

**4****WRITTEN TEST****Test Booklet No.****CHEMISTRY**

Name of Applicant ..... Answer Sheet No. ....

Application ID : ..... Signature of Applicant : .....

Date of Examination: .....

Signature of the Invigilator(s)

1. ....

Time of Examination : .....

2. ....

**Duration : 1 Hour]****[Maximum Marks : 50****IMPORTANT INSTRUCTIONS**

- (i) The question paper is in the form of Test-Booklet containing **50 (Fifty)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct.
- (ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **50** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- (iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **50** rows containing four circles each. One row pertains to one question.
- (iv) The candidate should write his/her Application number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and **NOWHERE ELSE**.
- (v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.
- (vi) For every correct answer of the question **One (1) mark will be awarded**. For every unattempted question, Zero (0) mark shall be awarded. **There is no Negative Marking**.
- (vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.
- (viii) To mark the answer on the Answer-Sheet, candidate should **darken** the appropriate circle in the row of each question with Blue or Black pen.
- (ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the question will be treated as cancelled.
- (x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.
- (xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.
- (xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*
- (xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

**DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.**



1. Which of the following reagents is commonly used for the conversion of an alkene into a cyclic ether?
- (A) Lithium aluminium hydride  
(B) Borane-methyl sulphide complex  
(C) Hydrogen peroxide  
(D) Epoxide ring-opening catalyst
2. Which of the following functional groups is typically not compatible with common reducing agents such as lithium aluminium hydride ( $\text{LiAlH}_4$ )?
- (A) Esters  
(B) Ketones  
(C) Aldehydes  
(D) Amides
3. Which of the following methods is most commonly used for the introduction of a fluorine atom into an organic molecule?
- (A) Electrophilic aromatic substitution  
(B) Nucleophilic substitution  
(C) Friedel-Crafts acylation  
(D) Nucleophilic addition
4. Which of the following is an example of a protecting group commonly used for the protection of alcohols?
- (A) Acetyl  
(B) Benzyl  
(C) Tosyl  
(D) All of the above
5. Which of the following is an example of a commonly used chiral auxiliary in asymmetric synthesis?
- (A) Toluene  
(B) Tartaric acid  
(C) Triethylamine  
(D) Thionyl chloride
6. Which of the following reagents is commonly used for the conversion of an aldehyde or ketone into its corresponding enol or enolate?
- (A) Lithium aluminium hydride  
(B) Sodium borohydride  
(C) Grignard reagent  
(D) Strong base, such as LDA (lithium diisopropylamide)

7. Which of the following techniques is commonly used for the separation and purification of organic compounds based on their boiling points?
- (A) Thin-layer chromatography
  - (B) Gas chromatography
  - (C) High-performance liquid chromatography
  - (D) Distillation
8. Which of the following reactions is an example of a metal-catalysed cross-coupling reaction?
- (A) Diels-Alder reaction
  - (B) Fischer esterification
  - (C) Heck reaction
  - (D) Friedel-Crafts alkylation
9. Which of the following protecting groups is commonly used for the protection of amines?
- (A) Methoxy
  - (B) Benzyl
  - (C) Acetyl
  - (D) Triethyl silyl
10. Which of the following reagents is commonly used for the conversion of an alcohol into an alkyl halide?
- (A) Sodium borohydride
  - (B) Thionyl chloride
  - (C) Lithium aluminium hydride
  - (D) Sodium hydroxide
11. Which of the following compounds is an example of an ester?
- (A) Methanol
  - (B) Ethanol
  - (C) Ethanoic acid
  - (D) Ethyl acetate
12. Which of the following is a characteristic feature of alkenes?
- (A) Presence of a double bond
  - (B) High boiling point
  - (C) Strong acidity
  - (D) Non-polar nature

13. What is the product formed when an alcohol reacts with a carboxylic acid in the presence of an acid catalyst?
- (A) Ester  
(B) Amine  
(C) Aldehyde  
(D) Ketone
14. Which of the following is an example of a secondary alcohol?
- (A) Methanol  
(B) Ethanol  
(C) Propanol  
(D) Isopropyl alcohol
15. What is the correct IUPAC name for the compound with the following structure:  
 $\text{BrCH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{Br}$ ?
- (A) 1,3-Dibromobutane  
(B) 2,4-Dibromopentane  
(C) 2,3-Dibromobutane  
(D) 3,4-Dibromopentane
16. Which of the following compounds is an example of a tertiary alcohol?
- (A) Ethanol  
(B) Propanol  
(C) Butanol  
(D) 2-Methyl-2-propanol
17. Which of the following reagents is commonly used for the reduction of ketones to secondary alcohols?
- (A) Sodium borohydride ( $\text{NaBH}_4$ )  
(B) Lithium aluminum hydride ( $\text{LiAlH}_4$ )  
(C) Sodium cyanoborohydride ( $\text{NaBH}_3\text{CN}$ )  
(D) Potassium borohydride ( $\text{KBH}_4$ )
18. Which of the following functional groups is present in aspirin?
- (A) Carboxylic acid  
(B) Ester  
(C) Ketone  
(D) Aldehyde

19. Which of the following reactions is an example of a nucleophilic substitution reaction?
- (A) Esterification
  - (B) Hydrogenation
  - (C) E1 elimination
  - (D)  $\text{SN}_2$  reaction
20. Which of the following compounds has the highest oxidation state for the central metal atom?
- (A)  $\text{FeCl}_2$
  - (B)  $\text{MnO}_2$
  - (C)  $\text{CrCl}_3$
  - (D)  $\text{CoF}_2$
21. The coordination number of a metal in a square planar complex is:
- (A) 4
  - (B) 5
  - (C) 6
  - (D) 8
22. The type of isomerism exhibited by the complex  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  is:
- (A) Linkage isomerism
  - (B) Coordination isomerism
  - (C) Ionization isomerism
  - (D) Geometric isomerism
23. The compound  $\text{XeF}_4$  exhibits which of the following geometries?
- (A) Square planar
  - (B) Trigonal pyramidal
  - (C) Tetrahedral
  - (D) Octahedral
24. Which of the following is an example of a chelating ligand?
- (A)  $\text{NH}_3$
  - (B)  $\text{Cl}^-$
  - (C)  $\text{H}_2\text{O}$
  - (D) EDTA

25. The correct order of increasing basicity among the following compounds is:
- (A)  $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3$
- (B)  $\text{NH}_3 < \text{AsH}_3 < \text{PH}_3 < \text{SbH}_3$
- (C)  $\text{AsH}_3 < \text{NH}_3 < \text{PH}_3 < \text{SbH}_3$
- (D)  $\text{SbH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{NH}_3$
26. Which of the following oxides is amphoteric in nature?
- (A)  $\text{CO}_2$
- (B)  $\text{SO}_2$
- (C)  $\text{Al}_2\text{O}_3$
- (D)  $\text{Na}_2\text{O}$
27. The coordination number of the metal in the complex  $[\text{Ni}(\text{CO})_4]$  is:
- (A) 4
- (B) 5
- (C) 6
- (D) 8
28. The compound  $\text{KMnO}_4$  is used as an oxidizing agent in acidic medium. The oxidation state of manganese in  $\text{KMnO}_4$  is:
- (A) +2
- (B) +3
- (C) +4
- (D) +7
29. Which of the following elements is commonly used as a catalyst in Haber's process for the synthesis of ammonia?
- (A) Iron
- (B) Platinum
- (C) Copper
- (D) Nickel
30. Which of the following elements is considered a soft acid?
- (A) Sodium (Na)
- (B) Aluminum (Al)
- (C) Oxygen (O)
- (D) Mercury (Hg)

- 31.** Which of the following elements is considered a hard base?
- (A) Sodium (Na)
  - (B) Oxygen (O)
  - (C) Bromine (Br)
  - (D) Iodine (I)
- 32.** The reaction between a soft acid and a hard base is often characterized by:
- (A) Covalent bonding
  - (B) Ionic bonding
  - (C) Metallic bonding
  - (D) Hydrogen bonding
- 33.** Which of the following is an example of a redox reaction?
- (A) Dissolution of sugar in water
  - (B) Combustion of methane
  - (C) Acid-base neutralization reaction
  - (D) Hydrolysis of a salt
- 34.** The oxidation state of an atom in a compound is a measure of:
- (A) The number of electrons gained by the atom
  - (B) The number of electrons lost by the atom
  - (C) The electronegativity of the atom
  - (D) The coordination number of the atom
- 35.** Metalloenzymes are enzymes that contain:
- (A) Organic compounds
  - (B) Transition metals
  - (C) Noble gases
  - (D) Alkali metals
- 36.** The unique properties of silicones, such as heat resistance and flexibility, are due to:
- (A) Carbon-carbon double bonds
  - (B) Carbon-silicon bonds
  - (C) Silicon-silicon bonds
  - (D) Oxygen-silicon bonds

37. Which of the following is an example of an extensive property?
- (A) Temperature
  - (B) Pressure
  - (C) Volume
  - (D) Specific heat
38. The rate constant of a first-order reaction is  $0.05 \text{ s}^{-1}$ . The time required for 75% completion of the reaction is:
- (A) 6.9 s
  - (B) 9.2 s
  - (C) 13.8 s
  - (D) 23.0 s
39. The standard cell potential ( $E^\circ$ ) of a galvanic cell is +0.80 V. The value of  $\Delta G^\circ$  for the cell reaction is:
- (A) -0.80 J
  - (B) +0.80 J
  - (C) -96.48 kJ
  - (D) +96.48 kJ
40. Which of the following statements is true for an exothermic reaction?
- (A)  $\Delta H > 0$
  - (B)  $\Delta H < 0$
  - (C)  $\Delta G > 0$
  - (D)  $\Delta G < 0$
41. According to the kinetic theory of gases, the average kinetic energy of gas molecules is directly proportional to:
- (A) Pressure
  - (B) Temperature
  - (C) Volume
  - (D) Molar mass
42. The Van der Waals equation corrects for the deviations from ideal behavior by considering:
- (A) Intermolecular forces
  - (B) Temperature only
  - (C) Pressure only
  - (D) Volume only
43. Which of the following statements is true for a spontaneous process?
- (A)  $\Delta S < 0$
  - (B)  $\Delta G > 0$
  - (C)  $\Delta H > 0$
  - (D)  $\Delta E < 0$
44. The freezing point of a solution is always \_\_\_\_\_ than the freezing point of the pure solvent.
- (A) Higher
  - (B) Lower
  - (C) The same
  - (D) Unpredictable

45. According to the Nernst equation, the cell potential (E) is related to the standard cell potential ( $E^\circ$ ) by:
- (A)  $E = E^\circ/nF$   
 (B)  $E = E^\circ - RT/nF$   
 (C)  $E = E^\circ - 0.0592/n \log Q$   
 (D)  $E = E^\circ + 0.0592/n \log Q$
46. The rate of a chemical reaction is determined by the:
- (A) Concentration of reactants  
 (B) Activation energy  
 (C) Temperature  
 (D) All of the above
47. Which of the following statements is true for an isothermal process?
- (A)  $\Delta H = 0$   
 (B)  $\Delta S = 0$   
 (C)  $\Delta G = 0$   
 (D)  $\Delta E = 0$
48. According to the Arrhenius equation, if the temperature of a reaction is increased by a factor of 2, the rate constant will:
- (A) Decrease by a factor of 2  
 (B) Increase by a factor of 2  
 (C) Increase by a factor of 4  
 (D) Increase by a factor of 8
49. The slope of the Arrhenius plot ( $\ln k$  vs.  $1/T$ ) is equal to:
- (A) Activation energy ( $E_a$ )  
 (B) Frequency factor (A)  
 (C) Gas constant (R)  
 (D) Temperature (T)
50. Which of the following equations describes the wave-particle duality of matter?
- (A) Schrödinger equation  
 (B) Bohr equation  
 (C) Planck's equation  
 (D) de Broglie equation

## ROUGH WORK

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