Sarajevo School of Science and Technology
Sarajevo, June 2014

Entrance Exam

CHEMISTRY

Name: _____

Show that one of the provided answers is the solution of the problem. Circle the correct answer.

1. Elements in the Periodic Table are arranged according to the

   A: atomic mass.
   B: number of neutrons.
   C: mass number.
   D: atomic number.
   E: chemical properties.

2. How many protons, neutrons and electrons are in the ion below?

   $_{19}K^{39+}$

   A: 20 protons, 19 neutrons, 19 electrons
   B: 19 protons, 20 neutrons, 18 electrons
   C: 39 protons, 19 neutrons, 38 electrons
   D: 20 protons, 19 neutrons, 20 electrons
   E: 40 protons, 20 neutrons, 19 electrons

3. All of the following molecules are polar except:

   A: CO_2 B: H_2S C: CH_3OH D: H_2O E: NH_3

4. Benzene, C_6H_6, is a common solvent. Select the substances that are well soluble in benzene.

   1. NaI 2. I_2 3. Margarine 4. Table salt

   A: 1,2,3,4 B: 2,3,4 C: 1,4 D: 1,2 E: 2,3

5. The vapor pressure of a liquid is **low** at room temperature. The liquid

   A: has low melting point.
   B: has low surface tension.
   C: has weak intermolecular forces.
   D: has high boiling point.
   E: is volatile.

6. The dissolution of a solid in water is **endothermic**. You have a saturated solution, which of the following changes will cause more solid to dissolve?

A: Increase the temperature.
B: Increase the pressure.
C: Decrease the temperature.
D: Decrease the pressure.
A: Add more solid.

7. 0.2 g of hydrogen fluoride (HF) is:

Molar masses: H=1.0 g/mol ; F=19 g/mol

A. 6×10^{21} mole B: 100 mole C: 20 mole D: 0.02 mole E: 0.01 mole

8. 0.08 g NaOH is dissolved in enough water to make 10 mL of solution. Calculate the **molarity** of the solution.

Molar masses: Na=23 g/mol ; O=16 g/mol ; H=1.0 g/mol

A. 0.2 M B: 0.2 mM C: 20 mM D: 5 ME: 5 mM

9. The pH of an acid solution is 3. It may be all of the following solutions **except**.

A: 10^{-3} M HCl solution.
B: 10^{-3} M CH_3COOH solution.
C: 10^{-3} M HNO_3 solution.
D: 10^{-3} M HBr solution.
E: 5×10^{-4} M H_2SO_4 solution.

10. A 0.01 M HCl solution is diluted with water hundred times.

1. The pH of the solution increases by 2.
2. The pOH of the solution increases by 2.
3. The hydronium ion concentration of the solution decreases from10^{-2} M to10^{-4} M.
4. The hydroxide ion concentration of the solution does not change.

A: 1,2 B: 2,3 C: 1,3 D: 1,3,4 E: 2,3,4

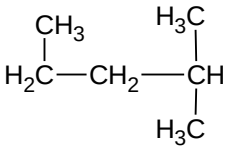
11. Choose the redox reaction.

A: $HNO_3 + KOH \rightarrow KNO_3 + H_2O$
B: $2HNO_3 + Na_2CO_3 \rightarrow 2NaNO_3 + H_2O + CO_2$
C: $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$
D: $2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$
E: $2HNO_3 + 3H_2S \rightarrow 2NO + 3S + 4H_2O$

12. Unstable nuclei undergo radioactive decay. During **alpha** radiation

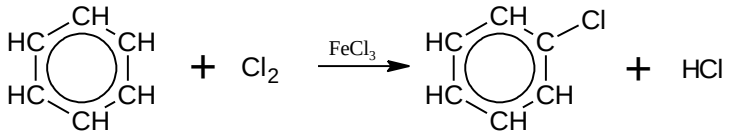
A: the atomic number decreases by 2 and the mass number by 4.
B: the atomic number decreases by 4 and the mass number by 2.
C: the atomic number increases by 1 and the mass number doesn't change.
D: the loss of a neutron decreases the mass number by 1 and the charge by
E: the loss of a proton decreases the mass number by 1 and increases the charge by 1.

13. The IUPAC name of the following compound is:



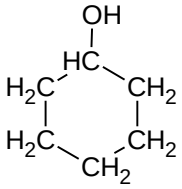
A: 2,2,4-trimethyl-propane
B: 2,2-dimethylbutane
C: 1-isopropylpropane
D: 2-methylpentane
E: 2-methylpentene

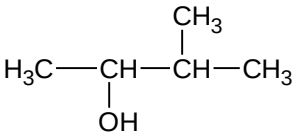
14. The reaction beow is classified as:

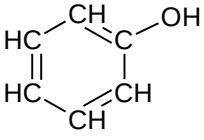


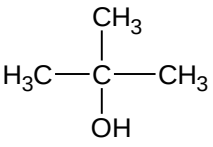
A: a substitution reaction.
B: an addition reaction.
C: an elimination reaction.
D: a saturation reaction.
E: an oxidation reaction.

15. Choose the compound(s) that are secondary alcohols

1) 

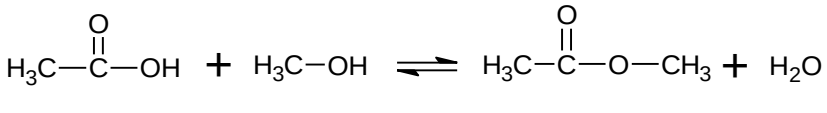
2) 

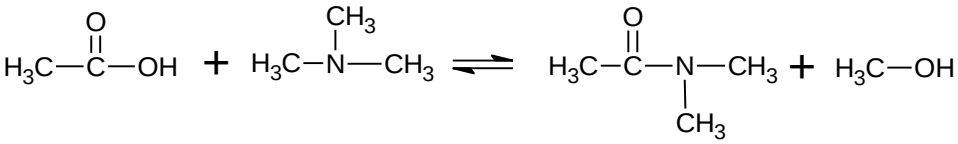
3) 

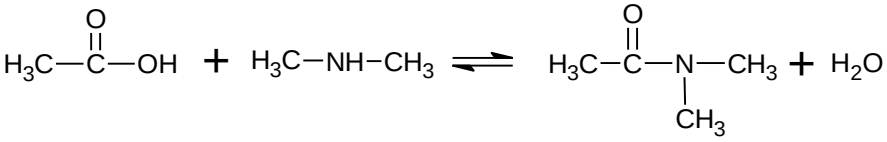
4) 

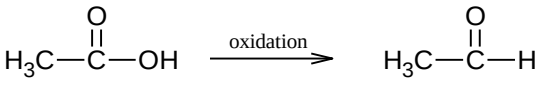
A: 1,2,3,4 B: 1,3 C: 1,4 D: 1,2 E: 2,3

16. Acetic acid gives which of the following reactions?

1) 

2) 

3) 

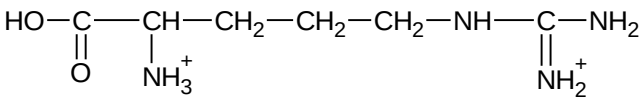
4) 

A: 1,2 B: 1,3 C: 2,3 D: 1,4 E: 2,4

17. How many stereoisomers does an aldopentose have in its open chain form?

A: 2
B: 3
C: 4
D: 6
E: 8

18. Which statement is true for the water solution of the following amino acid?



A: It has an acidic side chain.
B: It is hydrophobic due to the long carbon chain.
C: It is at its isoelectric point.
D: It is in an acidic solution.
E: It is in a basic solution.

19. Which of the following functional groups are **common** in proteins?

1) amide 2) phosphodiester 3) disulfide 4) alkyne

A: 1,2 B: 2,3 C: 1,3 D: 3,4 E: 1

20. Which of the following substances classify as lipids?

1) tryacyl glycerols 2) nucleosides 3) steroids 4) waxes

A: 1 B: 1,3 C: 1,3,4 D: 2,3 E: 1,2,3,4

21. 100 g of ethanol C_2H_6O is dissolved in 100 g of water. The final solution has a volume of 0.2 L. What is the density of the resulting solution?

a. 0.5 g/mL
b. 1 g/mL
c. 46 g/mL
d. 40 g/mL

22. The best way to separate isotopes of the same element is to exploit:

a. Differences in chemical reactivity
b. Differences in reduction potential
c. Differences in toxicity
d. Differences in mass

23. Any reaction that absorbs 150 kcal of energy can be classified as

a. activated
b. exothermic
c. oxidation
d. endothermic

24. Fifty (50) grams of acetic acid $C_2H_4O_2$ are dissolved in 200 g of water. Calculate the weight % and mole fraction of the acetic acid in the solution.

a. 20%, 0.069
b. 0.069%, 0.20
c. 25%, 0.075
d. 20%, 0.075

25. Which of the following reactions produces products with higher entropy than the starting materials?

I. Glucose (s) + water→glucose (aq)
II. $4Al\ (s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$
III. $Br_2 + light \rightarrow 2\ Br$
IV. Ice→water vapor

a. II, III
b. I, II
c. I, III
d. I, III, IV

26. Place the following in the correct order of increasing acidity.

    a. HCl< HF< HI< HBr
    b. HCl< HBr< HI< HF
    c. HI< HBr< HCl< HF
    d. HF< HCl< HBr< HI

27. What is the chemical composition of ammonium sulfate?

    a. N 21%, H 3%, S 24%, O 32%
    b. N 10%, H 6%, S 24%, O 60%
    c. N 10%, H 4%, S 12%, O 74%
    d. N 21%, H 6%, S 24%, O 48%

28. Comparing pure water and 1 M aqueous solution of NaCl, both at 1 atm of pressure, which of the following statements is most accurate?

    a. The pure water will boil at a higher temperature, and be less conductive
    b. The pure water will boil at a lower temperature and be less conductive
    c. The pure water will boil at a lower temperature and be more conductive
    d. The pure water boil at the same temperature and be more conductive

29. Ammonium Phosphate $(NH_4)_3PO_4$ is a strong electrolyte. What will be the concentration of all the ions in a 0.9 M solution of ammonium phosphate?

    a. 0.9 M NH_4+, 0.9 M PO_4^{3-}
    b. 0.3 M NH_4+, 0.9 M PO_4^{3-}
    c. 2.7 M NH_4+, 0.9 M PO_4^{3-}
    d. 2.7 M NH_4+, 2.7 M PO_4^{3-}