MEDICAL UNIVERSITY - PLEVEN, BULGARIA

CHEMISTRY EXAM Sample Test – v.3

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 two main parts of an atom are its:
   a) nucleus and electrons
   b) nucleons and protons
   c) oxidation number and valence
   d) protons and neutrons

2. Orbitals are not occupied by:
   a) 0 electrons b) 1 electron c) 2 electrons d) 3 electrons

3. Atoms of ^{16}O, ^{17}O, and ^{18}O have the same number of :
   a) protons, but a different number of electrons
   b) protons, but a different number of neutrons
   c) electrons, but a different number of protons
   d) neutrons, but a different number of protons

4. What is the Hund's Rule?
   a) The energy level of an electron is dependent on the shell
   b) Electrons fill a single orbital before moving to an empty orbital
   c) Two electrons in the same orbital must have separate spins
   d) Electrons will enter empty orbitals of the same energy level before pairing up in an orbital with an electron already present

5. Which of the following is a definition of a polar covalent bond?
   a) When two atoms share one or more electrons with each other
   b) When electrons are transferred from one atom to another
   c) When each atom has no partial charge associated with it
   d) When electrons are unequally shared between two atoms

6. Which of the following is an example of an ionic compound?
   a) NaF b) NO_2 c) CO_2 d) CH_4

7. Which of the following elements does NOT form an ion with a charge of 1^+ ?
   a) fluorine b) hydrogen c) potassium d) sodium

8. Bond energy is the energy
   a) required to break a chemical bond
   b) required to form a chemical bond
   c) released when a chemical bond breaks
   d) absorbed when a chemical bond forms

9. In what type of bonding do atoms completely give up electrons to other atoms ?
   a) polar covalent bond
   b) non-polar covalent bond
   c) ionic bond
   d) hydrogen bond

10. Which of the following statements are true regarding electronegativity ?
   a) If there is a slight difference between electronegativity between atoms then a polar covalent bond will form.
   b) If there is a large difference between electronegativity between atoms then an ionic bond will form.
   c) On the periodic table, excluding most transition metals and noble gases, as you move from left to right and from bottom to top the electronegativity increases.
   d) All of the answers are true statements.

11. Given the reaction: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
   In the above reaction copper
   a) gains protons b) loses protons c) gains electrons d) loses electrons

12. When the concentration of reactant molecules is increased, the rate of reaction increases because:
   a) the average kinetic energy of molecules increases
   b) the frequency of molecular collisions increases
   c) the rate constant increases
   d) the activation energy increases

13. A fast reaction should have
   a) low activation energy
   b) large equilibrium constant
   c) catalyst present
   d) high activation energy

14. If the concentration of hydrogen is increased twice, the rate of gaseous reaction
   $3H_2 + N_2 \rightarrow 2\,NH_3$ will speed up:
   a) 2 times b) 4 times c) 8 times d) 12 times

15. Change of which of the following conditions alters the state of equilibrium
   a) temperature
   b) pressure
   c) concentration of reactants and products
   d) all

16. Given the reaction at equilibrium: $2\,NO_{(g)} \rightleftarrows N_{2\,(g)} + O_{2\,(g)} + Q$
   Which change will shift the equilibrium to the left?
   a) increasing the volume
   b) adding a catalyst
   c) increasing the pressure
   d) increasing the temperature

17. A Brönsted-Lowry acid is a(n):
   a) proton donor
   b) electron donor
   c) proton acceptor
   d) electron acceptor

18. In an aqueous solution of 0.010 M HBr (a strong electrolyte), the pOH of the solution is:
   a) 2 b) 3 c) 7 d) 12

19. When an acid is added to water, what happens to the pH?
a) it goes up
b) it goes down
c) it stays the same
d) none of these

20. Identify the acids and the bases in the reaction: $CH_3COOH + H_2O \rightleftarrows H_3O^+ + CH_3COO^-$
a) H_2O and CH_3COOH are acids; H_3O^+ and CH_3COO^- are bases
b) H_2O and CH_3COOH are bases; H_3O^+ and CH_3COO^- are acids
c) H_2O and H_3O^+ are acids; CH_3COOH and CH_3COO^- are bases
d) H_2O and CH_3COO^- are bases; CH_3COOH and H_3O^+ are acids

21. When a double bond is formed between two atoms, one of the bonds is a sigma bond and the other is a pi bond. The pi bond is created by the overlap of :
a) sp^2 hybrid orbitals b) sp^3 hybrid orbitals c) *p* orbitals d) *s* orbitals

22. Markovnikov's rule would apply to reaction of HCl with:
a) $CH_2=CH-CH_3$ b) $CH_2=CH_2$ c) $CH_3-CH=CH-CH_3$ d) $CH_3-CH_2-CH_3$

23. The simplest member of organic compounds is
a) methanol b) methane c) formaldehyde d) formic acid

24. Calcium carbide on reaction with water gives
a) methane b) ethane c) propane d) acetylene

25. Which among the following product is formed when ethyne reacts with water?
a) formaldehyde
b) formic acid
c) acetaldehyde
d) acetic acid

26. Which is the most common product of the reaction between HBr and 1-pentene?
a) 1,2-dibromopentane
b) 2-bromopentane
c) 2,3-dibromopentane
d) 1-bromopentane

27. The correct IUPAC name for the following structure $CH_3CH_2CH_2\underset{\underset{OH}{|}}{C}HCH=CH_2$ is:
a) 5-hexen-4-ol
b) 1-hexen-3-ol
c) 4-hydroxy-5-hexene
d) 3-hydroxy-1-hexene

28. Which of the following can form metallic derivatives by the replacement of hydrogen atoms ?
a) ethylene b) acetylene c) ethane d) methane

29. What two functional groups are never found at the end of a carbon chain?
a) alcohol and aldehyde
b) ether and aldehyde
c) alcohol and ketone
d) ether and ketone

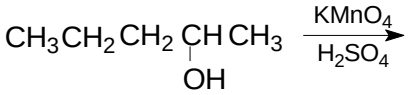
30. Which of the following is a tertiary alcohol?
a) CH_3CH_2OH
b) $(CH_3)_2CHOH$
c) $(CH_3)_2CHCH_2OH$
d) $(CH_3)_3COH$

31. Phenol on nitration with conc. HNO_3 forms:
a) 2-nitrophenol
b) 3-nitrophenol
c) 4-nitrophenol
d) 2,4,6-trinitrophenol

32. When phenol dissolves in water, it functions as
   a) a weak base
   b) a weak acid
   c) an oxidizing agent
   d) a reducing agent

33. Which of the following best describes the carbonyl group?
   a) The carbonyl group consists of a carbon atom joined to an oxygen atom by a polar double bond.
   b) The carbonyl group consists of a carbon atom joined to an oxygen atom by a double bond and to a hydrogen atom by a single bond.
   c) The carbonyl group consists of a carbon atom joined to an oxygen atom by a double bond and to a hydroxyl group by a single bond.
   d) The carbonyl group consists of a carbon atom joined to an oxygen atom by a relatively nonpolar double bond.

34. What product is formed in the following reaction?



   a) predominantly 1-pentene
   b) predominantly 2-pentene
   c) $CH_3CH_2CH_2COCH_3$
   d) $CH_3CH_2CH_2CHO$

35. Which of the following compounds will be formed by the hydrogenation of butanal ?
   a) 1-butanol b) 2-butanol c) butanoic acid d) propanone

36. Compare glycerol with ethanol
   a) they both contain 3 carbons in the skeleton
   b) they both have two hydroxyl groups
   c) glycerol is trihydric alcohol; ethanol is monohydric alcohol
   d) glycerol is a triol; ethanol is diol

37. Which of the following statements concerning standard amino acids is INCORRECT?
   a) There are about 20 of them.
   b) They are all alpha-amino acids.
   c) They may only contain one amino group and one acid group each.
   d) Some are essential amino acids, meaning they must be obtained through diet.

38. To which group carbohydrates does fructose belong?
   a) aldopentose b) ketohexose c) ketotriose d) aldohexose

39. What compounds give a positive silver mirror test?
   a) alcohols b) phenols c) aldehydes d) ketones

40. Saccharose is a disaccharide consisting of what two simple sugars?
   a) two glucose molecules
   b) one glucose molecule and one fructose molecule
   c) one glucose molecule and one galactose molecule
   d) one molecule of manose and one fructose molecule

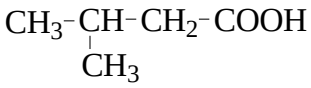
Part B: Short Answer Questions

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

1. The pH of aqueous solution is 3 at room temperature (25^oC). What is the concentration of H^+ ions?

2. Express the rate law equation for the reaction $2\,H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

3. What is the IUPAC name of the compound shown?



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4. Show the equation and name the products of the reaction between ethanoic acid and NaOH.