MEDICAL UNIVERSITY - PLEVEN, BULGARIA

CHEMISTRY EXAM Sample Test – v.1

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. The lowest principal quantum number (*n*) for an electron is:
   a) 0 b) 1 c) 2 d) 3

2. Which compounds dissociate into ions, when dissolved in water?
   A) glucose, $C_6H_{12}O_6$ C) sodium chloride, NaCl
   B) potassium sulfate, K_2SO_4 D) ethanol, CH_3CH_2OH
   a) A and D b) B and C c) A, C, and D d) all of them

3. The atom $^{35}_{17}Cl$ has:
   a)17 electrons, 35 protons, 18 neutrons c) 17 electrons, 17 protons, 18 neutrons
   b) 35 electrons, 17 protons, 18 neutrons d) 17 electrons, 18 protons, 18 neutrons

4. The atomic number is always equal to the total number of
   a) neutrons in the nucleus c) neutrons plus protons in the atom
   b) protons in the nucleus d) protons plus electrons in the atom

5. Which element is most likely to form a covalent compound?
   a) cesium b) carbon c) magnesium d) sodium

6. Which molecule is non-polar?
   a) CH_4 b) PH_3 c) H_2S d) H_2O

7. How does calcium obey the octet rule when reacting to form compounds?
   a) it gains electrons
   b) it gives up electrons
   c) it does not change its number of electrons
   d) calcium does not obey the octet rule

8. Which of the following elements can form diatomic molecules held together by triple covalent bonds?
   a) fluorine b) carbon c) nitrogen d) oxygen

9. Hydrogen bonding occurs in molecules when:
   a) a hydrogen atom forms a covalent bond with one other atom
   b) a hydrogen atom forms covalent bonds with more than one atom
   c) a hydrogen atom bonded to small electronegative atom is attracted an electron pair on an electronegative atom on an adjacent molecule
   d) a hydrogen atoms form an ionic bond with one other atom

10. Given the reaction: $2H_2 + O_2 \rightarrow 2H_2O$
The reducing agent in the above reaction:
a) gains protons b) gains electrons c) loses protons d) loses electrons

11. Which of the following ions has an incorrect charge?
a) PO_4^{3-} b) SO_4^{2+} c) OH^- d) Ca^{2+}

12. The rate constant of a chemical reaction depends on:
a) the nature of the substances only
b) the temperature
c) the reactants' concentration
d) both the temperature and the nature of the substances

13. A catalyst on adding to equilibrium:
a) increases the rate of forward reaction only
b) increases the rate of backward reaction only
c) causes no influence upon the position of equilibrium
d) changes the position of equilibrium

14. In which of the following compounds carbon has the lowest oxidation state?
a) $CaCO_3$ b) C_2H_2 c) CH_3Cl d) CO

15. Given the reaction at equilibrium: $2\,CO_{(g)} + O_{2(g)} \rightleftarrows 2\,CO_{2(g)} + Q$
Which change will shift the equilibrium to the right?
A) increasing the concentration of oxygen
B) adding a catalyst
C) increasing the pressure
D) increasing the temperature

a) A, B, C, D b) B, D c) A, C d) C, D

16. Which of the following pairs of species is not a conjugate acid-base pair?

a) CO_3^{2-} and H^+ c) H_2O and OH^-
b) HSO_4^- and SO_4^{2-} d) HF and F^-

17. Identify the acids and the bases in the reaction: $H_2O + NH_3 \rightleftarrows NH_4^+ + OH^-$
a) H_2O and NH_3 are bases; NH_4^+ and OH^- are acids
b) H_2O and NH_3 are acids; NH_4^+ and OH^- are bases
c) H_2O and NH_4^+ are acids; NH_3 and OH^- are bases
d) H_2O and OH^- are bases; NH_3 and NH_4^+ are acids

18. Which aqueous solution does not change the color of purple (neutral) litmus paper?
a) H_2S b) KNO_3 c) KOH d) CH_3COOH

19. If the pOH of a solution is 8, what is the molar concentration of hydrogen ions $[H^+]$?
a) 1.0×10^{-8} mol/L b) 8.0 mol/L c) 1.0×10^{-14} mol/L d) 1.0×10^{-6} mol/L

20. What is the hybridization in a molecule with 120 degree bond angles exclusively?
a) sp b) sp^2 c) sp^3 d) sp^3d

21. Which are the four most abundant elements in the human body?
a) H, C, N, O b) H, C, O, Fe c) C, O, P, S d) N, O, P, Ca

22. A saturated compound is one that:
a) contains only carbon-carbon sigma bonds
b) contains at least one carbon-carbon pi bond
c) contains at least one carbon-carbon double bond
d) contains at least one carbon-carbon triple bond

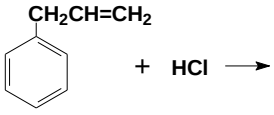
23. Isomers are compounds that:
a) have the same number of carbon atoms but a different number of hydrogen atoms
b) have the same number of hydrogen atoms but a different number of carbon atoms
c) have the same number and kind of atoms in a molecule but differ in structure
d) have the same kind of atoms in their molecular formulas but differ in the number of these atoms present

24. Which of the following compounds is named methanal?
a) C_2H_5OH b) CH_3COCH_3 c) CH_3OH d) HCHO

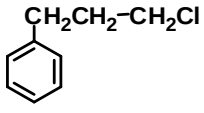
25. Given the compounds: (I) NaOH ; (II) CH_3OH ; (III) CH_3-NH_2 .
Which one or ones of these compounds form basic solutions when dissolved in water ?
a) I b) I and II c) II and III d) I and III

26. Which are the major products of nitration of toluene?
a) *ortho*- and *meta*-nitrotoluene
b) 2,3-dinitrotoluene
c) *ortho*- and *para*-nitrotoluene
d) *meta*- and *para*-nitrotoluene

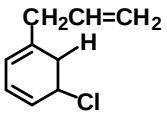
27. What is the predicted product of addition of HCl to the benzene derivative



according to the reaction



a)



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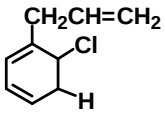

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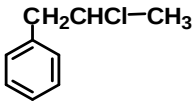


d)

28. The class of compounds that get reduced to primary alcohols and also respond to Fehling's (Benedict's) test is known as :
a) carboxylic acids b) ketones c) aldehydes d) ethers

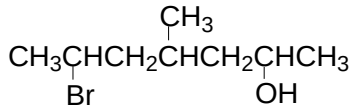
29. Reduction of an aldehyde gives:
a) ether b) primary alcohol c) secondary alcohol d) ketone

30. Which compound can be esterified with acetic acid ?
a) C_2H_5OH b) C_3H_7Br c) CH_3COCH_3 d) CH_3CHO

31. For which of the isomers shown is possible cis-trans isomerism?
A) 1-hexene B) 2-methyl-2-pentene C) 3-hexene D) 4-methyl-1-pentene

a) A, B and C b) C only c) B only d) B and D

32. The correct IUPAC name for the following compound



is:

a) 6-bromo-4-methylheptanol
b) 2-bromo-4-methyl-6-heptanol
c) 6-bromo-4-ethyl-2-heptanol
d) 6-bromo-4-methyl-2-heptanol

33. How many structural isomers are possible for the alkene C_4H_8?
a) two b) three c) four d) five

34. Trimethylamine is an example of :
a) primary amine
b) tertiary amine
c) secondary amine
d) quaternary amine

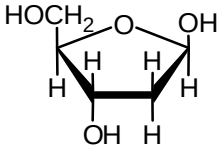
35. Which of the following is a secondary alcohol?
a) CH_3CH_2OH
b) $(CH_3)_2CHOH$
c) $(CH_3)_2CHCH_2OH$
d) $(CH_3)_3COH$

36. Which reagent can be used to distinguish between glucose and fructose?
a) $Cu(OH)_2$ b) Ag_2O c) both Ag_2O and $Cu(OH)_2$ d) Br_2-water

37. A peptide bond is formed between:
a) two molecules of α-amino acids
b) an aldehyde and an alcohol
c) a lipid and an alcohol
d) two molecules of carboxylic acids

38. Which carbohydrate can be hydrolyzed?
a) fructose b) glucose c) starch d) ribose

39. Choose the proper description of the Haworth structure shown below:



a) it is a hexose in its α-form included in RNA
b) it is a pentose in its β-form included in RNA
c) it is a pentose in its β-form included in DNA
d) it is a pentose in its α-form included in DNA

40. What class of compounds does the term "proteins" describe?
a) amides of aromatic carboxylic acids
b) large biological molecules consisting of many α-amino acid residues
c) solid triesters of long-chain carboxylic acids with glycerol
d) large biological molecules consisting of many glucose residues

Part B: Short Answer Questions

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

1. Identify the reducing and oxidizing agents in the redox reaction

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$$

reducing agent …… oxidizing agent ……

2. Write the equilibrium constant expression K_c for the process: $2CO_{2(g)} \rightleftarrows 2CO_{(g)} + O_{2(g)}$

3. Draw the condensed structural (semi-structural) formulas of the compounds propanal and propanone.

4. Complete the following equation and name the products of the reaction:

$$CH_3\text{-}CH_2\text{-}COOH + CH_3\text{-}OH \rightleftarrows$$