

PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA
RUDN UNIVERSITY

Tests for RUDN University Open Olympiad for Foreign Citizens

CHEMISTRY (M)

Variant 1

Test questions (1 point each)

1. The element (E) whose atomic electron configuration is $ls^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$ forms the following acid in its highest oxidation state

1) H_2EO_4 2) H_2EO_3 3) HEO_4
4) HEO_3

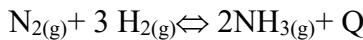
Answer

2. No hydrogen bond is formed between the following molecules

1) CH_3CHO 2) H_2O 3) NH_3 4) CH_3CH_2OH

Answer:

3. How does the rate of the forward reaction change when the ammonia concentration triples?



A) it triples	C) it increases by 9 times
B) it decreases by 9 times	D) it decreases by 27 times
E) it increases by 27 times	F) it does not change

Answer:

4. What is the pH of a solution of the strong electrolyte $LiOH$ if the concentration of the solution is 0.001 mol/l.

A) 14 C) 10
B) 3 D) 11

Answer:



5. Determine the nature of the medium of the aqueous solutions with the same concentration (mol/l) for the substances listed below.

- 1) sodium acetate
- 2) strontium hydroxide
- 3) potassium dichromate
- 4) aluminum (III) nitrate

Write down the numbers of the substances in the ascending order of the pH of their aqueous solutions.

Answer:

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6. In what order will the following ions be discharged at the cathode:

- 1) Ag^+
- 2) Pb^{2+}
- 3) Mn^{2+}
- 4) Cd^{2+}

Give your answer as a sequence of four numbers.

Answer:

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7. Choose from the proposed reagents the one which can be used to separate $\text{Mg}(\text{OH})_2$ and $\text{Fe}(\text{OH})_3$ mixture:

- a) HCl
- b) NH_3
- c) NH_4Cl
- d) H_3PO_4

Answer:

8. Acid properties are more pronounced in

- 1) water
- 2) phenol
- 3) ethanol
- 4) methanol

Answer:

9. According to their state of aggregation, the following colloidal systems are:

A) water and oil	1) suspension
B) blood	2) aerosol
C) smoke	3) emulsion
D) exhaust gas	4) sol

Answer:

A	B	C	D

10. Match the chemical reaction with the organic substance predominantly formed in this reaction. Choose the corresponding position indicated by a number for each position indicated by a letter.

REACTION	REACTION PRODUCT
A) trimerization of acetylene	1) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$
B) hydrogenation of 1,3-butadiene	2) $\text{CH}_3\text{-CO-CH}_2\text{-CH}_3$
C) dehydrogenation of cyclohexane	3) cyclohexane
D) hydration of 1-butene	4) $\text{CH}_3\text{-CH(OH)-CH}_2\text{-CH}_3$ 5) $\text{CH}_3\text{-CH(OH)-CH(OH)-CH}_3$ 6) benzene

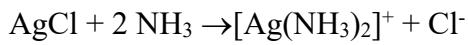
Write down the numbers in the answer arranging them in the order corresponding to the letters:

A	B	C	D

Part 2

1 Determine the heat of formation of copper (II) oxide (in kJ/mol) if 60.75 kJ of energy was released when burning 24 g of copper to copper (II) oxide.

2. The equilibrium constant of the reaction:
is calculated by the formula:



a) $K_p = K_s^o(\text{AgCl}) \cdot \beta_2(\text{Ag}(\text{NH}_3)_2^+);$ b) $K_p = \frac{1}{K_s^o(\text{AgCl}) \cdot \beta_2(\text{Ag}(\text{NH}_3)_2^+)};$

c) $K_p = \frac{\beta_2(\text{Ag}(\text{NH}_3)_2^+)}{K_s^o(\text{AgCl})};$ d) $K_p = \frac{K_s^o(\text{AgCl})}{\beta_2(\text{Ag}(\text{NH}_3)_2^+)}.$

3. *AgI* sol is obtained by adding *AgNO₃* solution to *NaI* solution. Write the formula of a micelle of the sol in excess of silver salt.

4. Write reaction equations which can be used to carry out the following transformations, indicate the conditions for the reactions:



5. The molar mass of the equivalent of potassium carbonate when titrated with hydrochloric acid in the presence of methyl orange ($pT=4$) is equal to:

a) $M(K_2CO_3)$; b) $M(K_2CO_3)/2$; c) $M(K_2CO_3)/3$; d) $2 M(K_2CO_3)$.