УДК 378.016:54

ORGANIZATION OF KNOWLEDGE CONTROL ON THE SUBJECT «GENERAL AND INORGANIC CHEMISTRY» IN STUDENTS STUDY IN ENGLISH

E.A. Gusakova
Vitebsk, Vitebsk State Medical University

Pedagogical diagnostics of students' knowledge and skills are obligatory condition the organization of educational process. The systematic control of knowledge fosters in students a responsible attitude to studies, allowing them to identify individual characteristics and apply a differentiated approach in training. Pedagogical control is reliable information about students' achievements in the subject being studied and the gaps in their preparation, can manage the learning process.

Pedagogical diagnostics of students' knowledge on the subject "General and Inorganic Chemistry" has a place for each topic studied in the laboratory and practical classes, as well as during the semester held a thematic control knowledge in the form of implementation of control work.

In this article, I presented the contents of a thematic control work that provides a model program on the subject. During preparation for the thematic control knowledge under the chapter "Laws of chemical processes" the student must repeat the following program questions:

1) Equivalent. The equivalents law. Determination of the molar mass of an equivalent of element, simple and complex substances. Calculations of the molar mass of an equivalent in acid-base and redox reactions.

2) Subject and problems of chemical thermodynamics. Interrelation between processes of a metabolism and energy in an organism. Chemical thermodynamics is a

theoretical basis of a bioenergetics.

3) The basic concepts of thermodynamics. Internal energy. Work and heat – two forms of energy transmission. Types of thermodynamic systems and processes. Enthalpy. Standard enthalpy changes of formation, standard enthalpy changes of combustion. The Hess´s law of heat summation. Thermochemical processes. Reversible and nonreversible processes in thermodynamic sense. Entropy. Standard entropy. Gibbs free energy. The standard Gibbs free energy of formation.

4) A chemical equilibrium. Reversible and nonreversible reaction. A constant of a chemical equilibrium and ways of its expression: K_p, K_c, K_a. The equation of isotherm of chemical reaction. To predict a shift of a chemical equilibrium, according to a Le Chatelier 's principle.

5) Chemical kinetics as a basis for study of rates and mechanisms of biochemical processes. Reactions simple and composite, homogeneous and heterogeneous. The mass action law for reaction rate. The effect of temperature on a reaction rate. The Arrhenius equation.

Control work

Variant 1

1. Enthalpy. Standard enthalpy changes of formation, standard enthalpy changes of combustion.

2. Concentration and reaction rate. Mass action law for rate of the chemical reaction. Rate constant.

3. Calculate the molar mass of an equivalent of phosphoric acid in the following reactions:

$$CaCl_2 + H_3PO_4 = CaHPO_4 + H_2O$$
$$Ca(NO_3)_2 + H_3PO_4 = Ca_3(PO_4)_2 + H_2O$$

4. Calculate the molar mass of an equivalent of oxidizing and reducing agents in the following reaction: $Fe_2O_3 + CO \rightarrow CO_2 + 2FeO$

5. What is value of ΔH^o for the reaction:

$$Saccharose + H_2O \rightarrow Glucose + Fructose$$

The ΔH_f^o (saccharose) = -222,7 kJ/mol, ΔH_f^o (H_2O) = -241,8 kJ/mol
ΔH_f^o (fructose) = -1006 kJ/mol, ΔH_f^o (glucose) = -1274,5 kJ/mol

6. The standard free energy change for the reaction

$$2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) \text{ is -180 kJ.}$$

Calculate the equilibrium constant (K) for this reaction at 300 K.

Variant 2

1. The Hess´s law of heat summation. Thermochemical processes.

2. The effect of temperature on a reaction rate. A temperature coefficient of reaction rate and its peculiarities for biochemical processes. The Arrhenius equation.

3. Calculate the molar mass of an equivalent of iron(III) hydroxide in the following reactions:

$$Fe(OH)_3 + HNO_3 = FeOH(NO_3)_2 + H_2O$$
$$Fe(OH)_3 + HCl = FeCl_3 + H_2O$$

4. Calculate the molar mass of an equivalent of oxidizing and reducing agents in the following reaction: $PbS + HNO_3 \rightarrow Pb(NO_3)_2 + NO_2 + S + H_2O$.

5. Calculate the enthalpy change for chemical reaction

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

if ΔH_f^o (CH_4) = -74,85 kJ/mol, ΔH_f^o (CO_2) = -393,5 kJ/mol, ΔH_f^o (H_2O) = -285,9 kJ/mol

6. Calculate the free-energy change for enzymatic reaction

$$\text{L-aspartate} \leftrightarrow \text{fumarate} + NH_4^+$$

if the equilibrium constant (K) is $1{,}6 \cdot 10^{-2}$ and 39°C.

Variant 3

1. Entropy. Standard entropy. Boltzmann's entropy formula.
2. Chemical equilibrium. Reversible and nonreversible reactions. Examples.
3. Calculate the molar mass of an equivalent of $Cu(OH)_2$ and CuOHCl in the following reactions:

$$Cu(OH)_2 + HCl = CuCl_2 + H_2O$$
$$CuOHCl + HCl = CuCl_2 + H_2O$$

4. Calculate the molar mass of an equivalent of oxidizing and reducing agents in the following reaction: $Al + HNO_3 \rightarrow Al(NO_3)_3 + N_2 + H_2O$.
5. Calculate the entropy change for chemical reaction

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

$S^o(CH_4)$ = 186,3 J/mol·K, $S^o(O_2)$ = 205,0 J/mol·K

$S^o(CO_2)$ = 213 J/mol·K, $S^o(H_2O)$ = 69,94 J/mol·K

6.The equilibrium concentrations of H_2, J_2 and HJ are 0,25, 0,05 and 0,9 mol/l respectively. Calculate the free-energy change of reaction: $H_2 + J_2 \leftrightarrow HJ$

Variant 4

1. Spontaneity and Free Energy.
2. Homogeneous and heterogeneous catalysis. Examples.
3. Calculate the molar mass of an equivalent of sulphuric acid in the following reactions:

$$H_2SO_4 + KOH = KHSO_4 + H_2O$$
$$H_2SO_4 + KOH = K_2SO_4 + H_2O$$

4. Calculate the molar mass of an equivalent of oxidizing and reducing agents in the following reaction:

$$KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow MnSO_4 + Fe_2(SO_4)_3 + K_2SO_4 + H_2O.$$

5. Calculate the ΔH^o of reaction:

$$2C_2H_6 \rightarrow 2CH_4 + C_2H_2 + H_2$$

if the ΔH^o of combustion C_2H_6, CH_4, C_2H_2 and H_2 are -1560, -890.2, -1299.0, -285,83 kJ/mol correspondingly.

6. ΔG^o for the reaction $N_2(g) + O_2(g) \leftrightarrow 2NO(g)$ is 173,1 kJ. Calculate the value of the equilibrium constant for this reaction at 25°C.

Control of knowledge plays important role in activization the educational activities of foreign students, as many of them have revealed a lack of a responsible attitude to learning, lack of motivation to study general professional disciplines, aborted skills of educational work.