Subani XII-A

GURU HARKRISHAN PUBLIC SCHOOL

(Running under the aegis of GHPS Society)

Half Yearly Examination /Term. I

SESSION (2024-25)

SUBJECT-CHEMISTRY

CLASS-XII

TIME: 3 Hrs. **M.M.:70**

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and follow them:

(i) This question paper contains **33** questions. **All** questions are compulsory.
(ii) Question paper is divided into **FIVE** sections – Section **A, B, C, D** and **E**.
(iii) In **Section A**: Question number **1** to **16** are Multiple Choice (MCQ) type questions carrying **1** mark each.
(iv) In **Section B**: Question number **17** to **21** are Very Short Answer (VSA) type questions carrying **2** marks each.
(v) In **Section C**: Question number **22** to **28** are Short Answer (SA) type questions carrying **3** marks each.
(vi) In **Section D**: Question number **29&30** are case based questions carrying **4** marks each.
(vii) In **Section E**: Question number **31** to **33** are long answer type questions carrying **5** marks each.
(viii) There is no overall choice. However, an internal choice has been provided in few questions in all the sections except SECTION A
(ix) Use of calculators is NOT allowed

SECTION – A

1. Which one of the following pairs will form an ideal solution?
(a) Bromoethane and Carbon disulphide
(b) Phenol and Acetone
(c) Ethanol and Acetone
(d) Benzene and Toluene

2. Auto – oxidation of chloroform in air and light produces a poisonous gas known as:
(a) Phosphine
(b) Mustard gas
(c) Phosgene
(d) Tear gas

3. An electrochemical cell can behave like an electrolyte cell when _____

(a) $E_{cell} = 0$

(b) $E_{cell} > E_{ext}$

(c) $E_{ext} > E_{cell}$

(d) $E_{cell} = E_{ext}$

4. The rate constant for first order reaction whose half-life is 480 sec is

(a) $2.88 \times 10^{-3} s^{-1}$

(b) $2.72 \times 10^{-2} s^{-1}$

(c) $1.44 \times 10^{-3} s^{-1}$

(d) $1.44\ s^{-1}$

5. The electronic configuration of Cu(II) is $3d^9$ whereas that of Cu(I) is $3d^{10}$. Which of the following is correct for aqueous solution of copper ions.

(a) Cu(II) is more stable

(b) Cu(II) is less stable

(c) Cu(I) and Cu(II) are equally stable

(d) Stability of Cu(I) and Cu(II) depends on nature of copper salts.

6. The molar ionic conductivities of Ca^{2+} and Cl^- are 119.0 and 76.3 Scm^2mol^{-1} respectively. The value of limiting molar conductivity of $CaCl_2$ will be:

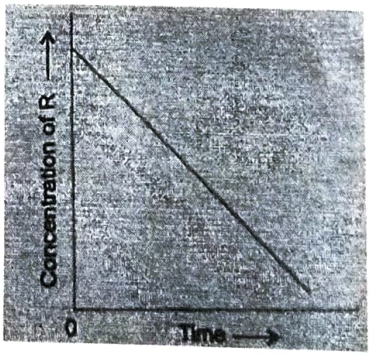
(a) 195.3 Scm^2mol^{-1}

(b) 43.3 Scm^2mol^{-1}

(c) 314.3 Scm^2mol^{-1}

(d) 271.6 Scm^2mol^{-1}

7. In a given graph of zero order reaction, the slope and intercept are:



(a) Slope = k, Intercept = $[R]_0$

(b) Slope = - k, Intercept = $[R]_0$

(c) Slope = $\frac{k}{2.303}$, Intercept = In $[R]_0$

(d) Slope = $\frac{-k}{2.303}$, Intercept = In A

An azeotropic solution of two liquids has a boiling point higher than either of the two when it:

(a) Shows a negative deviation from Raoult's law.
(b) Shows a positive deviation from Raoult's law.
(c) Is saturated.
(d) Shows no deviation from Raoult's law.

9. The units of rate and rate constant of a reaction are the same for
(a) First order reaction
(b) Second order reaction
(c) Zero order reaction
(d) Third order reaction

10. A fuel cell is used to convert chemical energy into
(a) Mechanical energy
(b) Solar energy
(c) Electrical energy
(d) Potential energy

11. Which of the following is NOT a colligative property
(a) Osmotic pressure
(b) Depression in freezing point
(c) Lowering of vapour pressure
(d) Depression in boiling point

12. Artificial radioactive decay takes place through
(a) First order reaction
(b) Second order reaction
(c) Zero order reaction
(d) Third order reaction

Assertion & Reasoning

In the following questions (Q16 toQ20) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Assertion and reason both are correct statements, and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion.
(c) Assertion is correct statement, but reason is wrong statement.
(d) Assertion is wrong statement but reason is correct statement.

13. Assertion: The half-life of a zero-order reaction gets doubled when concentration of the reactants are doubled.
Reason: For a zero-order reaction its rate is independent of the initial concentration of reactants.

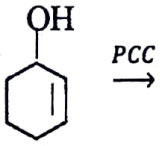
14. Assertion: When aqueous sodium chloride solution is electrolysed, chlorine gas is produced at the anode.
Reason: It is due to the overpotential for oxidation of water to oxygen.

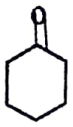
15. Assertion: Molar mass of acetic acid in benzene calculated using colligative property is almost double the actual value.
Reason: Acetic acid dimerises in solution.

16. Assertion: The vapour phase is always richer in the component which is less volatile.
Reason: The relative lowering of the vapour pressure of a solution is proportional to mole fraction of the solute.

SECTION – B

17. Write the product of the following reactions

(a)  $\xrightarrow{PCC}$

(b)  $+ CH_3MgBr \xrightarrow{H_3O^+}$ (1x2)

18. Haloarenes are less reactive than haloalkanes towards nucleophilic substitution reaction. Explain why? (2)

19. The rate of the chemical reaction doubles for an increase of 10K in absolute temperature from 298K. Calculate E_a. (log2 = 0.3010) (2)

20. In a reaction if the concentration of reactant 'A' is tripled, the rate of reaction becomes twenty seven times. What is the order of the reaction? (2)

21. 18g of glucose is dissolved in 1kg of water in a saucepan. At what temperature will water boil under 1.013 bar pressure. (K_b of water = 0.52kkgmol^{-1}) (2)

OR

Explain the following phenomena with the help of Henry's law

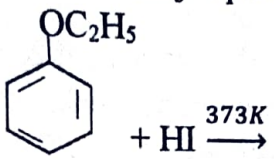
(i) Painful conditions known as bends.

(ii) Feeling of weakness and discomfort in breathing at high altitude. (1x2)

SECTION -C

22. (a) Give reason why n-butylbromide has higher boiling point than tert-butyl bromide?

(b) Write the major product:



(c) Write the structure of 3-bromo-2-methylprop-1-ene. (1x3)

23. Calculate the mass of Ag deposited at cathode when a current of 2A was passed through a solution of $AgNO_3$ for 15 minutes.
Molar mass of Ag = $108 gmol^{-1}$, F = $96500 Cmol^{-1}$ (3)

24. In the given reaction $A + 3B \rightarrow 2C$ the rate of formation of 'C' is $2.5 \times 10^{-4} molL^{-1}s^{-1}$. Calculate the (a) rate of reaction, (b) rate of disappearance of B. (3)

25. Complete the following equation:

(a) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$

(b) $Cr_2O_7^{2-} + 14H^+ + 6I^- \xrightarrow{\Delta}$

(c) $MnO_4^- + 5NO_2^- + 6H^+ \rightarrow$ (1x3)

26. Give reason:

(a) p-dichlorobenzene has higher melting point than those of ortho and meta isomer.

(b) C – Cl bond length in chlorobenzene is shorter than C – Cl bond length in CH_3-Cl.

(c) SN^1 reaction are accomplished by racemization in optically active alkyl halides.(1x3)

27. Write all steps to show mechanism of hydration of alkene to form alcohol. (3)

OR

Convert:

(a) Cumene to Phenol

(b) Phenol to 4-bromophenol

(c) Phenol to Benzene (3)

28. Write chemical equations for the following reactions: (Do any three)

(a) Hydroboration – Oxidation Reaction (b) Williamson Synthesis

(c) Friedel – Crafts Alkylation of Anisole (d) Reimer -Tiemann Reaction (1x3)

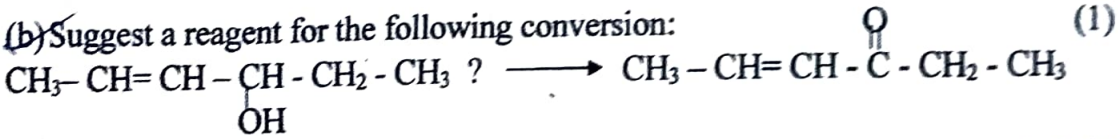
Case study

29. **Read the passage given below and answer the following questions:**

Alcohols can be oxidized by oxidizing agents such as chromate and dichromate ions (these contain chromium in +6 oxidation state). A primary alcohol is oxidized to an aldehyde and then oxidizing further to a carboxylic acid. In the process of oxidation, the orange chromate solution is reduced to a green solution containing chromium in the +3 oxidation state. During this oxidation, hydrogen atoms are removed from the alcohol (one hydrogen is removed from the - OH group). Tertiary alcohols cannot be oxidized because there is no hydrogen atom attached to the alcoholic carbon. However, if the substance is tested is an unknown alcohol or phenol and reaction occurs, it means that it cannot be a tertiary alcohol. Phenols can also be oxidized, but they are not oxidized to aldehydes or ketones.

(a) Write the IUPAC name of the following compound. (1)

(b) Suggest a reagent for the following conversion: (1)



(c) What happens when (1x2=2)

(i) Ethanol reacts with alkaline $KMnO_4$ in acidic medium?

(ii) Phenol reacts with $Na_2Cr_2O_7$ in presence of H_2SO_4?

OR

(c) Compare acidity of phenol with that of ethanol. (2)

30. Read the passage below and answer any four questions:

Transition metals have incomplete d-subshell either in neutral atom or in their ions. The presence of partly filled d – orbitals in their atoms makes transition elements different from that of the non - transition elements. With partly filled d-orbitals, these elements exhibit certain characteristic properties such as display of a variety of oxidation states, formation of colored ions and entering into complex formation with a variety of ligands. The transition metals and their compounds also exhibit catalytic properties and paramagnetic behavior. The transition metals are very hard and have low volatility. An examination of the $E^0_{M^{2+}/M}$ values show the varying trends:

$E^0_{M^{2+}/M}$	
V	−1.18
Cr	−0.91
Mn	−1.18
Fe	−0.44
Co	−0.28
Ni	−0.25
Cu	+0.34
Zn	−0.76

(Ar) $4s^2\ 3d^9$
$4s^1\ 3d^{10}$

Based on the above the information, answer the following question:

(a) On what basis can we say that Cu is a transition element but Zn is not? (1)
[Atomic number: Cu =29, Zn = 30]

(b) Why do transition elements show variety of oxidation states? (1)

(c) (i) Why do $E^0_{M^{2+}/M}$ values show irregular trend from Vanadium to Zinc? (2)

(ii) How is the variability in oxidation states of transition metals different from that of the non-transition elements?

OR

(i) Of the d^4 species, Cr^{2+} is strongly reducing while Mn^{3+} is strongly oxidizing. Why?
[Atomic number: Cr = 24, Mn = 25]

(ii) Complete the following equation: (1x2=2)
$2MnO_4^- + H_2O + I^- \rightarrow$
(Basic)

SECTION – E

31. (a) Calculate the EMF of the cell in which the following reaction takes place (3)
$Ni(s) + 2Ag^+(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag(s)$
Given that $E^0_{cell} = 1.05V$, log4 = (0.6021)

(b) State Faraday's laws of electrolysis. (2)

OR

(a) The conductivity of 0.0025 mol L^{-1} acetic acid is 5.25×10^{-5} S cm^{-1}. (2)
Calculate its degree of dissociation if Λ^0_m for acetic acid is 390 S cm^2 mol^{-1}.

(b) Write anode, cathode and overall reaction of lead storage battery when in use. (3)

32. (a) Define Molality and Molarity. (2)

(b) Calculate the molality and molarity of an aqueous solution of 20% KI if its density is 1.2020g/ml.(Atomic mass K = 39, I = 127) (3)

OR

(a) Define Raoult's law and give its expression.

(b) The partial pressure of ethane over a saturated solution containing 6.56×10^{-2}g of ethane is 1bar. If the solution contains 5×10^{-2}g of ethane, then what will be the partial pressure of the gas?

33.(a) Give reason why the second and third row of transition elements resemble each other much more than they resemble the first row. (1x2=2)

(b) Compare Lanthanoids and Actinoids in terms of

(i) Electronic configuration
(ii) Oxidation state
(iii) Chemical reactivity (1x3=3)

OR

Give reason:

(a) Transition metals have high enthalpy of atomisation.
(b) Zn, Cd and Hg are soft metals.
(c) Mn shows highest oxidation state of +7 with oxygen but with fluorine it shows highest oxidation state of +4.
(d) Zr and Hf show similar properties.
(e) Actinoid contraction is more than lanthanoid contraction. (1x5=5)

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