



# MEDICAL UNIVERSITY OF VARNA

## CHEMISTRY EXAM TEST

### Section A: Multiple-Choice Questions

1. What is the symbol for an ion which has 8 protons and 10 electrons?

- a.  $N^{3-}$
- b.  $O^{2-}$
- c.  $O^{3-}$
- d.  $F^{-}$

2. Select the formula of potassium dichromate:

- a.  $K_2Cr_2O_7$
- b.  $KCr_2O_7$
- c.  $KCr_2O_5$
- d.  $K_2Cr_2O_4$

3. What are the products of reaction  $Zn + CuSO_4 \rightarrow$  :

- a. Zinc sulfate and copper
- b. Zinc oxide and copper oxide
- c. Zinc oxide, copper oxide and sulfur dioxide
- d. Zinc oxide, copper oxide and oxygen

4. The angular (subshell) quantum number ( $l$ ) describes:

- a. The size of the orbital
- b. The shape of the orbital
- c. The orientation in space of a particular orbital
- d. The orientation in space of a particular electron

5. In a redox reaction, there must be:

- a. An oxidizing agent and no reducing agent
- b. A reducing agent and no oxidizing agent
- c. A reducing agent and an oxidizing agent
- d. No reducing or oxidizing agent

6. The electronic configuration of sulfur atom ( ${}_{16}S$ ) is:

- a.  $1s^2 2s^2 2p^6 3s^2$
- b.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- c.  $1s^2 2s^2 2p^4$
- d.  $1s^2 2s^2 2p^6 3s^2 3p^4$

7. Which element belongs to the  $p^3$  elements?

- a. B
- b. Cr
- c. Au
- d. Sb

8. What is the name of the major component of a solution?

- a. Electrolyte
- b. Solvent
- c. Ether
- d. Solute



9. Select one strong acid among the following:

- a.  $\text{CH}_3\text{COOH}$
- b.  $\text{H}_2\text{CO}_3$
- c.  $\text{NH}_4\text{OH}$
- d. No answer is correct

10. The electrons in a nonpolar covalent bond are:

- a. Gained
- b. Lost
- c. Shared equally
- d. Shared unequally

11. The concentration of  $\text{H}_3\text{O}^+$  in the aqueous solution at  $T=25^\circ\text{C}$  is  $1 \times 10^{-3} \text{ mol.l}^{-1}$ . What is the pH of this solution:

- a. 3
- b. 1
- c. 10
- d. 7

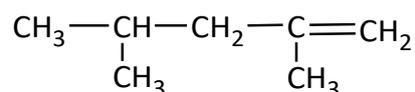
12. Which of the following is true for all equilibrium systems:

- a. The mass of reactants is equal to the mass of products
- b. Addition of a catalyst changes the equilibrium concentrations
- c. The concentration of reactants is equal to the concentration of products
- d. The rate of the forward reaction is equal to the rate of the reverse reaction

13. Alkenes have the general formula:

- a.  $\text{C}_n\text{H}_{2n}$
- b.  $\text{C}_n\text{H}_{2n-2}$
- c.  $\text{C}_n\text{H}_n$
- d.  $\text{C}_{2n}\text{H}_n$

14. What is the name of the compound below:



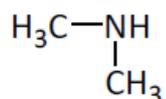
- a. 2,4-methylbutene
- b. 2,5-dimethylpentane
- c. 2,4-dimethyl-1-pentene
- d. 2,4-dimethyl-4-pentene

15. The addition of HBr to 2-butene produces:

- a. 1-bromobutane
- b. 2-bromobutane
- c. 1,2-dibromobutane
- d. 2,3-dibromobutane



16. The given compound is:



- a. Primary amine
- b. Secondary amine
- c. Tertiary amine
- d. Quaternary amine

17. What are the products when benzene is burnt in a plentiful supply of oxygen:

- a. Carbon dioxide only
- b. Hydrogen sulphide
- c. Carbon dioxide and water
- d. Carbon monoxide and carbon

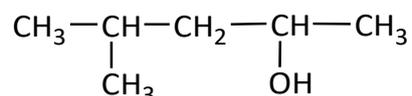
18. Find the compound containing primary alcohol group:

- a. Pentane-1-ol
- b. Cyclohexanol
- c. 3-methyl-pentane-3-ol
- d. Glycerol

19. Which of the following organic compounds is very likely to form hydrogen bonds:

- a. Alkanes
- b. Ethers
- c. Alkenes
- d. Alcohols

20. What is the IUPAC name of the compound shown:



- a. 2,2-dimethyl-4-butanol
- b. 4-methyl-2-pentanol
- c. 2-methyl-4-pentanol
- d. 2-isohexanol

21. All of the following properties of alcohols are affected by hydrogen bonding except:

- a. Boiling point
- b. Molecular weight
- c. Miscibility with water
- d. Ability to dissolve polar substances

22. Which of the following represent a polyalcohol?

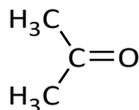
- a.  $\text{C}_3\text{H}_5(\text{OH})_3$
- b.  $\text{C}_3\text{H}_7\text{OH}$
- c.  $\text{C}_6\text{H}_5\text{OH}$
- d. None of the above



23. Which of the following compounds will be formed by the hydrogenation of butanal:

- a. 2- butanol
- b. Butanoic acid
- c. 1-butanol
- d. Propanoic acid

24. Select the type of the following compound:



- a. Aldehyde
- b. Ester
- c. Ether
- d. No answer is correct

25. Which of the following substance will oxidize acetone?

- a. Fehling reagent
- b. Tollen's reagent
- c. Bromine water
- d.  $\text{K}_2\text{Cr}_2\text{O}_7$

26. Ethanal is prepared by oxidation of:

- a. Ethanol
- b. Acetaldehyde
- c. Propan-1-ol
- d. Propan-2-ol

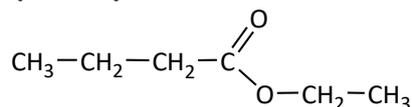
27. Which of the following dissociation reactions is true:

- a.  $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3^+ + \text{COOH}^-$
- b.  $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{CO}^+ + \text{OH}^-$
- c.  $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^+ + \text{H}^-$
- d.  $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$

28. Which of the following reactions is not a standard means of synthesizing carboxylic acids?

- a. Oxidation of primary alcohols
- b. Oxidation of aldehydes
- c. Hydrolysis of nitriles
- d. None of the above

29. The following compound was prepared by reaction of:



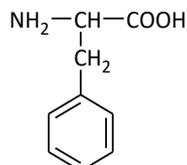
- a. Butanoic acid and ethanol
- b. Formic acid and butanol
- c. Acetic acid and butanol
- d. Butanoic acid and propanol



**30. Carboxylic acids boil at considerably higher temperatures than do ketones and aldehydes of similar molecular weights. This is because they:**

- a. Form stable hydrogen bond
- b. Are hydrophobic
- c. Are more acidic
- d. Have a greater oxygen content

**31. Give the correct common name of the standard amino acid whose structural formula is:**



- a. Glycine
- b. Serine
- c. Phenylalanine
- d. Cysteine

**32. The peptide bond is formed by reaction between:**

- a. Two carboxylic groups
- b. Hydroxylic group and carboxylic group
- c. Amino group and carboxylic group
- d. No answer is correct

**33. Carbohydrates may contain the functional groups:**

- a. Of an aldehyde
- b. Of a ketone
- c. Hydroxyl groups
- d. All of the above

**34. An example of a hexose is:**

- a. Sucrose
- b. Lactose
- c. Starch
- d. Glucose

**35. The disaccharide sucrose is composed of the monosaccharides:**

- a. Glucose and glucose
- b. Fructose and fructose
- c. Glucose and fructose
- d. None of the above

### Section B: Gap Filling Questions

1. Amino acids are linked together by a(n) \_\_\_\_\_ bond, created when the carboxylic acid group of one amino acid reacts with the amine group of another amino acid to form a(n) \_\_\_\_\_ functional group. Condensation is a chemical reaction in which two substances combine to form a larger molecule with the release of a small molecule, such as \_\_\_\_\_. Protein molecules are described in terms of their primary, \_\_\_\_\_ and tertiary structures.



2. Rate of reaction is the change in \_\_\_\_\_ of a reactant or product per time unit. For a chemical reaction:



the rate equation or rate law is given by: \_\_\_\_\_. Main factors that affect the reaction rate are concentration and temperature. The higher the reactants' concentration, the \_\_\_\_\_ the reaction rate. Usually, an increase in temperature is accompanied by \_\_\_\_\_ in the reaction rate.

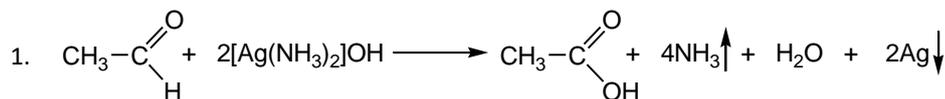
### Section C: Matching Questions

1.

1. Na<sub>2</sub>S
2. O<sub>2</sub>
3. Br<sub>2</sub>
4. NH<sub>3</sub>
5. SO<sub>2</sub>

- a. Covalent polar bond, double bond
- b. Covalent nonpolar bond, single bond
- c. Covalent nonpolar bond, double bond
- d. Covalent polar bond, single bond
- e. Ionic bond

2.



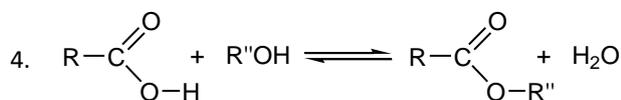
a. Esterification reaction



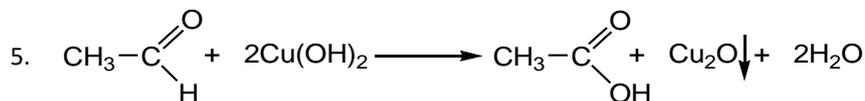
b. Photosynthesis



c. Wohler reaction



d. Fehling's solution test



e. Silver mirror test

### Section D: True/False Questions

1. The rate constant is the rate of reaction at constant temperature.
2. CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub> is the formula for a saturated hydrocarbon.

### Section E: Definitions and Explanations

1. Define electrolytic dissociation. Explain the difference between weak and strong electrolytes. Give two examples of each.
2. Give a definition for **esterification**. Explain chemical conditions and present an example with chemical equation.