Clinical Medicine and Public Health: Second-round sample tasks for the Open Doors undergraduate track

You will be asked to complete 33 tasks, including:
- 20 entry-level tasks, each correct answer worth 0-1 point,
- 10 intermediate-level tasks, each correctly answered task worth 0-5 points,
- 3 advanced tasks with (constructed response), each correctly completed task valued at 0–10 points.

In test tasks, correct answers are highlighted in bold.
Evaluation criteria and standard answers are provided for the advanced tasks requiring constructed responses.

Pharmacology

Task 1
Entry level (0-1 points)

Using a given series of elements choose the one with two unpaired electrons on the outer shell in the ground state:

a) Cl
b) Ba
c) Si
d) P

Answer: c

Task 2
Entry level (0-1 points)

Indicate a series containing only acidic oxides:

a) CO_2; SiO_2; N_2O; SO_3
b) V_2O_5; CrO_3; TeO_3; Mn_2O_7
c) P_2O_3; Al_2O_3; N_2O_5; SO_2
d) CaO; CO; P_2O_5; NO_2

Answer: b

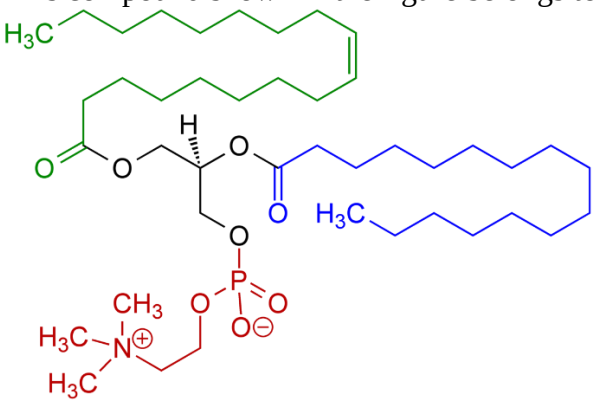
Task 3
Entry level (0-1 points)

How many structural isomers are possible for a substance having the molecular formula C_3H_8O?
a) 1
b) 2
c) 3
d) 4
e) 5

Answer: c

Task 4
Entry level (0-1 points)

This compound shown in the figure belongs to the subclass of:



a) sphingolipids
b) taxanes
c) glycerophospholipids
d) fatty acid

Answer: c

Task 5
Entry level (0-1 points)

Which of the following is a vegetative organ of a plant?
a) root
b) seed
c) pistil
d) rhizome

Answer: a

Dentistry, oral surgery & medicine

Task 6
Entry level (0-1 points)

What is the probability of gametes with both recessive alleles in a diheterozygous organism if the non-allelic genes are not linked?

a) 100%
b) 50%
c) 25%
d) 0%

Answer: c

Task 7
Entry level (0-1 points)

Which of the following animals is not a parasite?

a) **Milk planaria**
b) Beef tapeworm
c) Liver fluke
d) Echinococcus

Answer: a

Task 8
Entry level (0-1 points)

The Eustachian tube anatomically connects:

a) larynx and pharynx
b) pharynx and middle ear
c) larynx and inner ear
d) pharynx and inner ear
Answer: b

Task 9
Entry level (0-1 points)

In which of the presented compounds the hybridization type of the central atom is sp^2?
a) BH_3
b) CO_2
c) H_2O
d) CH_4

Answer: a

Task 10
Entry level (0-1 points)

Choose the correct statement.
a) Alkanes are isomeric with alkenes.
b) Alkenes are isomeric with cycloalkanes
c) Alkenes give a positive Tollens' test
d) Cycloalkanes are soluble in water
e) Alkanes react with sodium

Answer: b

Medicine, general & internal

Task 11
Entry level (0-1 points)

Which of the following is an idioadaptation?
a) appearance of the flower
b) separation of the pulmonary and systemic circulation in birds
c) protective colouration in animals
d) absence of the digestive system in tapeworms
Answer: c

Task 12
Entry level (0-1 points)

Dog tick and taiga tick belong to the class of:

a) Crustaceans
b) Insects
c) **Arachnids**
d) Polychaetes

Answer: c

Task 13
Entry level (0-1 points)

Both parents of the child have IV(AB) blood group. What blood type can the child have?

a) O(I), A(II), B (III)
b) O(I)
c) A(II), B (III)
d) A(II), B (III), AB (IV)
Answer: d

Task 14
Entry level (0-1 points)

At the temperature of 80°C, the rate of a reaction equals 81 mole/(l·sec). At which temperature its rate will become 3 mole/(l·sec) if the temperature coefficient is 3?
a) 110
b) 60
c) 50
d) 40

Answer: c

Task 15
Entry level (0-1 points)

Choose the product of the reaction of toluene with bromine under UV light.

a) o-bromotolene
b) m-bromotolene
c) p-bromotolene
d) benzyl bromide
e) bromobenene

Answer: d

Public health

Task 16
Entry level (0-1 points)

Which of the following is a viral disease?

a) Malaria
b) Hemophilia
c) Ebola fever
d) Cholera

Answer: c

Task 17
Entry level (0-1 points)

Which phylum of the Animal Kingdom contains the highest number of species?

a) Annelida
b) **Arthropoda**
c) Mollusca
d) Chordata

Answer: b

Task 18
Entry level (0-1 points)

There are two types of neurons in the retina - rods and cones. The rods' function provides

a) colour vision
b) black-and-white vision and brightness
c) daytime vision and contrast
d) red colour discrimination

Answer: b

Task 19
Entry level (0-1 points)

Which pair of ions participate in the chemical reaction at the addition of the solution of $AgNO_3$ to the solution of KCl?
a) K^+ and Ag^+
b) K^+ and NO_3^-
c) NO_3^- and Cl^-
d) Ag^+ and Cl^-

Answer: d

Task 20
Entry level (0-1 points)

Among the given oxides – SiO_2; Al_2O_3; NO; P_2O_5; ZnO; CaO – choose those which react with water.

a) SiO_2 and P_2O_5
b) P_2O_5 and CaO
c) NO and P_2O_5
d) all the oxides

Answer: b

Pharmacology

Task 21
Intermediate level (0-5 points)

Select the correct sequence of evolution of plants. Choose one correct answer.
a) Gymnospermae, Ferns, Flowering plants, Algae, Mosses
b) Algae, Mosses, Ferns, Gymnospermae, Flowering plants
c) Algae, Ferns, Mosses, Flowering plants, Gymnospermae
d) Mosses, Algae, Ferns, Gymnospermae, Flowering plants
e) Ferns, Mosses, Algae, Flowering plants, Gymnospermae
Answer: b

Task 22
Intermediate level (0-5 points)

α -amylase is an enzyme of saliva and pancreas that can break down (choose multiple correct answers):

a) fructose
b) glycogen
c) glucose
d) topoisomerase
e) pulp
f) starch
Answers: b, f

Dentistry, oral surgery & medicine

Task 23
Intermediate level (0-5 points)

Which of the following organisms have cell walls? Choose multiple correct answers.

a) Ferns

b) Insects
c) Humans
d) Fungi
e) Escherichia coli

Answer: a, d, e

Task 24
Intermediate level (0-5 points)

Choose the correct statements (choose multiple correct answers):

a) there are 2 types of immunity: innate and acquired
b) antigen-presenting cells are macrophages, B cells and dendritic cells
c) the innate immune system includes only humoral components
d) acquired immunity has a cellular and humoral component

Answer: a, b, d

Task 25
Intermediate level (0-5 points)

What volume (ml) of 96 % solution of sulfuric acid (density 1.84 g/ml) should you take to prepare 1.2 l of a 0.5 M solution?

a) 35.27
b) 33.29
c) 25.15
d) 28.48

Answer: b

Medicine, general & internal

Task 26
Intermediate level (0-5 points)

What do the sperm cells of one organism contain? Choose multiple correct answers.
a) different sex chromosomes
b) identical sex chromosomes
c) different sets of autosomes
d) identical sets of autosomes
e) homologous chromosomes
g) non-homologous chromosomes
Answers: a, d, g

Task 27
Intermediate level (0-5 points)

Thermal decomposition of which salt leads to the mutual formation of a basic and an acidic oxide? Choose one correct answer.
a) $CuCO_3$
b) $NaNO_3$
c) $KClO_3$
d) $(NH_4)_2SO_4$

Answer: a

Task 28
Intermediate level (0-5 points)

Glycogen does not contain the following monosaccharide units (choose multiple correct answers):

a) L- Glucose
b) L- Fructose
c) D- Xylose
d) D- Galactose
e) D- Glucose
f) D- Arabinose
g) L- Talose
Answer: a, b, c, d, f, g

Public health

Task 29
Intermediate level (0-5 points)

What are the characteristics of the phylum Chordata? Choose multiple correct answers.

a) Triploblasty
b) Secondary body cavity (Coelom)
c) Deuterostomia
d) Bilateral symmetry
e) Absence of an internal skeleton

Answers: a, b, c, d

Task 30
Intermediate level (0-5 points)

The oxidation of an alkene with an acidic solution of potassium permanganate resulted in the formation of a single product, 2-pentanone. Write down the number of carbon atoms in the original alkene.

Answer: 10

Pharmacology

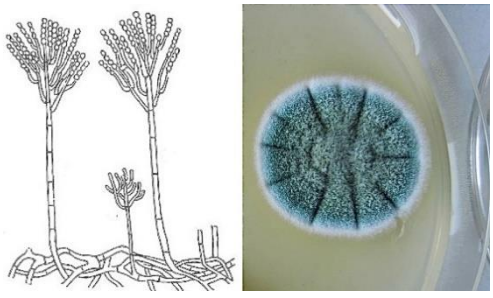
Task 31
High level (0-10 points)

Analysis of the family history shows that the studied pathological trait appears in every generation. It is inherited from an affected father by all his daughters. A mother can pass this trait on to a child of any gender.
1. Which method was used in the study?
2. Determine the type of inheritance of the given disease.
3. Calculate the probability of a left-handed child (an autosomal recessive trait) with the given disease for the couple who are affected and heterozygous for the gene determining handedness. It is known that the wife's mother was healthy.

Note that the evaluation will consider how you solve the task; providing only the final answer is not sufficient.

Criterion No. 1. Able to analyze and systematize information. Maximum score – 3.
Answer to question 1: Pedigree analysis (genealogical method)
Criterion No. 2. Able to justify conclusions. Maximum score – 3.
Answer to question 2: The disease is X-linked dominant.
Criterion No. 3. Knows biological laws, and knows how to apply theoretical and practical knowledge to solve complex problems. Maximum score – 4.
Answer to question 3: For example, the A gene determines handedness, and the B gene is responsible for the given disease. The cross is AaX^BX^b x AaX^BY. The probability of a left-handed affected child will be 3/16 (18.75%).

OR:



The organism shown in the figure is called green or blue mold.
1. Which kingdom does this organism belong to?
2. Give at least three features of this kingdom.
3. What is the medical significance of this organism?

Criterion No. 1. Able to analyze and systematize information. Maximum score – 3.
Answer to question 1: Kingdom Fungi.
Criterion No. 2. Able to justify conclusions. Maximum score – 3.

Answer to question 2: Possible answers: Fungi have a body represented by mycelium, a cell wall, unlimited growth, only heterotrophic nutrition, and glycogen as a reserve carbohydrate.
Criterion No. 3. Knows biological laws, knows how to apply theoretical and practical knowledge to solve complex problems. Maximum score – 4.
Answer to question 3: The organism shown in the figure is called Penicillium. It produces Penicillin antibiotic that is used to treat bacterial diseases.

Dentistry, oral surgery & medicine

Task 32
High level (0-10 points)

The figure shows the anterior end of a parasitic worm.

Questions:

1. Name the phylum and class of this animal.
2. How does a patient become the final host of this parasite? What is the name (names) of the disease?
3. What structural features can you find in this organism as adaptations to a parasitic lifestyle? Write at least three characteristics.

Criterion No. 1. Can analyze and systematize information. Maximum score – 3.
Answer to question 1: Phylum Platyhelminthes (Plathelminthes, Flatworms); Class Tapeworms (Cestoda);
Criterion No. 2. Can justify conclusions. Maximum score – 3.
Answer to question 2: Eating undercooked meat with measles (taeniasis); infection with eggs due to insufficient hygiene (cysticercosis)
Criterion No. 3. Knows biological laws, and can apply theoretical and practical knowledge to solve a complex problem. Maximum score – 4.
Answer to question 3: Presence of attachment organs (hooks, suckers); reduction of the digestive system; reduction of the sense organs; well-developed reproductive system.

OR:

Humans have several large vessels that are anatomically connected to the heart. These are the aorta, inferior vena cava, pulmonary artery (pulmonary trunk) and pulmonary veins.

Questions:

1. List what right and left parts of the heart you know.

2. Which of the mentioned vessels are anatomically attached to the right parts of the heart, and which to the left parts of the heart?
3. Which of the listed vessels belong to the large (systemic) circle of blood circulation, and which to the small (pulmonary) circle? What is the degree of blood oxygenation in these vessels (arterial or venous)?

Criterion №1. A correct answer to question 1 was given. Maximum score – 3.
Answer to question 1: the right atrium and right ventricle are the right chambers of the heart. The left chambers of the heart include the left atrium and left ventricle.
Criterion №2. Knowledge of the anatomy of the heart and blood vessels is demonstrated. Maximum score – 3.
Answer to question 2: the pulmonary veins and aorta are associated with the left chambers of the heart; the pulmonary arteries (pulmonary trunk) and inferior vena cava are associated with the right chambers of the heart.
Criterion №3. Demonstration of knowledge of anatomy and physiology, the ability to reason logically. Maximum score - 4.
Answer to question 3: the aorta (arterial blood) and inferior vena cava (venous blood) are part of the systemic circulation; The pulmonary circulation includes the pulmonary arteries/pulmonary trunk (venous blood) and the pulmonary veins (arterial blood)

Medicine, general & internal

Task 33
High level (0-10 points)

In humans, an increase in temperature over 38°C leads, among other things, to loss of appetite and various disorders of the digestive tract, for example, diarrhoea. One of the reasons for these effects is a change in the activity of digestive enzymes.
1) How exactly does it change in this case (increases or decreases)?
2) What and why happens to the enzyme itself?
3) Why does this change its ability to catalyze chemical reactions?

Criterion No. 1. Able to analyze and systematize information. Maximum score – 3.
Answer to question 1: Enzyme activity decreases with increasing body temperature until it disappears.
Criterion No. 2. Able to justify conclusions. Maximum score – 3.
Answer to question 2: An enzyme is a polypeptide chain consisting of amino acids with different chemical properties. Depending on environmental conditions, this chain can take on different conformations. As body temperature increases, the conformations of proteins (including digestive enzymes) can change, even to the point of denaturation.
Criterion No. 3. Knows biological laws, and knows how to apply theoretical and practical knowledge to solve complex problems. Maximum score – 4.
Answer to question 3: Under physiological conditions (at 37°C), a catalytic centre is formed in the tertiary structure of the enzyme, catalyzing biochemical reactions. As the temperature increases, the conformation of the protein changes so that the structure of the catalytic centre changes and the protein loses its enzymatic activity.