MEDICAL UNIVERSITY - PLEVEN, BULGARIA

CHEMISTRY EXAM Sample Test – v.4

Part A: Multiple Choice Questions

- **Indicate the correct answers on the answer sheet with "×".**
- **For each question there is only one correct answer. Multiple answers will be scored as incorrect.**

1. Compared to the entire atom, the nucleus of the atom is :
   a) smaller and contains most of the atom's mass
   b) larger and contains little of the atom's mass
   c) larger and contains most of the atom's mass
   d) smaller and contains little of the atom's mass

2. A carbon atom has 6 protons, 7 neutrons, and 6 electrons. What is the mass number of this atom?
   a) 6 b) 12 c) 13 d) 19

3. Which one of the following statements about *s* orbitals is incorrect ?
   a) they are found in all principal energy levels
   b) they are spherical in shape
   c) they can only hold one electron
   d) the maximum number of s orbitals in any principal level is 1

4. Two atoms have the same number of protons, but one nucleus has one more neutron than the other. These atoms represent:
   a) different elements, but the same ion
   b) the same element, but different ions
   c) the same element, but different isotopes
   d) different elements, but the same isotope

5. Which of the following pairs of elements is most likely to form an ionic compound?
   a) nitrogen and oxygen
   b) sulfur and hydrogen
   c) sodium and aluminum
   d) magnesium and fluorine

6. Which of the following are non-polar molecules?
   a) CO_2 b) CH_4 c) O_2 d) all of them

7. Which statement about electronegativity is INCORRECT?
   a) Within a periodic table group, electronegativity decreases from top to bottom.
   b) Metals generally have higher electronegativity values than non-metals.
   c) Within a periodic table row, electronegativity increases from left to right.
   d) Fluorine is more electronegative than carbon.

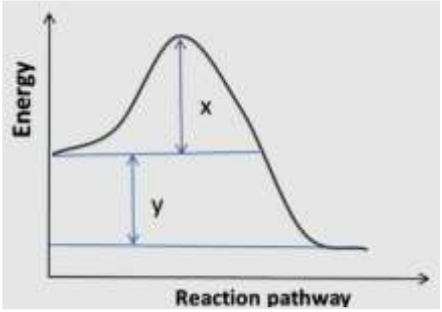
8. In the reaction $2KNO_3 \rightarrow 2KNO_2 + O_2$, the oxidation state of nitrogen changes from :
   a) -3 to +2 b) +5 to +3 c) +3 to +5 d) -3 to +3

9. Which compound contains sulphur in the lowest oxidation state?
   a) H_2S b) SO_2 c) SO_3 d) H_2SO_3

10. Which of the following equations represents a redox reaction ?
    a) $ZnO + 2\ HCl \rightarrow ZnCl_2 + H_2O$
    b) $CuO + C \rightarrow CO + Cu$
    c) $AgNO_3 + HCl \rightarrow AgCl + HNO_3$
    d) $CH_3COONa + HCl \rightarrow CH_3COOH + NaCl$

11. The rate of reaction
    a) may decrease or increase as the reaction proceeds
    b) increases as the reaction proceeds
    c) decreases as the reaction proceeds
    d) remains the same as the reaction proceeds

12. Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?



a) x b) y c) x + y d) x – y

13. What happens when a catalyst is added to a system at equilibrium?
    a) the reaction follows an alternative pathway of lower activation energy
    b) the heat of reaction decreases
    c) the potential energy of the reactants decreases
    d) the potential energy of the products decreases

14. Raising the temperature of an equilibrium system:
    a) favours the endothermic reaction only
    b) favours the exothermic reaction only
    c) favours the exothermic and endothermic reactions
    d) favours nether the exothermic nor endothermic reactions

15. The reaction $2\ NO(g) + O_2(g) \rightleftarrows 2\ NO_2(g) + Q$
    is reversible and exothermic. Which conditions will give the largest yield of nitrogen dioxide?
    a) low temperature and low pressure
    b) low temperature and high pressure
    c) high temperature and high pressure
    d) high temperature and low pressure

16. The pH of a solution of HCl is 3. This shows that the concentration of the solution is :
    a) 3.0 mol/L b) 0.3 mol/L c) 0.003 mol/L d) 0.001 mol/L

17. If the pH of a solution of a salt is 9.0, the salt must be one which could be formed by the reaction of :
    a) a strong acid and a strong base
    b) a weak acid and a strong base
    c) a strong acid and a weak base
    d) a weak acid and a weak base

18. Which of the following structures represents the conjugate acid of HCO_3^- ?
    a) H_2CO_3 b) CO_3^{2-} c) H_3CO_3 d) CO_2

19. When zinc and hydrochloric acid react, they produce :
a) hydrogen and zinc chloride
b) hydrogen and zinc oxide
c) oxygen and zinc chloride
d) chlorine and zinc oxide

20. The rate law for the reaction $2\ SO_2 + O_2 \rightarrow 2\ SO_3$ is:
a) $v = k.[SO_2].[O_2]^2$
b) $v = k.[SO_2]^2.[O_2]$
c) $v = k + 2[SO_2] + [O_2]$
d) $v = k.[SO_3]^2$

21. Which of the following contains a *pi* bond or bonds?
a) aromatics b) alkenes c) alkynes d) all of these

22. Which of the following reactants can be used to convert an alkene to an alkane?
a) HCl b) Cl_2 c) H_2O d) H_2

23. Which compounds are within the same homologous series?
a) butane and butene
b) ethane and ethanol
c) heptane and octane
d) methanol and methanal

24. The general formula for the alkenes is :
a) C_nH_n b) C_nH_{2n} c) C_nH_{2n+2} d) C_nH_{2n-2}

25. The term used to describe the geometry of a carbon atom involved in a triple bond is :
a) linear b) perpendicular c) trigonal planar d) tetrahedral

26. When an alkene undergoes a hydration reaction the product is :
a) ether b) alcohol c) alkane d) alkyne

27. Which of the following statements about amines is INCORRECT?
a) They react with acids to form salts.
b) Aliphatic amines are more basic than aromatic amines.
c) Primary amines are more basic than secondary amines.
d) Phenylamine is a primary aromatic amine.

28. When phenol is treated with excess of bromine water, it gives
a) m-bromophenol
b) 3,5-dibromophenol
c) 2,4-dibromophenol
d) 2,4,6-tribromophenol

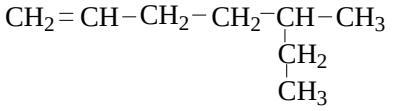
29. Ketones are prepared by the oxidation of:
a) primary alcohols
b) secondary alcohols
c) tertiary alcohols
d) phenols

30. What is true about carboxylic acids?
a) carboxylic acids are strong acids
b) carboxylic acids can react with metals
c) carboxylic acids are always aromatic
d) carboxylic acids cannot form hydrogen bonds

31. The reaction of benzene with chlorine in the presence of iron gives:
a) benzene hexachloride
b) chlorobenzene
c) benzyl chloride
d) benzoyl chloride

32. When HCl reacts with 1-butene the product is:
    a) 1,2-dichlorobutane
    b) 2-chlorobutane
    c) 1-chlorobutane
    d) 3-chlorobutane

33. The IUPAC name of the molecule shown is :



    a) 5-ethyl-1-hexene
    b) 3-methyl-6-heptene
    c) 2-ethyl-5-hexene
    d) 5-methyl-1-heptene

34. Which of the following is not the common name of an aromatic compound?
    a) phenol b) aniline c) toluene d) acetone

35. Which of the following types of compounds are expected products from the reaction of a fat with sodium hydroxide?
    a) glycerol and fatty acids
    b) fatty acid salts and fatty acids
    c) glycerol and fatty acid salts
    d) triesters of glycerol

36. Which of the following compounds will react with Tollens reagent?
    a) CH_3-CHO
    b) CH_3-COOH
    c) CH_3-CH(OH)-CH_3
    d) CH_3-CO-CH_2-CH_3

37. Which one of the following is the strongest acid ?
    a) CH_3COOH
    b) CCl_3COOH
    c) $CH_2ClCOOH$
    d) C_2H_5COOH

38. Amino acids are ampholytes because they can function as either a(an):
    a) neutral molecule or an ion
    b) polar or a nonpolar molecule
    c) standard or a nonstandard monomer in proteins
    d) acid or a base

39. The end product of acid hydrolysis of starch is:
    a) soluble starch
    b) glucose
    c) fructose
    d) dextrin

40. What is the molecular formula of sucrose?
    a) $C_{10}H_{20}O_{10}$ b) $C_{12}H_{20}O_{11}$ c) $C_{12}H_{22}O_{11}$ d) $C_6H_{12}O_6$

Part B: Short Answer Questions

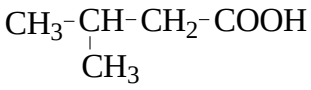
- **Write your answers in the space provided for each question!**

1. Assign the proper oxidation state for the sulfur atom in each of the following species.

H_2S _____ SO_3 _____ H_2SO_3 _____

2. The concentration of OH^- ions in an aqueous solution at room temperature (25^oC) is 1×10^{-6} mol.l^{-1}. What is the concentration of H^+ ions?

3. Give the IUPAC name of the following compound:



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4. Show the equation and name the product formed when acetaldehyde reacts with H_2.