

NAME:

ROLL NO.

PRE-BOARD (2023-24)
XII - CHEMISTRY THEORY (043) – SET B

Max. Marks: 70

Time: 3 hours

General Instructions:

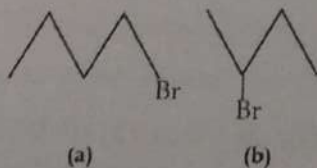
Read the following instructions carefully.

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case-based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed.

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

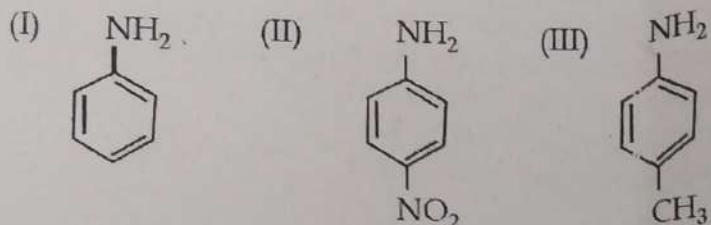
- The charge required for reduction of 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ ions to Cr^{3+} is-
 - 96500 C
 - 2×96500 C
 - 6×96500 C
 - 4×96500 C
- Which of the following compounds is formed when benzyl alcohol is oxidised with KMnO_4 ?
 - CO_2 and H_2O
 - Benzoic acid
 - Benzaldehyde
 - Benzophenone
- Nucleotides are joined together by
 - peptide linkage
 - disulphide linkage
 - glycosidic linkage
 - phosphodiester linkage
- Which alkyl halide from the following pair is chiral and undergoes faster $\text{S}_{\text{N}}2$ reaction?



- a is chiral and b undergoes faster $\text{S}_{\text{N}}2$ reaction
- a is chiral and undergoes faster $\text{S}_{\text{N}}2$ reaction
- b is chiral and undergoes faster $\text{S}_{\text{N}}2$ reaction

5. The correct order of increasing acidic strength is:
- Phenol < Ethanol < Chloroacetic acid < Acetic acid
 - Ethanol < Phenol < Chloroacetic acid < Acetic acid
 - Ethanol < Phenol < Acetic acid < Chloroacetic acid
 - Chloroacetic acid < Acetic acid < Phenol < Ethanol

6. The correct increasing order of basic strength for the following compounds is _____



- II < III < I
- III < I < II
- III < II < I
- II < I < III

7. Which of the following statement is correct?

- The rate of a reaction decreases with passage of time as the concentration of reactants decreases.
- The rate of a reaction is same at any time during the reaction.
- The rate of a reaction is independent of temperature change.
- The rate of a reaction decreases with increase in concentration of reactant(s).

8. Which set of ions exhibit specific colours? (Atomic number of Sc = 21, Ti = 22, V = 23, Mn = 25, Fe = 26, Ni = 28, Cu = 29 and Zn = 30)

- Sc³⁺, Ti⁴⁺, Mn³⁺
- Sc³⁺, Zn²⁺, Ni²⁺
- V³⁺, V²⁺, Fe³⁺
- Ti³⁺, Ti⁴⁺, Ni²⁺

9. Phenol is less acidic than _____.

- ethanol
- o-nitrophenol
- o-methylphenol
- o-methoxyphenol.

10. For the reaction $A \rightarrow B$, the rate of reaction becomes three times when the concentration of A is increased by nine times. What is the order of reaction?

- 1
- 2

- c. 1/2
- d. 0

11. Monochlorination of toluene in sunlight followed by hydrolysis with aq. NaOH yields.

- a. o-Cresol
- b. m-Cresol
- c. 2, 4-Dihydroxytoluene
- d. Benzyl alcohol

12. Which of the following statements is not correct?

- a. La is actually transition element.
- b. In Lanthanide series, ionic radii decrease from La^{3+} to Lu^{3+} .
- c. $\text{La}(\text{OH})_3$ is less basic than $\text{Lu}(\text{OH})_3$.
- d. Ionic radii of Zr and Hf are almost similar due to Lanthanoid contraction.

13. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A) : Ortho-and para-nitrophenol can be separated by using steam distillation.

Reason (R): Ortho-isomer associates through intermolecular hydrogen bonding while para isomer associates through intramolecular hydrogen bonding

Select the most appropriate answer from the options given below:

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are true but R is not the correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

14. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A) : Aromatic aldehydes and formaldehyde undergo Cannizzaro reaction.

Reason(R) : Aromatic aldehydes are almost as reactive as formaldehyde.

Select the most appropriate answer from the options given below:

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are true but R is not the correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion :- The two strands of DNA are complementary to each other.

Reason :- The hydrogen bonds are formed between specific pairs of bases.

Select the most appropriate answer from the options given below:

- a. Both A and R are true and R is the correct explanation of A
- b. Both A and R are true but R is not the correct explanation of A.
- c. A is true but R is false.
- d. A is false but R is true.

16. Given below are two statements labelled as Assertion (A) and Reason (R)
Assertion (A): Conductivity of an electrolyte depends upon the size of the ions produced and their solvation

Reason (R): Conductivity of an electrolyte does not depend upon temperature

Select the most appropriate answer from the options given below:

- Both A and R are true and R is the correct explanation of A
- Both A and R are true but R is not the correct explanation of A
- A is true but R is false.
- A is false but R is true.

SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. A first order reaction takes 10 minutes for 25% decomposition. Calculate $t_{1/2}$ for the reaction. (Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 4 = 0.6021$).

18. A 1.00 molar aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.18°C . Determine the van't Hoff factor for trichloroacetic acid. (K_b for water = $0.512 \text{ K kg mol}^{-1}$).

19. Carry out the following conversions in not more than 2 steps:

a. Aniline to chlorobenzene

b. 2-Bromopropane to 1-Bromopropane

20. a. Out of p-tolualdehyde and p-nitrobenzaldehyde, which one is more reactive towards nucleophilic addition reactions, why?

b. Write the structure of the product formed when acetone reacts with 2,4 DNP reagent.

OR

Convert the following:

a. Benzene to m-nitrobenzaldehyde

b. Bromobenzene to benzoic acid

21. Differentiate between following:

a. α -helical and β -pleated sheet structure of protein

b. DNA and RNA

SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. a. Using crystal field theory, write the electronic configuration of iron ion in the following complex ion. Also predict its magnetic behaviour: $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

b. Write the IUPAC name of the coordination complex: $[\text{CoCl}_2(\text{en})_2]\text{NO}_3$.

c. What will be the correct sequence of absorption of wavelength of light in the visible region for the complexes. $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{CN})_6]^{3-}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

23. a. Give a simple chemical test to distinguish between the pair of organic compounds:

Ethanal and Propanal

b. Write the reactions involved in the following

- (i) Etard reaction
- (ii) Stephen reduction

24. How will you bring about following conversions:

- a. Chlorobenzene to phenol
- b. Cumene to phenol
- c. Phenol to benzoquinone

OR

- a. Methyl magnesium bromide to 2-Methylpropan-2-ol
- b. Bromo methane to propan-2-ol
- c. Chloro ethane to propan-1-ol

25. The rate constant for the first order decomposition of H_2O_2 is given by the following equation:

$$\log k = 14.2 - \frac{1.0 \times 10^4}{T} \text{ K} ;$$

Calculate E_a for this reaction and rate constant k if its half-life period be 200 min.

(Given: $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$).

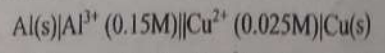
26. What information do we get when D-glucose reacts with following reagent, write the reaction also

- a. Hydroxylamine
- b. acetic anhydride
- c. nitric acid

27. What happens when:

- a. $\text{CH}_3\text{-Cl}$ is treated with aqueous KOH ?
- b. $\text{CH}_3\text{-Cl}$ is treated with KCN ?
- c. $\text{CH}_3\text{-Br}$ is treated with Mg in the presence of dry ether ?

28. Calculate the emf of the following cell at 298 K:



(Given $E^\circ(\text{Al}^{3+}/\text{Al}) = -1.66 \text{ V}$, $E^\circ(\text{Cu}^{2+}/\text{Cu}) = 0.34\text{V}$, $\log 0.15 = -0.8239$, $\log 0.025 = -1.6020$)

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. Neutral molecule which bound to the metal ion by secondary valency is called as ligand. In complex, metal ion acts as Lewis acid and ligand act as Lewis base. Ligands are classified according to number of electron pair in them. The ligand which can donate one e pair to the metal atom is called Unidentate ligand. The ligand which can donate two electron pair to the metal ion is called didentate ligand. The ligand in which two or more coordination sites are there is called polydentate ligand. Polydentate ligand forms cyclic structure with metal ion and form Chelate.

Answer the following questions:

- a. Which of the following is more stable complex and why?
 $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Co}(\text{en})_3]^{3+}$

- b. How is a double salt different from a complex?

- c. Write the IUPAC name of the ionisation isomer of the coordination compound $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$. Give one chemical test to distinguish between the two compounds.

OR

- c. Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.

30. The cell constant is usually determined by measuring the resistance of the cell containing a solution whose conductivity is already known. For this purpose, we generally use KCl solutions whose conductivity is known accurately at various concentrations and at different temperatures. Consider the resistance of a conductivity cell filled with 0.1 M KCl solution is 200 W. If the resistance of the same cell when filled with 0.02 M KCl solution is 420 W.

- a. State the relation between cell constant, resistance of the solution in the cell and the conductivity of the solution.
b. How is cell constant determined experimentally?
c. What is the conductivity of 0.02 M KCl solution and what is the SI unit for conductivity of a solution?

OR

- c. Define conductance and conductivity

SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. Explain the following: (Attempt any five)

- a. Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.
b. E° value for $(\text{Mn}^{2+}/\text{Mn})$ is negative whereas for $(\text{Cu}^{2+}/\text{Cu})$ is positive.
c. Cr^{2+} is a stronger reducing agent than Fe^{2+} in aqueous solution

- d. E° value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+} .
- e. Iron has higher enthalpy of atomisation than that of copper.
- f. Copper atom has completely filled d orbitals ($3d^{10}$) in its ground state, yet it is regarded as a transition element.
- g. Write the ionic equation for reaction of KI with acidified $KMnO_4$.

32.

- a. What is the effect of temperature on the solubility of glucose in water?
- b. Ibrahim collected a 10mL each of fresh water and ocean water. He observed that one sample labeled "P" froze at $0^\circ C$ while the other "Q" at $-1.30^\circ C$. Ibrahim forgot which of the two, "P" or "Q" was ocean water. Help him identify which container contains ocean water, giving rationalization for your answer.
- c. Calculate Van't Hoff factor for an aqueous solution of $K_3[Fe(CN)_6]$ if the degree of dissociation (α) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ($K_b = 0.52 \text{ K kg/mol}$)

OR

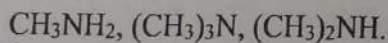
- a. What type of deviation from Raoult's Law is expected when phenol and aniline are mixed with each other? What change in the net volume of the mixture is expected? Graphically represent the deviation.
- b. The vapour pressure of pure water at a certain temperature is 23.80 mm Hg. If 1 mole of a non-volatile non-electrolytic solute is dissolved in 100g water, Calculate the resultant vapour pressure of the solution.

33.

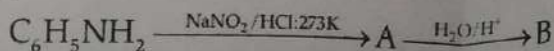
- a. Arrange the following in increasing order of property specified:
- Aniline, ethanamine, 2-Ethylethanamine (solubility in water)
 - Ethanoic acid, ethanamine, ethanol (boiling point)
 - Methanamine, N, N-Dimethylmethanamine and N-Methylmethanamine (basic strength in aqueous phase)
- b. Give a chemical test to distinguish between N-Methylethanamine and N,N-Dimethylethanamine.
- c. Write the reaction for catalytic reduction of nitrobenzene followed by reaction of product so formed with bromine water.

OR

- a. Arrange the following compounds in the increasing order of their basic strength in aqueous solution:



- b. Identify 'A' and 'B':



- c. Aniline does not undergo Friedel-Crafts reaction. Give reason.
- d. Aromatic primary amines cannot be prepared by Gabriel's phthalimide synthesis
- e. convert the following: Ethanoic acid into methanamine.