saliva was defined. Which enzyme activity from the named below was examined?

A. Pepsin. *B. Amylases.* *C. Gastricsin.* *D. Lactases.* *E. Trypsin.*

Notes:_____

4. The person distinguishes four gustatory qualities: sweet, sour, bitter and salt. Which from the listed gustatory substances is the sensitivity expressed in greater degree to?

A. Bitter. *B. Salt.* *C. Sour.* *D. Sweet.* *E. Mixed.*

Notes:_____

5. For clinical research of the patient's saliva it is necessary to define its digesting ability. What substrate is it necessary to use during this research?

A. Albumin. *B. Globulin.* *C. Fibrinogen.* *D. Glucose.* *E. Amylum.*

Notes:_____

6. A patient with brain bloodstream disorder has got difficulties with swallowing; he can choke over while eating liquid food. What part of the brain is damaged?

A. Medulla. *C. Cerebellum.* *E. Cervical part of the spinal medulla.*
B. Thalamencephalon. *D. Midbrain.*

Notes:_____

7. In course of an experiment chorda tympani of an animal was being stimulated by electric current, as a result the parotid duct excreted:

A. A lot of viscous saliva.
B. A lot of fluid saliva.
C. A small quantity of fluid saliva.
D. A small quantity of viscous saliva.
E. Saliva wasn't excreted.

Notes:_____

8. A man consumes dry food. What salivary glands secret most of all?

A. Submandibular. *B. Sublingual.* *C. Parotides.* *D. Buccal.* *E. Palatine.*

Notes:_____

9. In course of an experiment a nerve is being stimulated by electric impulses. As a result of it sublingual and submaxillary glands discharge some dense viscous saliva. What nerve is being stimulated?

A. N. glossopharyngeus. *C. N. trigeminus.* *E. N. sympathicus.*
B. N. facialis. *D. N. vagus.*

Notes:_____

10. A patient consulted a doctor about difficult chewing. On the examination he was found to have the atrophy of the right temporal muscle and masticatory muscles. Upon opening the mouth, the patient's jaw deviates to the left. What nerve is affected?

A. Maxillary. *C. Facial.* *E. Motor portion of the mandibular nerve.*
B. Inferior alveolar. *D. Mandibulohyoid.*

Notes:_____

11. Stimulation of peripheral segment of Chorda tympani in an experimental animal resulted in the discharge of the following secretion from the parotid salivary fistula:

A. A lot of viscose saliva. *C. A small amount of viscose saliva.* *E. There is no saliva.*
B. A lot of liquid saliva. *D. A small amount of liquid saliva.*

Notes:_____

12. In order to administer general health improving therapy a parodontist intends to study factors of nonspecific resistance of saliva and mucous secretion. Which of the following factors of nonspecific resistance should be studied in the first line?

A. Secretory IgA. *B. Properdin.* *C. Interferon.* *D. Complement.* *E. Lysozyme.*

Notes:_____

13. A 60 year old patient was found to have a dysfunction of main digestive enzyme of saliva. This causes the disturbance of primary hydrolysis of:

A. Cellulose. *B. Carbohydrates.* *C. Fats.* *D. Proteins.* *E. Lactose.*

Notes:_____

14. Protective function of saliva is based on several mechanisms, including the presence of enzyme that has bactericidal action and causes lysis of complex capsular polysaccharides of staphylococci and streptococci. Name this enzyme.

A. Alpha-amylase. *C. Oligo-1,6-glucosidase.* *E. Beta-glucuronidase.*
B. Lysozyme. *D. Collagenase.*

Notes:_____

15. A patient presents with damaged fibers of the ninth pair of cranial nerves (glossopharyngeal nerve). What gustatory sensation will be disturbed in this case?

A. Bitterness. *B. Sourness.* *C. All gustatory sensations.* *D. Sweetness.* *E. Saltiness.*

Notes:_____

Digestion in the stomach

16. The patient with hypersecretion of gastric juice was recommended to exclude concentrated bouillon and vegetable decoctions from the diet because of their stimulation of gastric secretion. What is dominating mechanism of stimulation of secretion in this case?

A. Irritation of mechanoreceptors of the stomach.
B. Stimulation of excretion of secretin in the duodenum.
C. Irritation of taste receptors.
D. Stimulation of gastrin production by G-cells.
E. Irritation of mechanoreceptors of the oral cavity.

Notes:_____

17. When the pH level of the stomach lumen decreases to less than 3, the antrum of the stomach releases peptide that acts in paracrine fashion to inhibit gastrin release. This peptide is:

A. Somatostatin. *C. GIF.* *E. Acetylcholine.*
B. Gastrin-releasing peptide. *D. Vasoactive intestinal peptide.*

Notes:_____

18. The patient in consequence of postulcerative cicatrical changes had the constriction of pyloric part of the stomach (pyloric stenosis). Which functional manifestations hamper during digestion in the stomach?

A. Carbohydrate hydrolysis. *C. Fat hydrolysis.* *E. Secretion of gastric juice.*
B. Albuminolysis. *D. Evacuation of contents.*

Notes:_____

19. Experimental method "fictitious feeding" proves the realization of control mechanisms for gastric secretion which are named as:

A. Gastric phase. *C. Complex-reflex phase.* *E. Humoral phase.*
B. Intestinal phase. *D. Neurohumoral phase.*

Notes:_____

20. The patient after the gastric resection had derangements of digestion processes. Which regulation mechanism change from the named below results in derangements development in this case?

A. Complex-reflex. *C. Neurohumoral.* *E. Nervous.*
B. Humoral. *D. Unconditioned-reflex.*

Notes:_____

21. During the examination of acid-forming stomach function the patient in fasting condition had the following parameters: total acidity is 120 mmole/l, pH – 0.9. What from the named below corresponds to estimation of acid-forming function to the greatest degree?

A. Normal secretion. *C. Hyposecretion.* *E. Achylia.*
B. Submaximal secretion. *D. Hypersecretion.*

Notes:_____

22. In clinic the research of gastric maximal secretion is carried out using gastrointestinal hormones as the secretion stimulators. What from the listed is the most appropriate to use for this purpose?

A. Gastricsin. *B. Secretin.* *C. Motilin.* *D. Cholecystokinin.* *E. Pentagastrin.*

Notes:_____

23. Often gastroesophagal reflux (regurgitation of food from a stomach into esophagus) is the gastrointestinal tract motor disorders. What from the named forwards the development of such condition to the greatest degree?

A. Pyloric sphincter tonus decrease. *D. Inferior esophageal sphincter tonus decrease.*
B. Pyloric sphincter tonus increase. *E. Cardia tonus increase.*
C. Inferior esophageal sphincter tonus increase.

Notes:_____

24. The patient has the low acidity of gastric juice. What from the listed functions changes in the greater degree at the lack of the given component?

A. Activation of lipolysis. *C. Activation of proteolysis.* *E. Motility depression.*
B. Activation of glycolysis. *D. Activation of glycogenolysis.*

Notes:_____

25. An experimental dog by means of stomach tube was given 150 ml of meat broth. The concentration of which of the below mentioned substances will be increased in animal's blood?

A. Neurotensin. *C. Somatostatin.* *E. Insulin.*
B. Vasoactive intestinal polypeptide. *D. Gastrin.*

Notes:_____

26. A 57-year-old patient was admitted to the gastroenterological department with suspicion on Zollinger-Ellison syndrome because of rapid increase of gastrin level in the blood scrum. What disorder of the secretory function of the stomach is the most likely?

A. Hypoacid hypersecretion. *C. Hyperacid hypersecretion.* *E. Achylia.*
B. Hyperacid hyposecretion. *D. Hypoacid hyposecretion.*

Notes:_____

27. Examination of a 35 year old patient revealed high acidity of gastric juice. What receptors should be blocked in order to reduce it?

A. α_1-adrenoreceptors. *C. β_1-adrenoreceptors.* *E. Histamine.*
B. β_2-adrenoreceptors. *D. α_2-adrenoreceptors.*

Notes:_____

28. A patient ill with chronic gastritis went for endogastric pH-metry that allowed to reveal decreased acidity of gastric juice. It is indicative of diminished function of the following cells:

A. Parietal exocrinocytes. *C. Endocrinocytes.* *E. Chief exocrinocytes.*
B. Accessory cells. *D. Cervical cells.*

Notes:_____

29. Surgical removal of a part of stomach resulted in disturbed absorption of vitamin B_{12}, it is excreted with feces. The patient was diagnosed with anemia. What factor is necessary for absorption of this vitamin?

A. Gastrin. *B. Folic acid.* *C. Hydrochloric acid.* *D. Gastromucoprotein.* *E. Pepsin.*

Notes:_____

30. After examining the patient the doctor recommended him to eliminate rich meat and vegetable broth, spices, smoked products from the diet, since the patient was found to have:

A. Reduced secretion of hydrochloric acid by the stomach glands. *D. Reduced salivation.*
B. Increased secretion of hydrochloric acid by the stomach glands. *E. Biliary dyskinesia.*
C. Reduced motility of the gastrointestinal tract.

Notes:_____

31. A newborn child suffers from milk curdling in stomach, this means that soluble milk proteins (caseins) transform to insoluble proteins (paracaseins) by means of calcium ions and a certain enzyme. What enzyme takes part in this process?

A. Lipase. *B. Gastrin.* *C. Secretin.* *D. Renin.* *E. Pepsin.*

Notes:_____

32. A 35-year-old man with peptic ulcer disease has undergone antrectomy. After the surgery secretion of the following gastrointestinal hormone will be disrupted the most:

A. Histamine. *B. Gastrin.* *C. Neurotensin.* *D. Cholecystokinin.* *E Secretin. .*

Notes:_____

33. A patient is diagnosed with atrophic gastritis attended by deficiency od Castle's intrinsic factor. What type of anemia does the patient have?

A. B_{12}-deficiency anemia. *C. Iron-deficiency anemia.* *E. Hemolytic anemia.*
B. Iron refractory anemia. *D. Protein-deficiency anemia.*

Notes:_____

34. A patient has undergone surgical removal of the pylorus. Decreased secretion of the following hormone can be expected?

A. Gastrin. *B. Histamine.* *C. Secretin.* *D. Gastrin inhibitory polypeptide.* *E. Cholecystokinin.*

Notes:_____

35. A patient with exacerbated peptic ulcer disease of the stomach has made an appointment with the doctor. What type of drugs should be included in the complex therapy of the patient?

A. α-Adrenergic antagonist. *C. H_2-antagonists.* *E. β-Adrenergic antagonist.*
B. α-Adrenergic agonist. *D. H_1-antagonists.*

Notes:_____

36. During first year of life an infant presents with disturbed process of breast milk curdling. What cells of the proper gastric glands are functionally disturbed?

A. Exocrinocytes. *C. Parietal Exocrinocytes.* *E. Main Exocrinocytes.*
B. Accessory mucous cells. *D. Cervical mucous cells.*

Notes:_____

37. Gastroscopy of a patient revealed the lack of mucus in the coating of the mucous membrane. This can be caused by the dysfunction of the following cells of the gastric wall:

A. Parietal cells of gastric glands.
B. Endocrinocytes.
C. Main exocrinocytes.
D. Cervical cells.
E. Cells of prismatic glandular epithelium.

Notes:_____

38. At artificial feeding of infants the cow milk is used which is necessarily diluted. Which from the listed features of infants' gastric digestion is the reason of diluted milk use?

A. Low acidity.
B. High activity of lipase.
C. Low activity of pepsin.
D. Small stomach volume.
E. Low acid discharge.

Notes:_____

Digestion in the duodenum

39. Exocrinous activity of pancreas is in formation and discharge into duodenum of the juice containing zymogens. What from the listed causes zymogens' activation of pancreas juice?

A. Hydrochloric acid. *B. Histamine.* *C. Chemotrypsin.* *D. Enterokinase.* *E. Trypsin.*

Notes:_____

40. The patient has entered in gastroenterological department with the complaint for diarrhea which appears after rich and fatty food intake. What from the named can be the most probable reason of such condition development?

A. Low activity of phospholipase.
B. Low activity of trypsin.
C. High activity of lipase.
D. Cholepoiesis increase.
E. Biliation decrease.

Notes:_____

41. Because of present gallstone in the common bile duct, a patient has no bile excretion into duodenum. What disorder can it cause?

A. Carbohydrates digestion.
B. Proteins digestion.
C. Lipids digestion.
D Carbohydrates absorption. .
E. Proteins absorption.

Notes:_____

42. Secretion of which gastrointestinal hormones is primerily decreased in patient with removed duodenum?

A. Histamine.
B. Gastrin.
C. Gastrin and histamine.
D. Cholecystokinin and secretin.
E. Neurotensin.

Notes:_____

43. A 30-vear-old woman was diagnosed with insufficiency of exocrinous function of pancreas. Hydrolysis of what nutrients will be disturbed?

A. Proteins. *C. Proteins, carbohydrates.* *E. Proteins, fats, carbohydrates.*
B. Fats, carbohydrates. *D. Proteins. fats.*

Notes:_____

44. After consumption of rich food a patient has nausea and heartburn, steatorrhea. This condition might he caused by:

A. Increased lipase secretion. *D. Disturbed phospholipase synthesis.*
B. Bile acid deficiency. *E. Disturbed trypsin synthesis.*
C. Amylase deficiency.

Notes:_____

45. A patient underwent an operation on account of gall bladder excision that resulted in obstruction of Ca_2+ absorption through the bowels wall. What vitamin will stimulate this process?

A. C. *B.* B_{12}. *C.* D_3. *D. K.* *E. PP.*

Notes:_____

46. A patient has a disturbed absorption of fat hydrolysates. It might have been caused by a deficit in the small intestine cavity:

A. Of bile pigments. *C. Of bile acids.* *E. Of liposoluble vitamins.*
B. Of lipolytic enzymes. *D. Of sodium ions.*

Notes:_____

47. A patient consumed a lot of reach in proteins food that caused increase of rate of proteolytic enzymes of pancreatic juice. It is also accompanied by increase of rate of the following enzyme:

A. Trypsin. *B. Pepsin.* *C. Enterokinase.* *D. Gastricsin.* *E. Renin.*

Notes:_____

48. Alterations in protein digestion in the small intestine are induced by the impairment of trypsin and chymotrypsin activity. What enzyme deficiency may be the cause of this impairment?

A. Lipase. *B. Maltase.* *C. Pepsin.* *D. Amylase.* *E. Enterokinase.*

Notes:_____

49. An animal has been given a weak solution a hydrochloric acid introduced into the duodenum through a tube. Which hormone concentration will increase in the animal?

A. Neurotensin. B. Glucagon. C. Cholecystokinin (pancreozymin). D. Secretin. E. Gastrin.

Notes:_____

50. A 48-year-old female patient with history of cholilithiasis has recurring steatorrhea. What vitamin deficiency may develop as a complication of the current disease?

A. PP. *B. K.* *C. B_6.* *D. B_{12}.* *E. C.*

Notes:_____

51. A patient has a critical impairment of protein, fat and hydrocarbon digestion. Most likely it has been caused by low secretion of the following digestive juice:

A. Gastric juice. B. Intestinal juice. C. Pancreatic juice. D. Saliva. E. Bile.

Notes:_____

52. A 30-year-old woman has subnormal concentration of enzymes in the pancreatic juice. This might be caused by the hyposecretion of the following gastrointestinal hormone:

A. Somatostatin. *C Cholecystokinin-pancreozymin. .* *E. Vaso-intestinal peptide.*
B. Secretin. *D. Gastro-inhibiting peptide.*

Notes:_____

53. Examination of a patient revealed that dental hypoplasia was caused by hypovitaminosis of vitamins A and D. These vitamins were administered perorally but they didn't have any medicinal effect. What is the probable cause of disturbed vitamin assimilation?

A. Achylia. B. Achlorhydria. C. Bile acid deficiency. D. Hypochlorhydria. E. Hyperchlorhydria.

Notes:_____

54. During an acute experiment some of diluted solution of hydrochloric acid was injected into the duodenal cavity of an experimental animal. This will result in hypersecretion of the following hormone:

A. Histamine. *B. Gastrin.* *C. Motilin.* *D. Neurotensin.* *E. Secretin.*

Notes:_____

55. Roentgenologically confirmed obstruction of common bile duct resulted in preventing bile from inflowing to the duodenum. What process is likely to be disturbed?

A. Protein absorption. *C. Fat emulgation.* *E. Salivation inhibition.*
B. Carbohydrate hydrolysis. *D. Hydrochloric acid secretion in stomach.*

Notes:_____

56. A patient complains of frequent diarrheas, especially after consumption of rich food, weight loss. Laboratory examination revealed steatorrhea; his feces were hypocholic. What might have caused such condition?

A. Unbalanced diet.
B. Lack of pancreatic lipase.
C. Lack of pancreatic phospholipase.
D. Obturation of biliary tracts.
E. Inflammation of mucous membrane of small intestine.

Notes:_____

57. A 30-year-old male patient with acute pancreatitis has been found to have a disorder of cavitary protein digestion. The reason for such condition can be the hyposynthesis and hyposecretion of the following enzyme:

A. Pepsin. *B. Dipeptidase.* *C. Trypsin.* *D. Lipase.* *E. Amylase.*

Notes:_____

58. A patient has normally coloured stool including a large amount of free fatty acids. The reason for this is a disturbance of the following process:

A. Biliary excretion. *B. Fat hydrolysis.* *C. Choleresis.* *D. Fat absorption.* *E. Lipase secretion.*

Notes:_____

59. Due to the blockage of the common bile duct (which was radiographically confirmed), the biliary flow to the duodenum was stopped. We should expect the impairment of:

A. Fat emulsification.
B. Protein absorption.
C. Carbohydrate hydrolysis.
D. Secretion of hydrochloric acid.
E. Salivation inhibition.

Notes:_____

60. Stool test detects in the patients feces a large amount of undigested fats. This patient is the most likely to have disturbed secretion of the following enzymes:

A. Pancreatic lipases.
B. Pancreatic proteases.
C. Pancreatic amylase.
D. Gastric protease.
E. Bile lipase.

Notes:_____

61. A 45-year-old woman presents with insufficient secretion of enterokinase enzyme. Enterokinase deficiency can cause disturbance of the following digestive function:

A. Protein hydrolysis.
B. Lipid hydrolysis.
C. Carbohydrate hydrolysis.
D. Lipid absorption.
E. Vitamin absorption.

Notes:_____

62. Disturbed activity of trypsin and chymotrypsin leads to disturbed protein breakup in the small intestine. Activity of these enzymes depends on the presence of the following factor:

A. Enterokinase. *B. Pepsin.* *C. Na^+ salts.* *D. Hydrochloric acid.* *E. Bile acids.*

Notes:_____

Digestion in the small and large intestine. Physiology of nutrition

63. A 60-year-old patient was diagnosed with hypothalamic lateral nuclei stroke. What changes in patient's behavior may be expected?

A. Unsatisfied hunger. *C. Aggressive behavior.* *E. Depression.*
B. The rejection of food. *D. Thirst.*

Notes:_____

64. As a result of a trauma the patient had the damaged lateral nuclei of hypothalamus. Which from the listed conditions of the organism causes such damage?

A. Bulimia. *B. Aphagia.* *C. Hyperphagia.* *D. Anorexia.* *E. Areflexia.*

Notes:_____

65. A 2-year-old child has got intestinal dysbacteriosis, which resulted in hemorrhagic syndrome. What is the most likely cause of hemorrhage of the child?

A. Fibrinogen deficiency. *C. PP hypovitaminosis.* *E. Activation of tissue*
B. Hypocalcemia. *D. Vitamin K deficiency.* *thromboplastin.*

Notes:_____

66. A 60-year-old patient presents with weakened peristaltic activity of the bowels. Which of the following foodstuffs would stimulate peristalsis most of all?

A. Meat. *B. White bread.* *C. Brown bread.* *D. Lard.* *E. Tea.*

Notes:_____

67. A 36-eyar-old male patient has malabsorption of sodium ions from the intestinal lumen into blood. At the same time, absorption of the following substances remains unchanged:

A. Proteins. *B. Fats.* *C. Chlorides.* *D. Carbohydrates.* *E. Water.*

Notes:_____
_____
_____
_____
_____

68. A newborn develops dyspepsia after the milk feeding. When the milk is substituted by the glucose solution the dyspepsia symptoms disappear. The newborn has the subnormal activity of the following enzyme:

A. Maltase. *B. Isomaltase.* *C. Lactase.* *D. Invertase.* *E. Amylase.*

Notes:_____
_____
_____
_____
_____

69. During Experiment the processes of food and water hydrolysis products absorption were studied. It was determined that these processes mainly occur in the following gastrointestinal segment:

A. Large intestine. *B. Oral cavity.* *C. Stomach.* *D. Rectum.* *E. Small intestine.*

Notes:_____
_____
_____
_____
_____

PHYSIOLOGY OF DIGESTION SYSTEM

Answers

Digestion in the mouth

1. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 23 Urinary system. – P. 881).*

Discharge (excretion) is carried out by respiratory, integumentary (skin and mucous membranes), digestive and urinary systems. The digestive system not only eliminates food residue (which is not a process of excretion) but also actively excretes water, salts, carbon dioxide, lipids, bile pigments, cholesterol, and other metabolic wastes.

2. Correct answer is C. *(Ackermann PDQ Physiology. – P. 102–103).*

Central nervous system mechanisms function to initiate, coordinate, and anticipate autonomic responses. They also provide set points and adapt them to circumstances when that is warranted by Hierarchy of Central Autonomic Control **Limbic cortex and amygdala -** these very high centers function both as a brake on automatic responses that may accompany emotional states, such as fear, rage, embarrassment, or sexual desire, and as direct activators of the system. The latter is seen prominently in two circumstances: (1) in the responses of blood pressure, sweat glands, or genitalia to dreams and fantasies and (2) in the volitional control of resting autonomic functions during states of deep meditation. Activation of sympathetic nervous system under the influence of higher nervous centers causes sympathetic responses, including change of salivation (small volume of viscous saliva) that causes sensation of dry mouth

3. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 946).*

Saliva contains 2 enzymes - salivary α-amylase (ptyalin), an enzyme that begins starch digestion in the mouth; and lingual lipase, an enzyme that is activated by stomach acid and digests fat after the food is swallowed. Thus, enzymatic activity of saliva in the mouth means only activity of α-amylase.

4. Correct answer is A. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 16 Sense Organs. – P. 594).*

The threshold for the bitter taste is the lowest of all – that is, we can taste lower concentrations of alkaloids than of acids, salts, and sugars. That can be related to the fact that most toxins and poisons have bitter taste (protective function of such high sensitivity – bitter compounds tend to trigger rejection responses such as gagging to protect against the ingestion of toxins). The senses of sweet and salty are the least sensitive.

5. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 946).*

Saliva contains 2 enzymes – salivary α-amylase (ptyalin), an enzyme that begins starch digestion in the mouth; and lingual lipase, an enzyme that is activated by stomach acid and digests fat after the food is swallowed. Thus, for research of saliva's digestive ability starch (amylum) is used.

6. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology, p. 783).* The areas that control swallowing are collectively called the deglutition or swallowing center and are located in the medulla and lower pons.

7. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 947).*

Parasympathetic nervous system through VII and IX cranial nerves stimulates the salivary glands to produce a lot of fluid, thin saliva rich in enzymes.

8. Correct answer is C *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 345).*

The **parotid glands** are composed of serous cells and secrete an aqueous fluid composed of water, ions, and enzymes.

9. Correct answer is E. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 947).*

A little amount of dense, viscous, thick saliva with a lot of mucus is caused by sympathetic stimulation

10. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 781).*
Most of the muscles of chewing (including right temporal and masticatory) are innervated by the motor branch of the fifth cranial nerve, and the chewing process is controlled by nuclei in the brain stem.
11. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 947).*
Parasympathetic nervous system through VII and IX cranial nerves stimulates the salivary glands to produce a lot of fluid, thin saliva rich in enzymes.
12. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal Physiology. – P. 794).*
Saliva contains several factors that destroy bacteria. One of these is thiocyanate ions and another is several proteolytic enzymes – the most important, lysozyme – that: a) attack the bacteria, b) aid the thiocyanate ions in entering the bacteria where these ions in turn become bactericidal, and c) digest food particles, thus helping further to remove the bacterial metabolic support.
13. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 946).*
Saliva contains 2 enzymes – salivary α-amylase (ptyalin), an enzyme that begins starch digestion in the mouth; and lingual lipase, an enzyme that is activated by stomach acid and digests fat after the food is swallowed. Thus, enzymatic activity of saliva in the mouth means only activity of α-amylase that starts digestion of carbohydrates
14. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal Physiology. – P. 794).*
Saliva contains several factors that destroy bacteria. One of these is thiocyanate ions and another is several proteolytic enzymes – the most important, lysozyme – that: a) attack the bacteria, b) aid the thiocyanate ions in entering the bacteria where these ions in turn become bactericidal, and c) digest food particles, thus helping further to remove the bacterial metabolic support.
15. Correct answer is A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 97).*
The posterior one third of the tongue (where bitter and sour sensations are most sensitive) is innervated by the glossopharyngeal nerve (CN IX).

Digestion in the stomach

16. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797–798).*
Gastrin is itself a hormone secreted by gastrin cells, also called G cells. These cells are located in the pyloric glands in the distal end of the stomach. Gastrin secretion is stimulated by mainly by presence of peptides (plus Ca++), also by high concentration of catecholamines and by bombesin (GRP). The vigorous mixing of the gastric juices transports the gastrin rapidly to the ECL cells in the body of the stomach, causing release of histamine directly into the deep oxyntic glands. The histamine then acts quickly to stimulate gastric hydrochloric acid secretion. As concentrated bouillons and decoctions contain a lot of peptides, they are potent stimulators of gastric secretion.
17. Correct answer is C. *(Uwe Ackerman – PDQ Physiology (Pretty Darned Quick Series): 1st (first) Edition, Chapter 8. Gastrointestinal System. – P. 306).*
Presence of acids leads to release of gastrin-inhibiting factor/peptide (GIF/GIP) by K-cells of stomach and duodenum that inhibits gastric HCl secretion and gastric motility and stimulates intestinal secretion
18. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 785).*
The distal opening of the stomach is the pylorus. Here the thickness of the circular wall muscle becomes 50 to 100 % greater than in the earlier portions of the stomach antrum, and it remains slightly tonically contracted almost all the time. Therefore, the pyloric circular muscle is called the

pyloric sphincter. Constriction of pyloric sphincter normally prevents passage of food particles until they have become mixed in the chyme to almost fluid consistency. In case of pyloric stenosis the passage of food (evacuation) from stomach is constantly impaired

19. Correct answer is C.*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 798).*

The cephalic (complex-reflex) phase of gastric secretion occurs even before food enters the stomach, especially while it is being eaten. It results from the sight, smell, thought, or taste of food. Method of "fictitious feeding" means that lower part of esophagus of the animal by special surgery is brought out, thus the food doesn't reach the stomach. However, the stomach secretion still increases in that case, proving the role of cephalic phase in stimulation of gastric secretion

20. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 957).*

Stomach plays an important role in both nervous (vagovagal and enterogastric reflexes) and humoral (secretion of histamine and gastrin) regulation of digestion.

21. Correct answer is D

In fasting conditions pH of gastric juice is 1,5–2,5 and total acidity 40–60 mmole/l. If pH is below 1,5 and total acidity is higher than 60 mmole/l, it indicates hyperacidic state (hypersecretion) of stomach.

22. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797–798)*

Pentagastrin is an artificial polypeptide that has similar structure as gastrin, thus it causes release of histamine directly into the deep oxyntic glands. The histamine then acts quickly to stimulate gastric hydrochloric acid secretion. As concentrated bouillons and decoctions contain a lot of peptides, they are potent stimulators of gastric secretion.

23. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 948).*

Gastroesophageal reflux, the backflow of stomach contents into the esophagus, is normally prevented partly by the tonus of lower (inferior) esophageal sphincter. If tonus of that sphincter decreases, reflux occurs

24. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797).*

Acidity of gastric juice depends on concentration of HCl in it. HCl in stomach activates proteolytic enzyme pepsin (that is first secreted in inactive form of pepsinogen). Thus, if acidity decreases, activation of proteolysis will be disturbed.

25. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797–798).*

Broth, bouillons and decoctions contain a lot of peptides that are the main stimulator of gastrin secretion (by G-cells of stomach).

26. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797–798).*

Gastrin is the main stimulator of gastric secretion that acts on ECL cells in the body of the stomach, causing release of histamine that stimulates gastric hydrochloric acid secretion. Increase of gastrin level will cause hypersecretion of hydrochloric acid (hyperacidic hypersecretion)

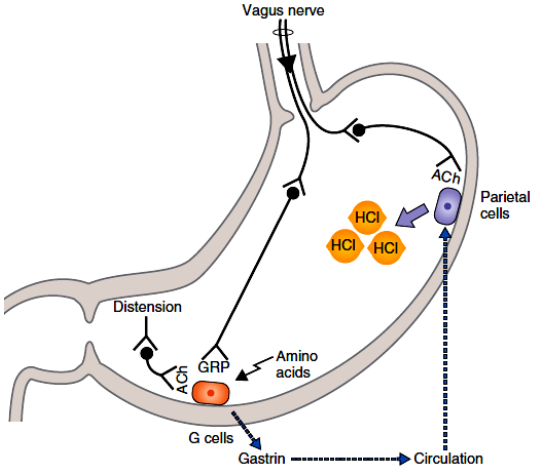
27. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797).*

The rate of formation and secretion of hydrochloric acid by the parietal cells is directly related to the amount of histamine secreted by the ECL cells. Thus, blockage of histamine receptors will decrease HCl secretion and correct acidity of gastric juice.

28. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*

The only cells that secrete hydrochloric acid are parietal cells located deep in the oxyntic glands of the main body of stomach.

29. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797).*
The substance called intrinsic factor (Castle's factor, gastromucoprotein), essential for absorption of vitamin B_{12} in the ileum, is secreted by the parietal cells of stomach along with the secretion of hydrochloric acid. When the acid-producing parietal cells of the stomach are destroyed, which frequently occurs in chronic gastritis, the person develops not only achlorhydria (lack of stomach acid secretion) but often also pernicious anemia because of failure of maturation of the red blood cells in the absence of vitamin B_{12} stimulation of the bone marrow.
30. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797–798).*
Broth, bouillons and decoctions contain a lot of peptides that are the main stimulator of gastrin secretion (by G-cells of stomach). Gastrin acts on the ECL cells in the body of the stomach, causing release of histamine that stimulates gastric hydrochloric acid secretion.
31. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 954).*
In infants, the chief cells of gastric glands besides pepsin also secrete gastric lipase and chymosin (rennin). Gastric lipase digests some of the butterfat of milk, and chymosin curdles milk by coagulating its proteins
32. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 795).*
The pyloric glands are located in the antral portion of the stomach, the distal 20 per cent of the stomach. The pyloric glands secrete mainly mucus for protection of the pyloric mucosa from the stomach acid and the hormone gastrin. Thus, antrectomy (resection of antral portion of stomach) will lead to **decrease of gastrin secretion**
33. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797).*
The substance called intrinsic factor (Castle's factor, gastromucoprotein), essential for absorption of vitamin B_{12} in the ileum, is secreted by the parietal cells of stomach along with the secretion of hydrochloric acid. When the acid-producing parietal cells of the stomach are destroyed, which frequently occurs in chronic gastritis, the person develops not only achlorhydria (lack of stomach acid secretion) but often also pernicious anemia because of failure of maturation of the red blood cells in the absence of vitamin B_{12} stimulation of the bone marrow.
34. Correct answer is A. *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 351).*
Gastrin is secreted into the circulation by G cells in the stomach antrum.



35. Correct answer is C
(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 352).
Histamine potentiates the actions of ACh and gastrin, H_2 receptor–blocking agents such as **cimetidine** have a greater effect than expected: They block the direct action of histamine *and* they also block the histamine potentiated effects of ACh and gastrin.

36. Correct answer is E *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 200).*
Chymosin, known also as rennin, is a proteolytic enzyme related to pepsin that synthesized by chief cells in the stomach. Its role in **digestion** is to curdle or coagulate **milk** in the stomach.
37. Correct answer is E *(Visual anatomy and physiology, 2nd Edition / Matrini, Ober, Nath, Bartholomew. – P. 848).*
A simple columnar epithelium lines all portions of the stomach. This epithelium produces a carpet of mucus that covers the interior surfaces of the stomach. The alkaline mucous layer protects epithelial cells against the acid and enzymes in the gastric lumen. Still, the environment is harsh, and a typical gastric epithelial cell has a life span of only 3 to 7 days.
38. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 797).*
Optimal pH for pepsin is 1,8–3,5, and in infants pH of gastric juice is 2,0–5,0, thus activity of pepsin is lower. Above a pH of about 5 it has almost no proteolytic activity and becomes completely inactivated in a short time.

Digestion in the duodenum

39. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 800).*
When first synthesized in the pancreatic cells, the proteolytic digestive enzymes are in the inactive forms of trypsinogen, chymotrypsinogen, and procarboxypolypeptidase, which are all inactive enzymatically. They become activated only after they are secreted into the intestinal tract. Trypsinogen is activated by an enzyme called enterokinase, which is secreted by the intestinal mucosa when chyme comes in contact with the mucosa. Other proteolytic enzymes are activated by trypsin.
40. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*
Bile acids in the bile do two things: (1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and (2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea.
41. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*
Bile acids in the bile do two things: (1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and (2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea.
42. Correct answer is D. *(Uwe Ackerman – PDQ Physiology (Pretty Darned Quick Series): 1st (first) Edition, Chapter 8. Gastrointestinal System. – P. 306).*
Epithelium of duodenum and jejunum contains I-cells that produce CCK (cholecystokinin) and S-cells that produce secretin, so removal of duodenum will decrease secretion of those 2 hormones.
43. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 799).*
Pancreatic secretion contains multiple enzymes for digesting all of the three major types of food: proteins (trypsin, chymotrypsin, and carboxypolypeptidase), carbohydrates (pancreatic amylase), and fats (pancreatic lipase, cholesterol esterase and phospholipase). It also contains large quantities of bicarbonate ions, which play an important role in neutralizing the acidity of the chyme emptied from the stomach into the duodenum.
44. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*
Bile acids in the bile do two things: 1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and 2) they aid in absorption of the digested fat end products through the intestinal

mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea with steatorrhea (undigested fats appearing in feces).

45. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 878).*

Vitamin D increases calcium absorption from the gastrointestinal tract and helps to control calcium deposition in the bone. The mechanism by which vitamin D increases calcium absorption is mainly to promote active transport of calcium through the epithelium of the ileum. In particular, it increases the formation of a calcium-binding protein in the intestinal epithelial cells that aids in calcium absorption.

Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*

Bile acids in the bile do two things: (1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and (2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea with steatorrhea (undigested fates appearing in feces).

47. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 800).*

When first synthesized in the pancreatic cells, the proteolytic digestive enzymes are in the inactive forms of trypsinogen, chymotrypsinogen, and procarboxypolypeptidase, which are all inactive enzymatically. They become activated only after they are secreted into the intestinal tract. Trypsinogen is activated by an enzyme called enterokinase, which is secreted by the intestinal mucosa when chyme comes in contact with the mucosa. Other proteolytic enzymes are activated by trypsin. Enterokinase itself is regulated dramatically in duodenum by pancreatic secretions (the more is pancreatic secretion, the more is activity of enterokinase).

48. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 800).*

When first synthesized in the pancreatic cells, the proteolytic digestive enzymes are in the inactive forms of trypsinogen, chymotrypsinogen, and procarboxypolypeptidase, which are all inactive enzymatically. They become activated only after they are secreted into the intestinal tract. Trypsinogen is activated by an enzyme called enterokinase, which is secreted by the intestinal mucosa when chyme comes in contact with the mucosa. Other proteolytic enzymes are activated by trypsin. Thus, low activity of proteolytic enzymes can be caused by deficiency of enterokinase

49. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 964).*

Acidic chyme stimulates S-cells of the duodenum to secrete secretin that stimulates the hepatic bile ducts and pancreatic ducts to secrete bicarbonates, so the bile and pancreatic juice both help to neutralize stomach acid in the duodenum

50. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 878).*

Vitamin K is necessary for the formation by the liver of prothrombin, Factor VII (proconvertin), Factor IX, and Factor X, all of which are important in blood coagulation. Therefore, when vitamin K deficiency occurs, blood clotting is retarded. Vitamin K is fat-soluble, thus it's absorbed only in presence of bile, and also is synthesized by bacteria in the colon. Deficiency of bile in intestine (obstruction of bile ducts) and dysbacteriosis of intestine both lead to deficiency of vitamin K causing hemorrhages

51. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 799).*

Pancreatic secretion contains multiple enzymes for digesting all of the three major types of food: proteins (trypsin, chymotrypsin, and carboxypolypeptidase), carbohydrates (pancreatic amylase), and fats (pancreatic lipase, cholesterol esterase and phospholipase). It also contains large quantities of bicarbonate ions, which play an important role in neutralizing the acidity of the chyme emptied from the stomach into the duodenum.

52. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 963).*
I-cells of duodenum secrete CCK that triggers three responses: (1) contraction of the gallbladder, which forces bile into the bile duct; (2) secretion of pancreatic enzymes; and (3) relaxation of the hepatopancreatic sphincter, which allows bile and pancreatic juice to be released into the duodenum. Thus, subnormal concentration of enzymes is caused by deficiency of CCK.
53. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 878).*
Vitamins A, D, E and K are fat-soluble, thus they are absorbed only in presence of bile. Deficiency of bile in intestine (obstruction of bile ducts) will lead to deficiency of fat-soluble vitamins due to their malabsorption.
54. Correct answer is E*(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 964).*
Presence of acid in duodenal lumen stimulates S-cells of the duodenum to secrete secretin that stimulates the hepatic bile ducts and pancreatic ducts to secrete bicarbonates, so the bile and pancreatic juice both help to neutralize stomach acid in the duodenum.
55. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*
Bile acids in the bile do two things: 1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and 2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea with steatorrhea (undigested fates appearing in feces).
56. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*
Bile acids in the bile do two things: 1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and 2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea with steatorrhea (undigested fates appearing in feces).
57. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 800).*
When first synthesized in the pancreatic cells, the proteolytic digestive enzymes are in the inactive forms of trypsinogen, chymotrypsinogen, and procarboxypolypeptidase, which are all inactive enzymatically. They become activated only after they are secreted into the intestinal tract. Trypsinogen is activated by an enzyme called enterokinase, which is secreted by the intestinal mucosa when chyme comes in contact with the mucosa. Other proteolytic enzymes are activated by trypsin.
58. Correct answer is D. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 972).*
Digestion of lipids includes 3 main steps: 1) emulsification of fats by bile with formation of smaller emulsification droplets by certain components of the bile—lecithin (a phospholipid) and bile acids (steroids); 2) digestion of lipids by pancreatic lipase, as a result two free fatty acids (FFAs) and a monoglyceride are formed from each triglyceride; 3) bile acids coat these and other lipids and form micelles, droplets about 5 nm in diameter containing bile acids, FFAs, monoglycerides, cholesterol, and fat-soluble vitamins; micelles pass amid the microvilli of the brush border and release their lipids, which diffuse freely through the plasma membranes (which are themselves mostly lipid) into the absorptive cells of small intestine. Therefore, if a patient has a lot of free fatty acids in feces, it means that digestion of lipids occurred, however, absorption didn't.
59. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 802).*

Bile acids in the bile do two things: (1) they help to emulsify the large fat particles of the food into many minute particles, the surface of which can then be attacked by lipase enzymes secreted in pancreatic juice, and (2) they aid in absorption of the digested fat end products through the intestinal mucosal membrane. Deficiency of bile causes disturbances of fats digestion and absorption leading to diarrhea

60. Correct answer is A (*Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 356).*

Most of the enzymes required for digestion of carbohydrates, proteins, and lipids are secreted by the pancreas. Pancreatic amylase and **lipases** are secreted as active enzymes. Pancreatic proteases are secreted in inactive forms and converted to their active forms in the lumen of the duodenum.

61. Correct answer is A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 356).*

Pancreatic proteases are secreted in inactive forms and converted to their active forms in the lumen of the duodenum. The pancreas secretes trypsinogen, which is converted in the intestinal lumen to its active form, trypsin by enterokinase.

62. Correct answer is A *(Physiology (fifth edition) / Linda S. Costanzo. – Saunders, Elsevier, 2014. – P. 356).*

Pancreatic proteases are secreted in inactive forms and converted to their active forms in the lumen of the duodenum. The pancreas secretes trypsinogen, which is converted in the intestinal lumen to its active form, trypsin by enterokinase.

Digestion in the small and large intestine. Physiology of nutrition

63. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 26 Nutrition and Metabolism. – P. 986–987).*

Lateral nuclei of the hypothalamus is feeding center or center of hunger; when it is destroyed in animals, they exhibit drastic loss of appetite and total rejection of food and starve to death if not force-fed. The ventromedial nuclei of hypothalamus are a center of saturation; damage here causes hyperphagia (overeating) and extreme obesity.

64. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 26 Nutrition and Metabolism. – P. 986–987).*

Lateral nuclei of the hypothalamus is feeding center or center of hunger; when it is destroyed in animals, they exhibit aphagia and total rejection of food and starve to death if not force-fed. The ventromedial nuclei of hypothalamus is a satiety center; damage here causes hyperphagia (overeating) and extreme obesity

65. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 878).*

Vitamin K is necessary for the formation by the liver of prothrombin, Factor VII (proconvertin), Factor IX, and Factor X, all of which are important in blood coagulation. Therefore, when vitamin K deficiency occurs, blood clotting is retarded. Vitamin K is fat-soluble, thus it's absorbed only in presence of bile, and also is synthesized by bacteria in the colon. Deficiency of bile in intestine (obstruction of bile ducts) and dysbacteriosis of intestine both lead to deficiency of vitamin K causing hemorrhages.

66. Correct answer is C. *(Effects of cereal fiber on bowel function: A systematic review of intervention trials /Jan de Vries, Paige E Miller, Kristin Verbeke // World J Gastroenterol. – 2015, Aug 7;21(29):8952-63. doi: 10.3748/wjg.v21.i29.8952.)*

Food that contains a lot of fiber greatly stimulates motility of intestine by bulking up the stool and retaining water. Fiber-rich products include vegetables, fruits, beans, and whole grains. Brown bread is made with significant amounts of whole grain flour, usually wheat, thus it's a potent stimulator of peristalsis.

67. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XII Gastrointestinal physiology. – P. 817).*

Absorption of proteins and carbohydrates in intestine occurs by way of Na+-co-transport. Absorption of water goes along the osmotic gradient created by Na+ concentration, and Cl- is absorbed by diffusion down the electrical gradient created by movement of Na+ ions. Only fats diffuse immediately out of the micelles and into the interior of the epithelial cells, which is possible because the lipids are also soluble in the epithelial cell membrane. Therefore, only fats absorption will not change because it doesn't depend on Na+ absorption.

68. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 25 The Digestive System. – P. 970).*

A child shows signs of dyspepsia only after milk intake, i.e. he has intolerance of lactose (disaccharide of milk) caused by deficiency of enzyme for it called lactase. If people with lactose intolerance consume milk, lactose passes undigested into the large intestine, increases the osmolarity of the intestinal contents, and causes colonic water retention and diarrhea. In addition, lactose fermentation by intestinal bacteria produces gas, resulting in painful cramps and flatulence

69. Correct answer is E *(Physiology (fifth edition) / Linda S. Costanzo. - Saunders, Elsevier, 2014. – P. 363–364).*

Absorption is the movement of nutrients, water, and electrolytes from the lumen of the intestine into the blood. Nutrients, most of water and electrolytes are absorbed in small intestine.

PHYSIOLOGY OF ENERGY EXCHANGE AND THERMOREGULATION

Questions

1. The population of the countries with hot climate and low humidity of air don't have hyperthermia. What from the listed factors of thermal acclimatization is the leading one?

A. Convection. *C. Pulmonary ventilation.* *E. Behavioral adaptation.*
B. Heat conduction. *D. Evaporation.*

Notes:_____

2. At definition of the basal metabolism of two patients of one age and with identical body weight the increase of this parameter is fixed at the patient who is higher. What from the listed factors is the principal cause of the detected difference?

A. Cellular metabolism. *C. The body surface area.* *E. Oxygenation of blood.*
B. Activity of hormonal link. *D. Maximal oxygen consumption.*

Notes:_____

3. In a sauna at low humidity the temperature of air achieves 100 °C. Which from the specified thermoregulation mechanisms protects the person from overheating?

A. Pulmonary ventilation. *C. Heat conduction.* *E. Evaporation of sweat.*
B. Thermal radiation. *D. Convection.*

Notes:_____

4. Which from the given parameters reflects energy metabolism intensity?

A. Quantity of consumed oxygen. *D. Composition of the food taken.*
B. Quantity of emitted heat. *E. Quantity of discharged CO_2.*
C. Quantity of the discharged water.

Notes:_____

5. Why are carbohydrates the first to be oxidized in the organism during physical exercise?

A. Carbohydrates during oxidation in the organism give the greatest respiratory coefficient.
B. For oxidation of 1 gram of carbohydrates the least quantity of O_2 is used.
C. Carbohydrates have the least size of thermal equivalent.
D. Carbohydrates have the greatest thermal value.
E. For oxidation of 1 gram of carbohydrates the greatest quantity of O_2 is used.

Notes:_____

6. What from the given complexes of normative conditions is used for definition of the basal metabolism?

A. Fasting, during sleep, sitting position, ambient temperature: +20 °C.
B. Fasting, wakefulness, lying position, ambient temperature: +10 °C.
C. Fasting, wakefulness, lying position, ambient temperature: +18 – (+20) °C.
D. In 12 hours after a meal, sitting, wakefulness condition, ambient temperature:+20 °C.
E. In 1 hour after a meal, sitting, wakefulness condition, at temperature of physiological comfort.

Notes:_____

7. What from the specified processes provides isothermia?

A. Processes of chemical thermoregulation.
B. Processes of physical thermoregulation.
C. Level of oxidizing processes in the organism.
D. Activity of exothermal reactions in the organism.
E. Optimum ratio of heat production and thermolysis.

Notes:_____

8. What from the listed thermoregulation processes are activated in conditions of ambient temperature drop?

A. Physical thermoregulation.
B. Pulmonary ventilation and sweat secretion.
C. Increase of muscle performance.
D. Chemical thermoregulation.
E. Heat conduction increase.

Notes:_____

9. A young man increased his energy inputs from 500 to 2 000 kJ per hour. What from the suggested can cause it?

A. Physical activity.
B. Rising of external temperature.
C. Food taking.
D. Change of sleeping for waking.
E. Mental activity.

Notes:_____

10. Buffer capacity of blood was decreased in the worker due to exhausting muscular work. Entry of what acid substance to the blood can this state be explained?

A. Pyruvate.
B. Lactate.
C. 3-phosphoglycerate.
D. 1,3-bisphosphoglycerate.
E. α-ketoglutarate.

Notes:_____

11. Respiratory coefficient was studied in the patient who strictly kept certain diet for 10 days. It was determined that it is 1. What diet does the patient follow?

A. With domination of carbohydrates.
B. Mixed.
C. With domination of proteins and fat.
D. With domination of fat and carbohydrates.
E. With domination of proteins and carbohydrates.

Notes:_____

12. What heat transfer mechanism is the most effective while the man being at 80 % moisture and the temperature +35 °C?

A. Evaporation. *B. –.* *C. Radiation.* *D. Heat conduction.* *E. Convection.*

Notes:_____

13. The energy inputs of a healthy man have been measured. In what position was the patient if his energy inputs were less than the main exchange?

A. Nervous exertion. *B. Easy work.* *C. Sleep.* *D. Rest.* *E. Calmness.*

Notes:_____

14. A lightly dressed man is standing in a room, air temperature is +14 °C, windows and doors are closed. In what way does he emit heat the most actively?

A. Perspiration. *B. Heat conduction.* *C. Heat radiation.* *D. Convection.* *E. Evaporation.*

Notes:_____

15. A human body cools in water much faster that in the air. What way of heat emission in water is much more efficient?

A. . Convection *B. Heat radiation.* *C. Heat conduction.* *D. Sweat evaporation.* *E. –.*

Notes:_____

16. An infant has apparent diarrhea resulting from improper feeding. One of the main diarrhea effects is plentiful excretion of sodium bicarbonate. What form of acid-base balance disorder is the case?

A. Metabolic alkalosis.
B. Respiratory alkalosis.
C. No disorders of acid-base balance will be observed.
D. Respiratory acidosis.
E. Metabolic acidosis.

Notes:_____

17. Workers of a hothouse farm work under conditions of unfavorable microclimate: air temperature is +37 °C relative humidity is 90%, air speed is 0,2 m/s. The way of heat emission under these conditions will be:

A. Radiation. *B. Convection.* *C. Heat conduction.* *D. All the ways.* *E. Evaporation.*

Notes:_____

18. The temperature of the ambient environment is +38 °C and relative air humidity is 50 %. What ways of heat emission provide maintaining a constant temperature of the human body?

A. Evaporation. *C. Heat conduction.* *E. Convection and conduction.*
B. Radiation. *D. Convection.*

Notes:_____

19. A man is being measured power inputs on an empty stomach, in the lying position, under conditions of physical and psychic rest at a comfortable temperature. Power inputs will reach the maximum at:

A. 5–6 p.m. *B. 7–8 a.m.* *C. 10–12 a.m.* *D. 2–3 p.m.* *E. 3–4 a.m.*

Notes:_____

20. A man's energy consumption is measured on an empty stomach, in lying position, under conditions of physical psychical rest, at comfortable temperature. At what time will the energy consumption be the lowest?

A. At 3–4 o'clock a.m. *C. At 10–12 o'clock a.m.* *E. At 5–6 o'clock p.m.*
B. At 7–8 o'clock a.m. *D. At 2–4 o'clock p.m.*

Notes:_____

21. A man left a conditioned premise and went outside. The outside temperature was +40 °C, the air moisture 60%.What way of heat emission will be mostly involved in this case?

A. Sweat evaporation. *B. Convection.* *C. Radiation.* *D. Conduction.* *E. –.*

Notes:_____

22. In a hot weather, the microclimate in hot rooms is often normalized by fans. At the same time heat radiation from the human body increases through:

A. Convection. *B. Heat conduction.* *C. Conduction.* *D. Radiation.* *E. Evaporation.*

Notes:_____

23. In a young man during exercise, the minute oxygen uptake and carbon dioxide emission equaled to 1000 ml. what substrates are oxidized in the cells of the body?

A. Proteins. *C. Fats.* *E. Carbohydrates and fats.*
B. Carbohydrates. *D. Carbohydrates and proteins.*

Notes:_____

24. The processes of heat transfer in a naked person at room temperature have been studied. It was revealed that under these conditions the greatest amount of heat is transferred by:

A. Heat radiation. *B. Heat conduction.* *C. –.* *D. Convection.* *E. Evaporation.*

Notes:_____

25. Which way of heat emission by the bodies of greenhouse workers is the most effective at the temperature of 36 °C degrees and relative humidity of 70 %?

A. Liquid evaporation. B. Thermal conduction. C. Heat radiation. D. Convection. E. –.

Notes:_____

26. Power inputs of a man were measured. In what state was this man if his power inputs were lower than basal metabolism?

A. Relaxation. B. Simple work. C. Rest. D. Sleep. E. Nervous tension.

Notes:_____

27. Thermometry revealed that the temperature of the exposed skin is by 1–1,5 °C lower than the temperature of the adjacent areas covered with clothing from natural fabrics. The reason for this is that the clothes reduce the heat loss through:

A. Convection. B. Radiation. C. Conduction. D. Evaporation. E. –.

Notes:_____

28. At the end of the working day a worker of a hot work shop has been delivered to a hospital. The patient complains of a headache, dizziness, nausea, general weakness. Objectively: the patient is conscious, his skin is hyperemic, dry, hot to the touch. Heart rate is of 130/min. Respiration is rapid, superficial. What disorder of thermoregulation is most likely to have occurred in this patient?

A. Increased heat transfer and reduced heat production.
B. Increased heat transfer and heat production.
C. Increased heat production with no changes to the heat transfer.
D. Reduced heat transfer.
E. Reduced heat production with no changes to the heat transfer.

Notes:_____

29. It was determined that basal metabolic rate of a patient under study increased due value by 8 %. This means that the intensity of energetic metabolism processes in this patient is:

A. Normal. *C. Moderately inhibited.* *E. Essentially increased.*
B. Moderately increased. *D. Essentially inhibited.*

Notes:_____

30. A month after a serious operation a 38-year-old patient has recovered and has now positive nitrogen balance. Urine of this patient may be found to have low concentration of the following nitrogen-containing substance:

A. Lactate. *B. 17-ketosteroids.* *C. Urea.* *D. Stercobilinogen.* *E. Galactose.*

Notes:

31. When measuring power input of a person by the method of indirect calorimetry the following result was obtained: oxygen consumption is 1000 ml and carbon dioxide production is 800 ml per minute. The person under examination has the following respiratory coefficient:

A. 1,25. *B. 1,0.* *C. 0,9.* *D. 0,84.* *E. 0,8.*

Notes:

32. For people adapted to high external temperature profuse sweating is not accompanied by loss of large volume of sodium chloride. This is caused by the effect the following hormone has on the perspiratory glands:

A. Cortisol. *B. Vasopressin.* *C. Aldosterone.* *D. Thyroxin.* *E. Natriuretic.*

Notes:

33. A tumor is detected in one of the regions of the patient's inability to maintain normal body temperature. What brain structure is damaged?

A. Cerebellum. *B. Striatum.* *C. Hypothalamus.* *D. Substantia nigra.* *E. Thalamus.*

Notes:

34. A 42-year-old woman, who has been keeping to a vegetarian diet for a long time, consulted a doctor. Examination revealed negative nitrogen balance in the patient. What factor is the most likely cause of such a condition?

A. Insufficient amount of protein in the diet.
B. Insufficient amount of fats in the diet.
C. Excessive amount of fats in the diet.
D. Insufficient amount of dietary fiber.
E. Decreased rate of metabolic processes.

Notes:

35. In hot weather the bus passengers asked to open the roof hatches. What way of heat transfer is activated in this situation?

A. Conduction.
B. Sweat evaporation.
C. Radiation.
D. Conduction and radiation.
E. Convection.

Notes:

36. A 16-year-old girl, who has been starving herself for a long time to lose weight, developed an edema. This phenomenon is mainly caused by:

A. Venous congestion and increased venous pressure.
B. Hypoglycemia due to glycogen synthesis disturbance.
C. Deceleration of glomerular filtration rate.
D. Decreased production of vasopressin in the hypothalamus.
E. Hypoproteinemia due to protein synthesis disturbance.

Notes:_____
_____
_____
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PHYSIOLOGY OF ENERGY EXCHANGE AND THERMOREGULATION

Answers

1. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*

If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat

2. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 886).*

Minimum level of energy required to exist (to perform all the chemical reactions of the body in resting state) is called the basal metabolic rate (BMR). Skeletal muscle, even under resting conditions, accounts for 20 to 30 per cent of the BMR. For this reason, BMR is usually corrected for differences in body size by expressing it as Calories per hour per square meter of body surface area, calculated from height and weight. Thus, in a taller person BMR will be higher because of bigger body surface area

3. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*

If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat

4. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 885).*

Not all the energy in foods is transferred to ATP; instead, a large portion of this energy becomes heat. On average, 35 per cent of the energy in foods becomes heat during ATP formation. Then, still more energy becomes heat as it is transferred from ATP to the functional systems of the cells, so that even under optimal conditions, no more than 27 per cent of all the energy from food is finally used by the functional systems. Even when 27 per cent of the energy reaches the functional systems of the cells, most of this eventually becomes heat. Therefore, the whole-body metabolic rate can be determined by simply measuring the total quantity of heat liberated from the body in a given time

5. Correct answer is B. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 26 Nutrition and Metabolism. – P. 1002).*

For oxidation of 1 molecule of glucose only 6 molecules of O_2 are used ($C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$) and 38 ATP are formed

6. Correct answer is C *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 886).*

The usual method for determining BMR is to measure the rate of oxygen utilization over a given period of time under the following conditions: 1) The person must not have eaten food for at least 12 hours. 2) The BMR is determined after a night of restful sleep. 3) No strenuous activity is performed for at least 1 hour before the test. 4) All psychic and physical factors that cause excitement must be eliminated. 5) The temperature of the air must be comfortable and between +18 ° and +20 °C. 6) No physical activity is permitted during the test.

7. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 889).*

The body temperature is controlled by balancing heat production against heat loss.

8. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 895–896).*

When the body is too cold, the temperature control system institutes increase in thermogenesis (heat production). Heat production by the metabolic systems is increased by promoting shivering, sympathetic excitation of heat production, and thyroxine secretion. An increase in either sympathetic stimulation or circulating norepinephrine and epinephrine in the blood can cause an immediate increase in the rate of cellular metabolism. This effect is called chemical thermogenesis. It results at least partially from the ability of norepinephrine and epinephrine to uncouple oxidative phosphorylation, which means that excess foodstuffs are oxidized and thereby release energy in the form of heat but do not cause adenosine triphosphate to be formed

9. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 887).*
Such dramatic increase of energy inputs (300 % more than initial) can be seen only in case of physical exercise. Rise of environmental temperature decreases metabolic rate (MR), food intake can increase MR not more than on 30 %, during sleep MR is lower and awakening just returns it to normal value, and mental activity comprises about 20 %.
10. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 837, 867, 883, 1058).*
In case of O_2 deficiency (like during intensive exercises) for formation of ATP glucose breaks down to pyruvic acid, the major portion of which is converted into lactic acid. Lactic acid diffuses readily out of the cells into the extracellular fluids and to blood, as a result pH of blood decreases.
11. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 867).*
"Respiratory quotient" is the ratio of CO_2 production to O_2 utilization and can be used to estimate fat and carbohydrate utilization. When carbohydrates are metabolized with oxygen, exactly one carbon dioxide molecule is formed for each molecule of oxygen consumed. This ratio of carbon dioxide output to oxygen usage is called the respiratory quotient, so the respiratory quotient for carbohydrates is 1.0 ($C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$).
12. Correct answer is A*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat
13. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 887).*
The metabolic rate decreases 10 to 15 per cent below normal during sleep. This fall is due to two principal factors: (1) decreased tone of the skeletal musculature during sleep and (2) decreased activity of the central nervous system.
14. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 891).*
If the temperature of environment is lower than body temperature and the clothes are light or person is nude, the main way of heat loss is radiation of heat.
15. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 891).*
The rate of heat loss to water is usually many times greater than the rate of heat loss to air because heat conductivity in water is very great in comparison with that in air.
16. Correct answer is E*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 891).*
The rate of heat loss to water is usually many times greater than the rate of heat loss to air because heat conductivity in water is very great in comparison with that in air.
17. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat.
18. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat
19. Correct answer is A. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 275).*
Minimal power inputs in human are seen in the early morning (4–5 a.m.), and maximal power inputs in the early evening (4–6 p.m.). Such changes are related to circadian rhythms and to rotation of Earth around its axis.

20. Correct answer is A. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 275).*
Minimal power inputs in human are seen in the early morning (3–5 a.m.), and maximal power inputs in the early evening (4–6 p.m.). Such changes are related to circadian rhythms and to rotation of Earth around its axis.
21. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat.
22. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
When the body is exposed to wind (including that made by fans), the layer of air immediately adjacent to the skin is replaced by new air much more rapidly than normally, and heat loss by convection increases accordingly.
23. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 867).*
"Respiratory quotient" is the ratio of CO_2 production to O2 utilization and can be used to estimate fat and carbohydrate utilization. Respiratory quotient for carbohydrates is 1.0 ($C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$), for fats RQ=0,7 and for proteins=0,8. In that case, 1000 ml CO_2 / 1000 ml O_2 = 1,0, thus the body is using carbohydrates.
24. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 891).*
If the temperature of environment is lower than body temperature and the clothes are light or person is nude, the main way of heat loss is radiation of heat.
25. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 892).*
If the temperature of environment is higher than body temperature and the humidity of air is below 100 %, the main way of heat loss is evaporation of sweat.
26. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 887).*
The metabolic rate decreases 10 to 15 per cent below normal during sleep. This fall is due to two principal factors: (1) decreased tone of the skeletal musculature during sleep and (2) decreased activity of the central nervous system.
27. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 891).*
The clothes prevent contact of new portions of cold air with skin, thus decreasing emission of heat by convection.
28. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 899).*
Listed symptoms belong to condition named heat stroke that develops when the body temperature rises above normal. The most often reason of heat stroke is reduced heat release in case of high temperature of environment. As in that case the person has physical activity (workshop) and the temperature of environment is high, the heat production in him is increased while heat release decreases due to high environmental temperature, and reduce of heat release causes development of heat stroke.
29. Correct answer is A. *(Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 274).*
Changes of BMR in range ±10 % are considered as normal.
30. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 866).*
Nitrogen balance is a state in which the rate of nitrogen ingestion equals the rate of excretion (chiefly as nitrogenous wastes). Positive nitrogen balance occurs when ingestion of proteins

exceeds their excretion. The average protein contains about 16 per cent nitrogen. During metabolism of the protein, about 90 per cent of this nitrogen is excreted in the urine in the form of urea, uric acid, creatinine, and other less important nitrogen products. This, in case of positive nitrogen balance the concentration of urea as a breakdown product will decrease.

31. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit XIII Metabolism and Temperature Regulation. – P. 867).*

"Respiratory quotient" is the ratio of CO_2 production to O_2 utilization and can be used to estimate fat and carbohydrate utilization. In that case, 800 ml CO_2 / 1000 ml O_2 = 0.8

32. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Chapter 77 Adrenocortical hormones. – P. 949).*

Aldosterone has almost the same effects on sweat glands and salivary glands as it has on the renal tubules. Both these glands form a primary secretion that contains large quantities of sodium chloride, but much of the sodium chloride, on passing through the excretory ducts, is reabsorbed, whereas potassium and bicarbonate ions are secreted. Aldosterone greatly increases the reabsorption of sodium chloride and the secretion of potassium by the ducts. The effect on the sweat glands is important to conserve body salt in hot environments, and the effect on the salivary glands is necessary to conserve salt when excessive quantities of saliva are lost.

33. Correct answer is C (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 280).*

Hypothalamus is crucial nervous structure for temperature regulation. Center of thermoregulation occupies medial preoptic area of anterior hypothalamus and its posterior part. If in the experiment these regions of hypothalamus are destroyed or their connections with other brain structures are cut, experimental animals loose their temperature control forever.

34. Correct answer is A (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 271).*

Proteins are our chief dietary source of nitrogen. ***Nitrogen balance*** is a state in which the rate of nitrogen ingestion equals the rate of excretion (chiefly as nitrogenous wastes). Growing children exhibit a state of ***positive nitrogen balance*** because they ingest more than they excrete, thus retaining protein for tissue growth. Pregnant women and athletes in resistance training also show positive nitrogen balance. When excretion exceeds ingestion, a person is in a state of ***negative nitrogen balance***. This indicates that body proteins are being broken down and used as fuel. Proteins of the muscles and liver are more easily broken down than others; thus negative nitrogen balance tends to be associated with muscle atrophy. Negative nitrogen balance may occur if carbohydrate and fat intake are insufficient to meet the need for energy. Carbohydrates and fats are said to have a protein-sparing effect because they prevent protein catabolism when present in sufficient amounts to meet energy needs.

35. Correct answer is E (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 278).*

Convection i*s the removal of heat from the body by convection air currents.* Actually, the heat must at first be conducted. Conductive heat loss is aided by convection, the motion of a gas (or fluid) due to uneven heating. Air is a fluid that becomes less dense and therefore rises as it is heated. Thus warm air rises from the body and is replaced by cooler air from below. The same is true for water; for example, when you swim in a lake or take a cool bath. In standard conditions (air temperature 20 ºC, humidity 40-60%) conduction and convection supply about 25–30 % of heat loss. In case of forced convection (wind, ventilation) heat loss is also intensified.

36. Correct answer is E *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*

Normal value of total protein in blood is 65–85 g/L. As that patient has 40 g/L, hypoproteinemia is concluded. As the protein content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure that normally opposes filtration and increases reabsorption of fluid from tissues to capillaries. Thus, when oncotic pressure falls, the filtration increases and reabsorption decreases.

PHYSIOLOGY OF EXCRETION SYSTEM

Questions

1. Person felt thirsty after staying in heat for a long time. Signals of what receptors caused it first of all?

A. Baroreceptors of aortic arch.
B. Osmoreceptors of hypothalamus.
C. Osmoreceptors of the liver.
D. Sodium receptors of hypothalamus.
E. Glucoreceptors of hypothalamus.

Notes:_____

2. Shock and sings of acute renal failure (ARF) developed in the patient due to severe injury. What is the leading cause of development of ARF in the case?

A. Decreased oncotic blood pressure.
B. Decreased arterial pressure.
C. Increased pressure in the nephron capsule.
D. Increased pressure in the renal arteries.
E. Urine excretion violation.

Notes:_____

3. During some diseases the patient experiences glucosuria. What is the possible reason of this phenomenon?

A. Mechanisms of secondary active transport are broken.
B. The level of glucose in blood is higher than 10 millimole/l.
C. The permeability of the renal filter increases.
D. ADH Level in blood increases.
E. Aldosterone secretion decreases.

Notes:_____

4. For definition of effective renal plasma flow the substance is used which is freely filtrated, does not reabsorb and is completely secreted. What substance clearance is calculated for ERP definition?

A. Insulin. *B. Inulin.* *C. PAG.* *D. Urea.* *E. Creatinine.*

Notes:_____

5. The patient with diabetes had chronic renal failure, with the development of uremia, glomerular filtration rate decreased up to 8 ml/min. What was the reason of the GFR drop?

A. Nephron number decrease through the development of nephrosclerosis.
B. Afferent arteriole spasm.
C. Osmotic blood pressure increase.
D. Systemic arterial pressure decrease.
E. Ureteral obstruction with stone.

Notes:_____

6. During the person's ageing gradual retrogression of the metabolic processes supplying energy in tissues is observed. What stage of uropoiesis will suffer in this case first of all?

A. Concentration. *B. Filtration.* *C. Secretion.* *D. Reabsorption.* *E. Synthesis.*

Notes:_____

7. During laboratory examination of the patient sugar in urine is detected. Glucose concentration in blood plasma is within the limits of physiological norm. What processes derangements are observed in this case?

A. Glomerular filtration. *C. Tubular secretion.* *E. Aldosterone secretions.*
B. Tubular reabsorption. *D. Insulin secretions.*

Notes:_____

8. At acute cardiovascular collapse the urine formation stops, anuria occurs. What from the listed results in anuria development?

A. Oncotic blood pressure decrease. *D. Derangements of the renal filter work.*
B. Water reabsorption increase in tubules. *E. ABP drop and GFR decrease.*
C. Hydrostatic pressure of primary urine increase.

Notes:_____

9. At head trauma in and around supraoptical and paraventricular nuclei of hypothalamus polyuria occurs. What results in development of the given phenomenon?

A. ADH secretion decrease. *D. Sodium uretine peptide secretion decrease.*
B. ADH secretion increase. *E. Aldosterone secretion increase.*
C. Renin secretion increase.

Notes:_____

10. At the decrease of systemic ABP the decrease of diuresis is observed. What mechanism derangements result in development of the given phenomenon?

A. Urine concentration in receiving tubules. *D. Glomerular filtration.*
B. Tubular reabsorption. *E. Urine flow from urinary bladder.*
C. Tubular secretion.

Notes:_____

11. Glomerular filtration rate (GFR) increased by 20 % due to prolonged starvation of the person. The most evident cause of filtration changes under these conditions is:

A. Increase of filtration coefficient. *D. Decrease of oncotic pressure of blood plasma.*
B. Increase of penetration of the renal filter. *E. Increase of renal plasma stream.*
C. Increase of systemic blood pressure.

Notes:_____

12. A 16 year-old patient got numerous traumas in automobile accident. Now the patient is having a shock. AP – 80/60 mm Hg, daily urine volume 60-80 ml. What pathogenic mechanism leads to kidneys function violation?

A. Increased vasopressin blood concentration.
B. Decreased hydrostatic pressure in glomerular capillaries.
C. Trauma of the urinary bladder.
D. Increased osmotic pressure in glomerular capillaries.
E. Increased pressure in Bowman's capsule.

Notes:_____

13. A 58-year-old patient with acute cardiac insufficiency has decreased volume of daily urine - oliguria. What is the mechanism of this phenomenon?

A. Decreased number of functioning glomerules.
B. Drop of oncotic blood pressure.
C. Rise of hydrostatic blood pressure in capillaries.
D. Reduced permeability of renal filter.
E. Decreased glomerular filtration.

Notes:_____

14. Examination of a patient revealed hyperkaliemia and hyponatremia. Low secretion of which hormone may cause such changes?

A. Natriuretic. *B. Parathormone.* *C. Cortisol.* *D. Aldosteron.* *E. Vasopressin.*

Notes:_____

15. A driver who got a trauma in a road accident and is shocked has reduction of daily urinary output down to 300 ml. What is the main pathogenetic factor of such diuresis change?

A. Decreased number of functioning glomerules.
B. Increased vascular permeability.
C. Secondary hyperaldosteronism.
D. Drop of arterial pressure.
E. Drop of oncotic blood pressure.

Notes:_____

16. A patient has a decreased vasopressin synthesis that causes polyuria and as a result of it evident organism dehydration. What is the mechanism of polyuria development?

A. Reduced tubular reabsorption of protein.
B. Reduced tubular reabsorption of Na ions.
C. Reduced glucose reabsorption.
D. Reduced tubular reabsorption of water.
E. Acceleration of glomerular filtration.

Notes:_____

17. A patient with diminished excretory function of kidneys has bad breath. What substance which is excessively excreted by salivary glands is the main cause of this occurence?

A. Alpha-amylase. *B. Lysozyme.* *C. Phosphatase.* *D. Urea.* *E. Mucin.*

Notes:_____

18. Glucose concentration in a patient's blood is 15 mmole/l (reabsorption threshold is 10 mmole/l). What effect can be expected?

A. Diuresis reduction.
B. Reduced glucose reabsorption.
C. Reduced vasopressin secretion.
D. Reduced aldosterone secretion.
E. Glucosuria.

Notes:_____

19. A 48 year old male patient was admitted to the hospital with acute attack of chronic glomerulonephritis. Examination revealed chronic renal failure. What is the cause of hyperazotemia by chronic renal failure?

A. Reduction of glomerular filtration.
B. Reduction of tubular reabsorption.
C. Reduction of tubular excretion.
D. Disorder of protein metabolism.
E. Disorder of water-electrolytic metabolism.

Notes:_____

20. A 23-year-old patient with diabetes mellitus has hyperglycemia at the rate 19 mmol/l which is clinically manifested by glycosuria, polyuria, polydipsia. Which is the listed below mechanisms is responsible for the development of glycosuria?

A. Polydipsia.
B. Tissue dehydration.
C. Polyuria.
D. Non-enzymatic glycosylation of proteins.
E. Exceedence of glucose renal threshold.

Notes:_____

24. Examination of a patient revealed glycosuria and hyperglycemia. He complains of dry mouth, itchy skin, frequent urination, thirst. He has been diagnosed with diabetes mellitus. What is the cause of polyuria in this patient?

A. Increased filtration pressure.
B. Increased plasma oncotic pressure.
C. Increased urine osmotic pressure.
D. Decreased plasma oncotic pressure.
E. Decreased cardiac output.

Notes:_____

25. Urine analysis has shown high levels of protein and erythrocytes in urine. This can be caused by the following:

A. Hydrostatic blood pressure in glomerular capillaries. *D. Oncotic pressure of blood plasma.*
B. Renal filter permeability. *E. Effective filter pressure.*
C. Hydrostatic pressure of primary urine.

Notes:_____

26. A patient has insufficient blood supply to the kidneys, which has caused the development of pressor effect due to the constriction of arterial resistance vessels. This is the result of the vessels being greatly affected by the following substance:

A. Renin. *B. Angiotensinogen.* *C. Angiotensin II.* *D. Catecholamines.* *E. Norepinephrine.*

Notes:_____

27. Diabetic nephropathy with uremia has developed in patient with pancreatic diabetes. The velocity of glomerular filtration is 9 ml/min. what mechanism of a decrease in glomerular filtration velocity and chronic renal failure development is most likely in the case of this patient?

A. Reduction of active nephron mass. *D. Obstruction of nephron tubules with hyaline casts.*
B. Tissue acidosis. *E. Arteriolar spasm.*
C. Decrease in systemic arterial pressure.

Notes:_____

28. A patient with massive burns developed acute renal insufficiency characterized by a significant and rapid deceleration of glomerular filtration. What is the mechanism of its development?

A. Reduction of functioning nephron number. *D. Reduction of renal blood flow.*
B. Damage of glomerular filter. *E. Renal artery embolism.*
C. Rise of pressure of tubular fluid.

Notes:_____

29. A child has an acute renal failure. What biochemical factor found in saliva can confirm this diagnosis?

A. Increase in glucose concentration. *D. Increase in concentration of higher fatty acids.*
B. Decrease in glucose concentration. *E. Decrease in nucleic acid concentration.*
C. Increase in urea concentration.

Notes:_____

30. A patient with a history of chronic glomerulonephritis presents with azotemia, oliguria, hypo- and isosthenuria, proteinuria. What is the leading factor in the pathogenesis of these symptoms development under chronic renal failure?

A. Mass decrease of active nephrons. *D. Disturbed permeability of glomerular membranes.*
B. Intensification of glomerular filtration. *E. Intensification of sodium reabsorption.*
C. Tubular hyposecretion.

Notes:_____

31. Due to the use of poor-quality measles vaccine for preventive vaccination, a 1-year-old child developed an autoimmune renal injury. The urine was found to contain macromolecular proteins. What process of urine formation was disturbed?

A. Filtration. *C. Secretion.* *E. Secretion and filtration.*
B. Reabsorption. *D. Reabsorption and secretion.*

Notes:_____

32. According to the results of glucose tolerance test, the patient has no disorder of carbohydrate tolerance. Despite that, glucose is detected in the patients's urine (5 mmol/l). The patient has been diagnosed with renal diabetes. What renal changes cause glucosuria in this case?

A. Decreased activity of glucose reabsorption enzymes. *D. Increased glucose secretion.*
B. Increased activity of glucose reabsorption enzymes. *E. Increased glucose filtration.*
C. Exceeded glucose reabsorption threshold.

Notes:_____

33. A man presents with glomerular filtration rate of 180 ml/min, while norm is 125 ml/min. The likely cause of it is the decreased:

A. Effective filtration pressure. *D. Renal blood flow.*
B. Plasma oncotic pressure. *E. Permeability of renal filter.*
C. Hydrostatic blood pressure in the glomerular capillaries.

Notes:_____

34. A woman presents with edemas. In her urine there is a large amount of protein excreted. What nephron segment is functionally disturbed in this case?

A. Ascending limb of loop of Henle. *D. Descending limb of loop of Henle.*
B. Renal corpuscle. *E. Proximal convoluted tubule.*
C. Distal convoluted tubule.

Notes:_____

35. During ultrasound a patient with atherosclerosis was diagnosed with bilateral stenosis of the renal arteries. Specify the bioactive substance that is the key pathogenetic link in the development of arterial hypertension in this case:

A. Cortisol. *B. Renin.* *C. Vasopressin.* *D. Thyroxin.* *E. Adrenaline.*

Notes:_____

36. The low specific gravity of the secondary urine (1002) was found out in the sick person. What is the most distant part of nephron where concentration of secondary urine takes place?

A. In the nephron's glomerulus. *C. In distal tubule of nephron.* *E. In the collecting duct.*
B. In ascending part of loop of Henle. *D. In proximal tubule of nephron.*

Notes:

37. Histologic specimen of the kidney demonstrates cells closely adjoined to the renal corpuscle in the distal convoluted tubule. Their basement membrane is extremely thin and has no folds. These cells sense the changes in sodium content of urine and influence renin secretion occurring in juxtaglomerular cells. Name these cells:

A. Macula densa cells. *C. Mesangial cells.* *E. Juxtaglomerular cell.*
B. Glomerular capillary endothelial cells. *D. Podocytes.*

Notes:

38. An 11-year-old girl is brought to the doctor's office by her mother who states her daughter has been weak with swollen face for 3 days. The mother states her daughter had always been healthy and active until the initiation of symptoms. Upon inquiry, the girl described a foamy appearance of her urine but denies blood in urine, urinary frequency at night, or pain during urination. Physical examination reveals generalized swelling of the face and pitting edema on the low limbs. Laboratory study shows proteinuria and microscopic hematuria. Which of the following is the most likely cause of findings in the laboratory study in urine?

A. Increased permeability across the glomerular capillary wall.
B. Increased hydrostatic pressure in Bowman's capsule.
C. Increased plasma oncotic pressure.
D. –.
E. Increased glomerular hydrostatic pressure.

Notes:

39. A patient with constant headaches, pain in the occipital region, tinnitus, dizziness has been admitted to the cardiology department. Objectively: AP – 180/110 mm Hg, heart rate - 95/min. Radiographically, there is a stenosis of one of the renal arteries. Hypertensive condition in this patient has been caused by the activation of the following system:

A. Sympathoadrenal. *C. Hemostatic.* *E. Immune.*
B. Renin-angiotensin. *D. Kinin.*

Notes:

PHYSIOLOGY OF EXCRETION SYSTEM

Answers

1. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 358).*

Heat causes loss of water from the organism through sweating, and leads to increase of blood osmolarity. That causes the special nerve cells called osmoreceptor cells, located in the anterior hypothalamus near the supraoptic nuclei, to shrink and to fire impulses.

2. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405).*

Acute renal failure (ARF) can be caused by 3 reasons: 1) decreased blood supply to the kidneys (prerenal ARF) – a consequence of heart failure with reduced cardiac output and low blood pressure or conditions associated with diminished blood volume and low blood pressure, such as severe hemorrhage; 2) Intrarenal ARF resulting from abnormalities within the kidney itself, including those that affect the blood vessels, glomeruli, or tubules; and 3)Postrenal ARF, resulting from obstruction of the urinary collecting system anywhere from the calyces to the outflow from the bladder (most common causes are kidney stones, caused by precipitation of calcium, urate, or cysteine). As a result of severe injury, the blood pressure decreases leading to ARF development.

3. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 331).*

In normal conditions, all filtered glucose is reabsorbed from primary urine. Renal threshold for glucose when its total reabsorption occurs is 10 mmol/L (or about 200 mg/dL). Glucose in urine appears if its concentration exceeds the renal threshold.

4. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 345).*

PAH (para-aminohippuric acid) is the only substance that is almost completely cleared from plasma (about 90%) because it's excreted by tubular secretion as well as glomerular filtration. Therefore, the clearance of PAH can be used as an approximation of renal plasma flow.

5. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 406, 316).*

Chronic renal failure results from progressive and irreversible loss of large numbers of functioning nephrons. Serious clinical symptoms often do not occur until the number of functional nephrons falls to at least 70 to 75 per cent below normal. Decrease of number of functioning nephrons decreases GFR (N GFR is about 125 ml/min constituting about 20% of renal plasma flow).

6. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 328).*

Tubular reabsorption includes passive and active mechanisms, and active mechanisms require adequate energy supply. Thus, decreased energy supply will lead to disorders of reabsorption first of all.

7. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 331).*

In normal conditions, all filtered glucose is reabsorbed from primary urine. Renal threshold for glucose when its total reabsorption occurs is 10 mmol/L (or about 200 mg/dL). Glucose in urine appears if its concentration exceeds the renal threshold. If glucose concentration in blood is normal, it means that the mechanisms of its reabsorption in nephrons are disturbed

8. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405).*

Acute renal failure (ARF) can be caused decreased blood supply to the kidneys (prerenal ARF) – a consequence of heart failure with reduced cardiac output and low blood pressure or conditions associated with diminished blood volume and low blood pressure, such as severe hemorrhage. As a result of blood pressure drop, the GFR decreases leading to ARF development.

9. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Chapter 75 Pituitary Hormones and Their Control by the Hypothalamus. – P. 928).*

Supraoptic nuclei of hypothalamus are synthesizing primarily ADH, and paraventricular nuclei synthesize primarily oxytocin. Antidiuretic hormone (ADH) increases the reabsorption of water in collecting tubules and ducts of kidneys thus decreasing the diuresis (daily production of secondary urine). Due to deficiency or absence of ADH (for example, in case of trauma in and around supraoptical nuclei) polyuria (increased amount of secondary urine) occurs.

10. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405, 317).*

As a result of blood pressure drop, the glomerular filtration rate (GFR) decreases leading to ARF development. That occurs due to decrease of hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure), which promotes filtration

11. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 317).*

GFR = Kf × Net filtration pressure. Kf is filtration coefficient, and the net filtration pressure represents the sum of the hydrostatic and colloid osmotic forces that either favor or oppose filtration across the glomerular capillaries. These forces include (1) hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure, PG), which promotes filtration; (2) the hydrostatic pressure in Bowman's capsule (PB) outside the capillaries, which opposes filtration; (3) the colloid osmotic pressure of the glomerular capillary plasma proteins (pG), which opposes filtration; and (4) the colloid osmotic pressure of the proteins in Bowman's capsule (pB), which promotes filtration. Starvation leads to decrease of blood oncotic (colloid osmotic) pressure that usually opposes filtration, thus leading to increase of GFR.

12. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405, 317).*

As a result of blood pressure drop, the glomerular filtration rate (GFR) decreases leading to ARF development. That occurs due to decrease of hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure), which promotes filtration.

13. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405, 317).*

As a result of acute cardiac insufficiency, the renal blood flow and the glomerular filtration rate (GFR) decrease leading to ARF development. That occurs due to decrease of hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure), which normally promotes filtration.

14. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Chapter 77 Adrenocortical hormones. – P. 948).*

Aldosterone is the hormone produced by adrenal cortex that causes increased renal tubule reabsorption of sodium and secretion of potassium. Simultaneously with sodium reabsorption in kidneys there is osmotic absorption of almost equivalent amounts of water that decrease the amount of urine. Hyposecretion of aldosterone will cause the reduced diuresis, hypernatremia and hypokalemia.

15. Correct answer is D*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405, 317).*

Shock is a state of abrupt drop of blood pressure that leads to decrease of the renal blood flow and the glomerular filtration rate (GFR) (acute renal failure development). That occurs due to decrease of hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure), which normally promotes filtration. Daily urinary output normally is about 1,5–2 L, in case of ARF decreases drastically.

16. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Chapter 75 Pituitary Hormones and Their Control by the Hypothalamus. – P. 928).*

Vasopressin (antidiuretic hormone, ADH) increases the reabsorption of water in collecting tubules and ducts of kidneys thus decreasing the diuresis (daily production of secondary urine). Due to deficiency or absence of vasopressin tubular reabsorption of water decreases and polyuria (increased amount of secondary urine) occurs

17. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 411).*

In case of renal failure high concentration of the nonprotein nitrogens— especially urea, creatinine, and uric acid—resulting from failure of the body to excrete the metabolic end products of proteins appears. This total condition is called uremia because of the high concentration of urea in the body fluids. Due to high concentration of urea in blood it starts to filter in saliva leading to bad breath

18. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 331).*

In normal conditions, all filtered glucose is reabsorbed from primary urine. Renal threshold for glucose when its total reabsorption occurs is 10 mmol/L (or about 200 mg/dL). Glucose in urine appears if its concentration exceeds the renal threshold, and that condition is called glucosuria.

19. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 406, 316).*

Chronic renal failure results from progressive and irreversible loss of large numbers of functioning nephrons. Serious clinical symptoms often do not occur until the number of functional nephrons falls to at least 70 to 75 per cent below normal. Decrease of number of functioning nephrons decreases glomerular filtration rate (N GFR is about 125 ml/min constituting about 20% of renal plasma flow).

20. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 331).*

In normal conditions, all filtered glucose is reabsorbed from primary urine. Renal threshold for glucose when its total reabsorption occurs is 10 mmol/L (or about 200 mg/dL). Glucose in urine appears if its concentration exceeds the renal threshold, and that condition is called glucosuria.

21. Correct answer is D. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 406, 316).*

Chronic diseases of kidneys can lead to chronic renal failure results from progressive and irreversible loss of large numbers of functioning nephrons. Serious clinical symptoms often do not occur until the number of functional nephrons falls to at least 70 to 75 per cent below normal. Decrease of number of functioning nephrons decreases glomerular filtration rate (N GFR is about 125 ml/min constituting about 20 % of renal plasma flow).

22. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 337).*

pH depends on concentration of hydrogen ions. Secretion of hydrogen ions in nephron occurs in proximal tubule by the secondary active secretion of and by late distal tubule and the cortical collecting tubule (intercalated cells) by an active hydrogen-ATPase mechanism.

23. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 332, 409).*

Polyuria (increased volume of urine) and hyposthenuria (low specific gravity of urine; N = 1,010 – 1,025) are the signs of diluted urine, i.e. urine with great volume of water. Water loss with urine depends on reabsorption of water in different parts of nephron. Thus, polyuria and hyposthenuria are caused by impairement of tubular reabsorption as a result of pyelonephritis. Pyelonephritis begins in the renal medulla and therefore usually affects the function of the medulla more than it affects the cortex, at least in the initial stages. Because one of the primary functions of the medulla is to provide the countercurrent mechanism for concentrating urine, patients with pyelonephritis frequently have markedly impaired ability to concentrate the urine.

24. Correct answer is C. *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 23 The Urinary System. – P. 902).*

The polyuria results from a high concentration of glucose in the renal tubule. Presence of glucose in urine increases the osmotic pressure of urine and opposes the osmotic reabsorption of water, so more water is passed in the urine (osmotic diuresis) and a person may become severely dehydrated. In diabetes mellitus the high glucose concentration in the tubule is a result of hyperglycemia.

25. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 316, 406).*

Renal filter has 3 major layers: (1) the endothelium of the capillary, (2) a basement membrane, and (3) a layer of epithelial cells (podocytes) surrounding the outer surface of the capillary basement membrane. Together, these layers make up the filtration barrier, which, despite the three layers, filters several hundred times as much water and solutes as the usual capillary membrane. Even with this high rate of filtration, the glomerular capillary membrane normally prevents filtration of plasma proteins, moreover of RBC. In case of increased permeability of filter due to inflammation etc. both protein and red blood cells to leak from the blood of the glomerular capillaries into the glomerular filtrate

26. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 322).*

Decreased blood supply to kidneys causes secretion of renin and the activation of RAAS. Renin converts angiotensinogen into angiotensin I, which is further transformed into angiotensin II by ACE. Angiotensin II is a potent vasoconstrictor that preferentially constricts in kidneys efferent arterioles, raises glomerular hydrostatic pressure while reducing renal blood flow.

27. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 406, 316).*

Chronic diseases of kidneys can lead to chronic renal failure results from progressive and irreversible loss of large numbers of active functioning nephrons. Serious clinical symptoms often do not occur until the number of functional nephrons falls to at least 70 to 75 per cent below normal. Decrease of number of functioning nephrons decreases glomerular filtration rate (N GFR is about 125 ml/min constituting about 20% of renal plasma flow).

28. Correct answer is D*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 405).*

Acute renal failure (ARF) can be caused by 3 reasons: 1) decreased blood supply to the kidneys (prerenal ARF) – a consequence of heart failure with reduced cardiac output and low blood pressure or conditions associated with diminished blood volume and low blood pressure, such as severe hemorrhage; 2) Intrarenal ARF resulting from abnormalities within the kidney itself, including those that affect the blood vessels, glomeruli, or tubules; and 3)Postrenal ARF, resulting from obstruction of the urinary collecting system anywhere from the calyces to the outflow from the bladder (most common causes are kidney stones, caused by precipitation of calcium, urate, or cysteine). As a result of severe injury, the blood pressure decreases leading to ARF development.

29. Correct answer is C. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 411).*

In case of renal failure high concentration of the nonprotein nitrogens – especially urea, creatinine, and uric acid—resulting from failure of the body to excrete the metabolic end products of proteins appears. This total condition is called uremia because of the high concentration of urea in the body fluids. Due to high concentration of urea in blood it starts to filter in saliva leading to bad breath

30. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 406, 316).*

Chronic diseases of kidneys can lead to chronic renal failure results from progressive and irreversible loss of large numbers of active functioning nephrons. Serious clinical symptoms often do not occur until the number of functional nephrons falls to at least 70 to 75 per cent below normal. Decrease of number of functioning nephrons decreases glomerular filtration rate (N GFR is about 125 ml/min constituting about 20% of renal plasma flow), leads to appearing of proteins in urine, disturbs the concentrating ability of kidneys.

31. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 316, 406).*

In normal conditions the proteins are not filtered into urine due to renal filter that has 3 major layers: (1) the endothelium of the capillary, (2) a basement membrane, and (3) a layer of epithelial cells (podocytes) surrounding the outer surface of the capillary basement membrane. In case of increased permeability of filter due to inflammation etc. both protein and red blood cells start to leak from the blood of the glomerular capillaries into the glomerular filtrate.

32. Correct answer is A. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 413).*

If person has glucosuria despite normal blood glucose concentration, it means that the transport mechanism for tubular reabsorption of glucose is greatly limited or absent. Glucose is cotransported with Na+ by carriers called sodium-glucose transport proteins (SGLTs). It is then removed from the basolateral surface of the cell by facilitated diffusion. Normally all glucose in the tubular fluid is reabsorbed and there is none in the urine

33. Correct answer is B. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 317).*

GFR = Kf × Net filtration pressure. Kf is filtration coefficient, and the net filtration pressure represents the sum of the hydrostatic and colloid osmotic forces that either favor or oppose filtration across the glomerular capillaries. These forces include (1) hydrostatic pressure inside the glomerular capillaries (glomerular hydrostatic pressure, PG), which promotes filtration; (2) the hydrostatic pressure in Bowman's capsule (PB) outside the capillaries, which opposes filtration; (3) the colloid osmotic pressure of the glomerular capillary plasma proteins (pG), which opposes filtration; and (4) the colloid osmotic pressure of the proteins in Bowman's capsule (pB), which promotes filtration. Decrease of effective filtration pressure, hydrostatic pressure of capsule, and permeability of renal filter will decrease GFR.

34. Correct answer is B *(Saladin: Anatomy & Physiology: The Unity of Form and Function (Third Edition) / Saladin K.S. – © The McGraw−Hill Companies, 2003. Chapter 18 The Circulatory system: Blood. – P. 682).*

As proteins are excreted with urine so that hypoproteinemia occurs. As the protein content of the blood plasma drops, so does its oncotic (colloid-osmotic) pressure that normally opposes filtration and increases reabsorption of fluid from tissues to capillaries. Thus, when oncotic pressure falls, the filtration increases and reabsorption decreases leading to edema.

35. Correct answer is B *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 322).*

Decreased blood supply to kidneys causes secretion of renin and the activation of RAAS. Renin converts angiotensinogen into angiotensin I, which is further transformed into angiotensin II by ACE. Angiotensin II is a potent vasoconstrictor that preferentially constricts in kidneys efferent arterioles, raises glomerular hydrostatic pressure while reducing renal blood flow.

36. Correct answer is E. *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 324).*

Changes in sodium chloride concentration are sensed by cells of macula densa - a patch of slender, closely spaced epithelial cells at the start of the distal convoluted tubule, directly across from the juxtaglomerular cells. In case of decrease in sodium chloride concentration signals from the macula densa (1) decrease resistance to blood flow in the afferent arterioles, which raises glomerular hydrostatic pressure and helps return GFR toward normal, and (2) increase renin release from the juxtaglomerular cells of the afferent and efferent arterioles. Renin released from these cells then functions as an enzyme to increase the formation of angiotensin I, which is converted to angiotensin II. Finally, the angiotensin II constricts the efferent arterioles, thereby increasing glomerular hydrostatic pressure and returning GFR toward normal

37. Correct answer is A*(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 324).*

Changes in sodium chloride concentration are sensed by cells of macula densa - a patch of slender, closely spaced epithelial cells at the start of the distal convoluted tubule, directly across from the juxtaglomerular cells. In case of decrease in sodium chloride concentration signals from the macula densa (1) decrease resistance to blood flow in the afferent arterioles, which raises glomerular hydrostatic pressure and helps return GFR toward normal, and (2) increase renin release from the juxtaglomerular cells of the afferent and efferent arterioles. Renin released from these cells then functions as an enzyme to increase the formation of angiotensin I, which is converted to angiotensin II. Finally, the angiotensin II constricts the efferent arterioles, thereby increasing glomerular hydrostatic pressure and returning GFR toward normal

38. Correct answer is A (*Physiology of visceral systems / D.I. Marakushin, L.V. Chernobay, I.S. Karmazina, I.N. Isaeva etc. – Kharkov : KhNMU, 2016. – P. 295).*
Kidney infections and trauma can damage the filtration membrane and allow albumin or blood cells to filter through. Kidney disease is sometimes marked by the presence of protein (especially albumin) or blood in the urine – conditions called **proteinuria** (**albuminuria**) and **hematuria**, respectively.
39. Correct answer is B *(Medical physiology (eleventh edition) / Arthur C. Guyton, John E. Hall. – Elseveier, 2006. Unit V The Body Fluids and Kidneys. – P. 322).*
Decreased blood supply to kidneys causes secretion of renin and the activation of RAAS. Renin converts angiotensinogen into angiotensin I, which is further transformed into angiotensin II by ACE. Angiotensin II is a potent vasoconstrictor that preferentially constricts in kidneys efferent arterioles, raises glomerular hydrostatic pressure while reducing renal blood flow.

Навчальне видання

Тренувальні тести в форматі «Крок 1» для самостійної підготовки студентів з англомовною формою навчання з відповідями та поясненнями (для медичних та стоматологічного факультетів). Частина ІІ. «Фізіологія вісцеральних систем»

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Формат А5. Ум. друк. арк. 7,5. Зам. № 20-33961.

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Свідоцтво про внесення суб'єкта видавничої справи до Державного реєстру видавництв, виготівників і розповсюджувачів видавничої продукції серії ДК № 3242 від 18.07.2008 р.