Sample questions 2025

Please find below a representative selection of examination questions in Biology, Chemistry (page no. 4), and Logic (page no. 9). These questions are intended to provide insight into the format utilized in our entry examination. Please ignore the question numbering.

For further details regarding the scope of the material, we encourage you to visit here.

Biology

The text for questions no. 6-7:

A patient is treated with antihypertensive medication (drug X). He was advised to take 12.5 mg of the drug X twice a day for the first 12 days, then 25 mg in the morning and 12.5 mg in the evening for the next 12 days, then 25 mg twice a day (final daily dose). He was prescribed 4 supplies of 30 tablets of 12.5 mg of drug X each.

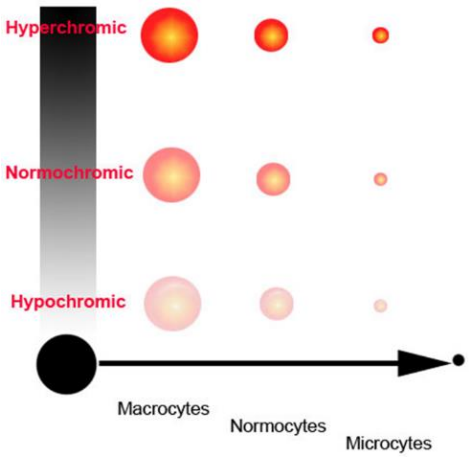
6. According to the dosage regimen above, how many days of treatment will be covered by the total number of tablets prescribed?

a. 27
b. 30
c. 39
d. 42
e. 50

7. According to the dosing, how many tablets are taken by the patient within the first 30 days of treatment?

a. 80
b. 84
c. 90
d. 94
e. 96

The text for questions no. 19-23:



Source: medicine.mcgill.ca

Excessively low values of red blood cell count, haematocrit, or haemoglobin may be indicative of anaemia. There are many different causes of anaemia (e.g. loss of blood through haemorrhage, bone marrow disease, iron deficiency, vitamin B12 deficiency, or folic acid deficiency, etc.) and some of those are characterized by typically very small or very large red blood cells or reduced haemoglobin concentration in each cell. Diagnosis of the type of anaemia may be assisted by relating the measurements of red blood cell (RBC) count, haematocrit and haemoglobin to derive the mean corpuscular volume (MCV) and the mean corpuscular haemoglobin concentration (MCHC).

Erythrocytes that have a normal size or volume (normal MCV) are called normocytic, when the MCV is high, they are called macrocytic. When the MCV is low, they are termed microcytic. Erythrocytes containing the normal amount of haemoglobin (normal MCHC) are called normochromic. When the MCHC is abnormally low they are called hypochromic, and when the MCHC is abnormally high, hyperchromic. The normal ranges for MCV and MCHC are as follows: 80-95 fl (MCV) and 30-34 g Hb/100 ml. The terms above are used together to describe different forms of anaemia. For example, iron deficiency anaemia is described as microcytic and hypochromic, whereas vitamin B12 deficiency is macrocytic and normochromic.

To calculate MCV and MCHC values, the following formulas should be used:

$$MCV = \frac{haematocrit(\%)x\ 10}{RBC\ count\ (\frac{million}{mm^3})} \qquad MCHC = \frac{haemoglobin\ (\frac{g}{100\ ml})x\ 100}{haematocrit\ (\%)}$$

19. The term anaemia refers to a blood disorder connected with which type of cells?

a. red blood cells
b. white blood cells
c. platelets
d. lymphocytes
e. basophiles

20. What is the MCV, expressed in femtoliters (fl), for a subject with a red blood cell count of 4 million/mm^3 of blood and a haematocrit of 35%?

a. 78
b. 82.5
c. 87.5
d. 90
e. 92.5

21. What is the MCHC, expressed as grams of haemoglobin per 100 ml packed cells, for a subject with a haematocrit of 40% and a haemoglobin concentration of 12 g/100 ml is?

a. 20
b. 25
c. 30
d. 32
e. 35

22. Referring to the above-quoted normal ranges of values MCV and MCHC, the cells of an individual with a MCV value of 105 fl and MCHT value of 42 g/100ml are:

a. macrocytic and hyperchromic
b. normocytic and normochromic
c. microcytic and hypochromic
d. microcytic and hyperchromic
e. normocytic and hypochromic

23. If vitamin B12 deficiency is macrocytic and normochromic, it means that erythrocytes have:

a. normal size and normal amount of haemoglobin

b. lower volume and normal amount of haemoglobin
c. higher volume and normal amount of haemoglobin
d. higher volume and lower amount of haemoglobin
e. normal size and higher amount of haemoglobin

CHEMISTRY

Texts for questions no. 50-53 :

The oxidation state or oxidation number is the hypothetical charge of an atom if all of its bonds to other atoms were fully ionic. It describes the degree of oxidation of an atom in a chemical compound. Conceptually, the oxidation state may be positive, negative, or zero. In other words – it is a total number of electrons that an atom either gains or loses in order to form a chemical bond with another atom. The overall charge of the compounds equals 0, unless there is an ion indication of the overall charge, e.g. hydronium ion: $[H_3O]^+$ or H_3O^+. In the nomenclature of inorganic chemistry, the oxidation number of an element that may exist in more than one oxidation state is indicated by a roman numeral in parentheses after the name of the element, e.g. iron(II) chloride: $FeCl_2$ and iron(III) chloride: $FeCl_3$. (https://www.britannica.com/science/oxidation-number)

Chlorine (Cl) forms a series of oxides – compounds with oxygen (O) – in which it presents different degrees of oxidation. It may have the formal oxidation states +I, +IV or +VII.

Dichlorine monoxide – chlorine oxide (I) – is a yellowish-red gas produced in the reaction of chlorine with mercury oxide (HgO), or with a solution of chlorine in CCl_4. It has a free electron on the chlorine atom. When heated or subjected to a spark, chlorine oxide (I) explodes to chloride and oxygen gases. This oxide is highly soluble in water, and it is the anhydride of HOCl - reacts with water to form an orange-yellow solution of hypochlorous acid. Chlorine dioxide - chlorine oxide (IV) - is a yellowish gas at room temperature and is commonly used as an oxidizing agent in industry. Chlorine dioxide is a highly explosive oxide. The photolysis of chlorine dioxide yields a dark brown solid chlorine trioxide with the formula $Cl_2O_{3(s)}$. Its facile and immediate explosive decomposition precludes study. Dichlorine tetraoxide is commonly called chlorine perchlorate as a consequence of its structure. Dichlorine hexaoxide is an unstable red oil that has the ionic structure in the solid state: $[ClO_2]^+[ClO_4]^-$. Dichlorine heptoxide - chlorine oxide (VII) - is a

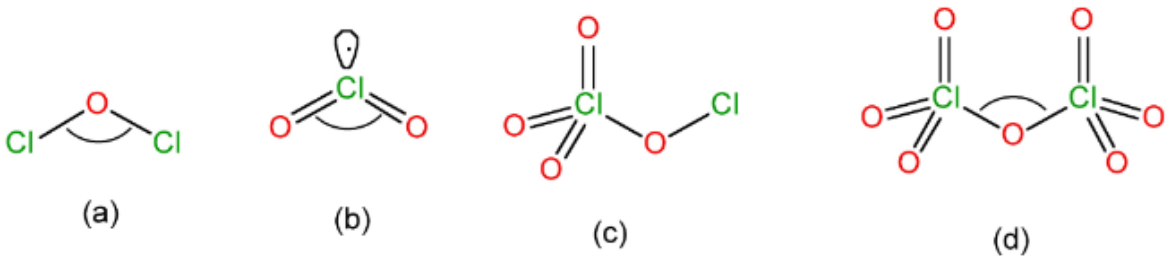
relatively stable oil that is prepared via the dehydration of perchloric acid at -10 °C, followed by vacuum distillation.

(https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Chemistry_of_the_Main_Group_Elements_(Barron)/10%3A_The_Halogens/10.03%3A_Compounds_of_Chlorine; https://doi.org/10.1016/B978-0-12-804697-5.00017-8;)

50. Indicate the compound with the highest oxidation number, knowing that the oxidation number for oxygen is (-II) while for hydrogen it is (+I)

A. H_2O
B. Mn_2O_7
C. CH_4
D. NO_2
E. SO_3

51. Indicate the answer where all chloride oxides formulas are named correctly:



A. (a) chlorine monoxide; (b) chlorine dioxide; (c) dichlorine tetraoxide; (d) dichlorine hexaoxide
B. (a) dichlorine monoxide; (b) chlorine dioxide; (c) dichlorine tetraoxide; (d) dichlorine heptoxide
C. (a) chlorine monoxide; (b) dichlorine trioxide; (c) dichlorine tetraoxide; (d) dichlorine hexaoxide
D. (a) and (b) dichlorine oxide; (c) dichlorine hexaoxide; (d) dichlorine heptoxide
E. (a) and (b) chlorine dioxide; (c) dichlorine trioxide; (d) dichlorine heptoxide

52. The oxide in which chlorine is in the highest oxidation state is obtained by the dehydration (water molecule removal) reaction of chloric acid containing chlorine in the same oxidation state - VII. **Indicate the reaction equation describing this process:**

A. $2\ HClO_4 \rightarrow Cl_2O_7 + H_2O$

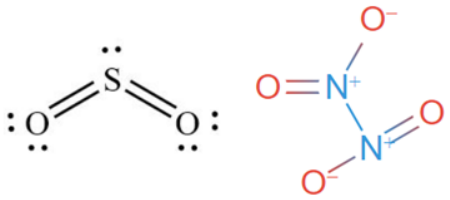
B. $3\ HClO_3 \rightarrow HClO_4 + H_2O + 2\ ClO_2$

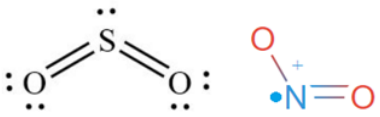
C. $2\ HOCl\ (g) \rightleftharpoons H_2O(g) + Cl_2O(g)$

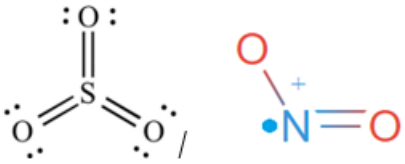
D. $8\ HClO_3 \rightarrow 4\ HClO_4 + 2\ H_2O + 2\ Cl_2(g) + 3\ O_2(g)$

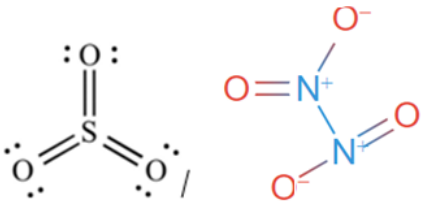
E. $3\ HClO \rightarrow HClO_3 + 2\ HCl$

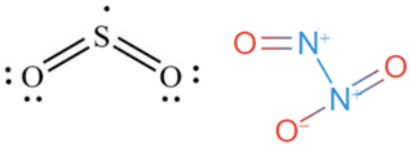
53. The structure of ClO_2 is equivalent to sulfur dioxide SO_2 but with one extra electron, resulting in a paramagnetic unpaired electron species. Unusually, despite the unpaired electron configuration, ClO_2 shows no tendency to dimerize. This is unlike the analogous nitrogen oxide (IV) - NO_2 molecule. Choose the structures of SO_2 and NO_2 dimer from the list:

A. 

B. 

C. 

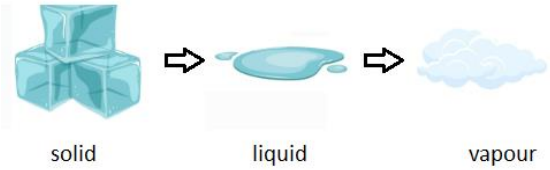
D. 

E. 

The text for the questions no. 81-82:

Entropy change - **ΔS** - is defined as thermodynamic quantity representing the unavailability of a system's thermal energy for conversion into mechanical work, often interpreted as the degree of disorder or randomness in the system. As the entropy of a system increases, the system becomes less ordered, meaning there is an increase in the disorder of the system components.
Enthalpy change - **ΔH** - was defined to determine the amount of heat released or absorbed by a reaction when any work is being done.
$\Delta H < 0$ means heat is leaving the system and the process which releases heat is exothermic.
$\Delta H > 0$ means heat is being absorbed by the system and the process which absorbs heat is endothermic.
(https://www.researchgate.net/publication/305856192_Thermodynamics_and_Cognition_Towards_a_Lawful_Explanation_of_the_Mind)

81. An experiment was conducted with normal atmospheric pressure and applied heat of 100 Celsius degrees. The picture below presents the processes that were observed in the course of the experiment. Determine the correct set of description for the presented experiment:



A. $\Delta S < 0$, exothermic
B. $\Delta S = 0$, exothermic
C. $\Delta S > 0$, endothermic
D. $\Delta S > 0$, exothermic
E. $\Delta S < 0$, endothermic

The text for the questions no. 82-83:

At room temperature and normal atmospheric pressure, the dinitrogen tetroxide decomposition to nitrogen dioxide gas is in equilibrium. Heating or cooling the flasks of NO_2 and N_2O_4 shifts the equilibrium between these two gases. When more NO_2 is produced, the color of the gas inside the flask becomes darker brown. Heat shifts the equilibrium in favor of NO_2. Since the formation of N_2O_4 is an exothermic reaction, lowering the temperature shifts the equilibrium in favor of colorless N_2O_4. The entropy change of the reaction: $2NO_2(g) \leftrightarrow N_2O_4(g)$, is positive, so one would expect the product to be favored at higher temperatures. https://chemdemos.uoregon.edu/demos/NO2N2O4-Equilibrium-Demonstration#

82. Choose the correct representation of the thermodynamic function sign that corresponds directly to the provided information on the formation of dinitrogen tetroxide.

A. $\Delta H > 0$ and $\Delta S < 0$

B. $\Delta H > 0$ and $\Delta S > 0$

C. $\Delta H < 0$

D. $\Delta H > 0$

E. It cannot be determined based on the description.

83. Indicate the true statement regarding the equilibrium between the described gases.

A. At higher temperatures, dinitrogen tetroxide is favored.

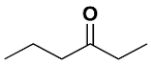
B. At lower temperatures, the temperature shifts the equilibrium in favor of the colorless gas.

C. Cold temperature shifts the equilibrium in favor of N_2O_4

D. The reactant and product are never close to equilibrium.

E. Heating or cooling the gases does not affect equilibrium.

90. In the primary (1°) alcohol, the carbon atom that carries the -OH group is attached to one other carbon atom in the so-called alkyl group. In the secondary (2°) alcohol, the carbon atom with the -OH group is attached directly to two other carbon atoms. Oxidation of alcohols can result in aldehydes, ketones and carboxylic acids. Mild oxidation of 1° alcohols results in aldehydes. Further oxidation of aldehydes results in carboxylic acids. Oxidation of 2° alcohols results in ketones (http://www.profpaz.com/Files/chem52/Chap_22.pdf).

Choose one alcohol oxidation of which will produce the following compound: 

A. $C_3H_7CHOHC_2H_5$

B. $C_5H_{12}CH_2OH$

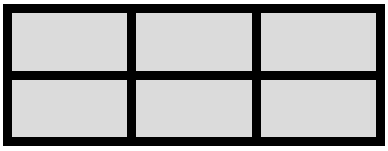
C. $C_2H_5(CH_3)COHC_2H_5$

D. $HOC_6H_{12}OH$

E. $CH_3CHOHCH_3$

LOGIC

94. How many rectangles are there in the figure below?



A. 20

B. 18

C. 15

D. 16

E. 12

95. In your pocket, you have 10 coins with the denomination of 50 US cents and 20 US cents. If the total value of all coins is 3 dollars and 50 cents, how many 50 cent coins do you have?

A. 3

B. 4

C. 5

D. 6

E. 7