[Easy Concept]

1 SAMPLE PAPER

Time Allowed: 3 hours] [*Maximum Marks:* 70

General Instructions:

Read the following instructions carefully.

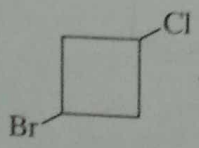
(*a*) There are **33** questions in this question paper with internal choice.
(*b*) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
(*c*) SECTION B consists of 5 short answer questions carrying 2 marks each.
(*d*) SECTION C consists of 7 short answer questions carrying 3 marks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

SECTION – A

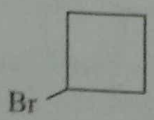
The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

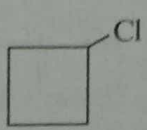
1. Gadolinium (64) has low value of third ionisation enthalpy because of
   (*a*) small size
   (*b*) high exchange enthalpy
   (*c*) high electronegativity
   (*d*) high basic character

2. The IUPAC name of complex $[Ag(H_2O)_2][Ag(CN)_2]$ is
   (*a*) dicyanido silver (II) diaquaargentate (II)
   (*b*) diaqua silver (II) dicyanido argentate (II)
   (*c*) dicyanido silver (I) diaquaargentate (I)
   (*d*) diaqua silver (I) dicyanido argentate (I)

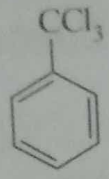
3. 

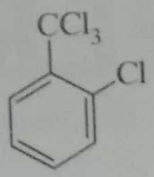
$+ 2Na \xrightarrow[\text{Ether}]{\text{Dry}}$ 'X', X is

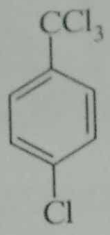
(*a*) 

(*b*) 

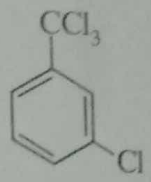
(*c*) 
(*d*) 

4.  + $Cl_2 \xrightarrow{FeCl_3}$ 'A', 'A' is

(a) 

(b) 

(c) Both (a) and (b)

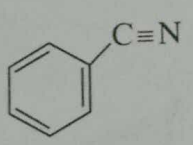
(d) 

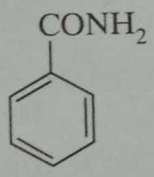
5. For a first order reaction A → Products, initial concentration of A is 0.1M, which becomes 0.001 M after 5 minutes, 'k' for reaction in s^{-1} [log 100 = 2, log 10 = 1, log 1000 = 3]

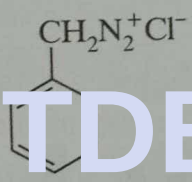
(a) 1.3818 s^{-1} (b) 0.0154 s^{-1} (c) 0.4606 s^{-1} (d) 0.2303 s^{-1}

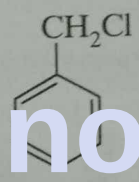
6. Compound 'X' on reaction with O_3 followed by Zn and H_2O gives formaldehyde and 2-methyl propanal as products. The compound 'X' is

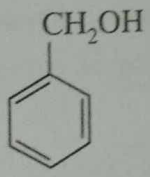
(a) 3-methyl but-1-ene
(b) 2-methyl but-1-ene
(c) 2-methyl but-2-ene
(d) Pent-2-ene

7.  $\xrightarrow[(3)\ H_2O]{(1)\ LiAlH_4,\ H_2O \\ (2)\ NaNO_2+HCl}$ 'X' is

(a) 

(b) 

(c) 

(d) 

8. The incorrect statement regarding enzymes is

(a) Enzymes are biocatalyst
(b) Enzymes reduce activation energy
(c) Enzymes are polysachharides
(d) Enzymes are very specific for particular reaction and substrate

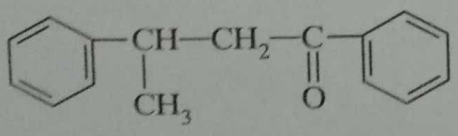
9. Which of the following will lead to a change in rate constant 'k' of a reaction?

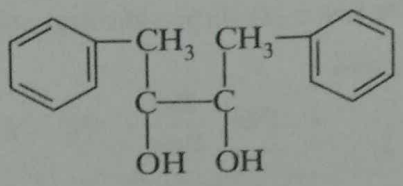
(a) Pressure
(b) Temperature
(c) Concentration
(d) Change in volume of reaction vessel

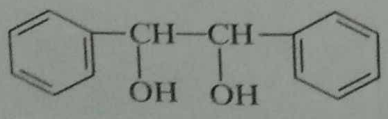
10. Choose the amide which on reduction with $LiAlH_4$ gives secondary amine.

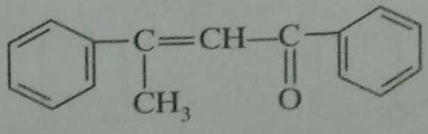
(a) Ethanamide
(b) N-Methyl ethanamide
(c) N, N-diethyl ethanamide
(d) Benzamide

11. Acetophenone when reacted with base C_2H_5—ONa followed by heating, yields a stable product:

(a) 

(b) 

(c) 

(d) 

12. Initial rate of formation of NO_2 is given

$2NO(g) + O_2(g) \longrightarrow 2NO_2(g)$

	Initial [NO]	Initial [O_2]	Initial rate of [NO_2] formation in mol L^{-1} s^{-1}
I.	0.30 M	0.30 M	0.096
II.	0.60 M	0.30 M	0.384
III.	0.30 M	0.60 M	0.192
IV.	0.60 M	0.60 M	0.768

The rate law is

(*a*) $r = k[NO]^1 [O_2]^1$ (*b*) $r = k[NO]^2 [O_2]^1$ (*c*) $r = k[NO]^1 [O_2]^2$ (*d*) $r = k[NO]^2 [O_2]^0$

In the following questions (Q. No. 13 – 16), a statement of assertion followed by statement of a reason is given. Choose the correct answer out of the following choices.

(*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.

13. **Assertion (A):** Primary aliphatic amines react with HNO_2 to give unstable diazonium salts.
Reason (R): Primary aromatic amines react with HNO_2 to form diazonium salts which are stable even at 300 K.

14. **Assertion (A):** In Lucas test, 1°, 2°, 3° alcohols are distinguished on the basis of their reactivity with conc. HCl + $ZnCl_2$ known as lucas reagent.
Reason (R): Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with lucas reagent.

15. **Assertion (A):** RNA and DNA are chiral due to D-sugar component.
Reason (R): RNA contains U[illegible], DNA con[illegible] Thym[illegible]

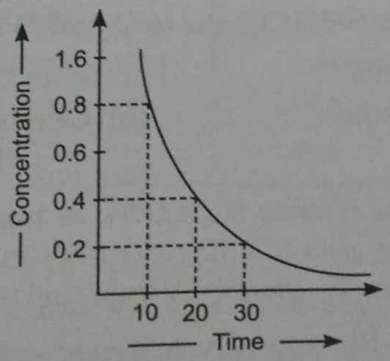
16. **Assertion (A):** Zn, Cd, Hg a[illegible] n[illegible] tr[illegible] el[illegible]
Reason (R): They do not have incompletely filled *d*-orbitals in ground as well as oxidised state.

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*) Why does *p*-dichloro benzene have zero dipole moment?
(*b*) CH_2Cl_2 has higher dipole moment than $CHCl_3$?

18. Analyse the given graph drawn between conc. of reactants Vs time.
(*a*) Predict the order of reaction.
(*b*) Theoretically can the concentration of reaction reduce to zero after infinite time? Explain.



19. A compound with the formula $C_6H_{12}O$ gives a negative Tollens' reagent test and a positive iodoform test. It produces semicarbazone and can be reduced to *n*-hexane with Clemmensen reduction. Identify the compound.

OR

(a) What happens when aniline reacts with benzaldehyde?

(b) $H-\overset{\overset{O}{\|}}{C}-H \xrightarrow[HCl(g)]{CH_3OH}$ 'X' $\xrightarrow[HCl(g)]{CH_3OH}$ 'Y'

Identify 'X' and 'Y'.

20. (a) What are globular proteins?

(b) What is meant by primary structure of protein?

21. A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction. (log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021)

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) Λ° for NaCl, HCl, CH_3COONa are 126.0, 426, 100, S cm^2 mol^{-1}. If the conductance of 0.001 M CH_3COOH is 5×10^{-5} S cm^{-1}, Calculate the degree of dissociation of CH_3COOH.

(b) Given below are half cell reactions:

$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$, $E^\circ_{MnO_4^-/Mn^{2+}} = +1.510\,V$

$\frac{1}{2}O_2 + 2H^+ + 2e^- \longrightarrow H_2O$, $E^\circ = +1.23V$

Will the MnO_4^- liberate oxygen from water in presence of acid?

23. (a) $[NiCl_4]^{2-}$ is paramagnetic, whereas $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral, why?

(b) Explain $[Co(NH_3)_6]^{3+}$ is inner orbital complex, whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. [Atomic number of Co = 27, Ni = 28]

(c) What is hybridisation, shape and magnetic behaviour of $[Cu(NH_3)_4]^{2+}$. [Atomic number of Cu = 29.]

24. Some ethylene glycol, $HOCH_2—CH_2OH$ is added to your car's cooling system along with 5 kg of water. If freezing point of water glycol solution is –15.0 °C, what is the boiling point of the solution? (K_b = 0.52 K kg mol^{-1}, K_f = 1.86 K kg mol^{-1} for water.)

25. Answer the following questions: (*Any 2*)

(a) Write the structural formulae of ammine chlorido(ethane 1,2-diamine)platinum(II) nitrate. How many ions it will produce in aqueous solution?

(b) What is coordination number of platinum in above complex? Give reason. Will it show optical isomerism?

(c) What is hybridisation in $[Pt(NH_3)_2Cl_2]$ and its shape? What is use of this complex?

26. How do you convert the following:

(a) Prop-1-ene to 1-fluoropropane

(b) Chlorobenzene to 2-Chlorotoluene

(c) Ethanol to propane nitrile

27. Compound 'A' having molecular formula (C_7H_7ON), on treatment with Br_2 and KOH gives 'B' (C_6H_7N) which on diazotization gives 'C'. 'C' reacts with aqueous solution of H_3PO_2 and forms 'D'. 'C' on reaction with KI gives 'E'. Identify 'A' to 'E' and write the chemical reactions involved.

28. (a) What are anomers?

(b) Give difference in properties of anomers.

(c) What is structural difference between glucose and fructose?

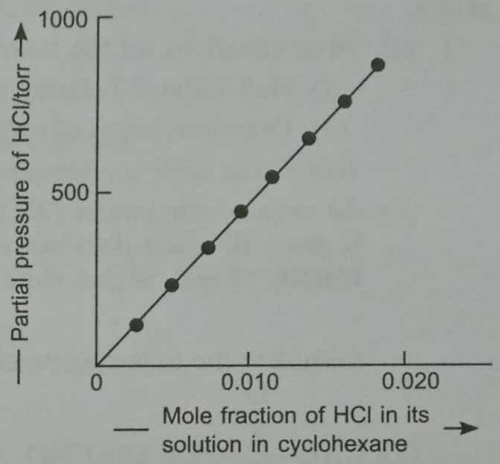
SECTION – D

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. **Henry's Law and its Applications**

Many gases dissolve in water, Oxygen dissolves only to small extent which sustains all aquatic life. NH_3 and HCl are highly soluble in water. Solubility of gases increases with increase in pressure and decreases with increase in temperature.

Henry's law states "*The partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas in the solution.* $p = K_H x$." Where K_H is Henry's law constant. If we draw a graph between partial pressure of the gas versus mole fraction of gas in solution, then we will get straight line as shown in graph.



Different gases have different K_H values of the same temperature. This suggests, K_H is a function of nature of gas.

Answer the following questions:

(*a*) What is slope of the line given in graph?

(*b*) What is significance of K_H?

(*c*) (*i*) Why does solubility of gas in liquid decreases with increase in temperature?

(*ii*) Why are cold drinks filled with CO_2 at high pressure?

OR

(*c*) (*i*) What is cause of anoxia at high altitude?

(*ii*) Why do scuba dive[illegible]ake [illegible]ir [illegible]lut[illegible]d [illegible]vit[illegible] [illegible]heli[illegible]m?

30. Phenols are acidic in natur[illegible]. In sub[illegible]titu[illegible] ph[illegible], le[illegible]n vit[illegible] d[illegible]ng groups such as $—NO_2$, enhances acidic strength of phenol, if $—NO_2$ group is present at *o*- and *p*-position. It is due to effective delocalisation of negative charge on phenoxide ion. Electron releasing groups, such as alkyl groups, do not favour formation of phenoxide ions resulting in decrease in acid strength e.g. cresols are less acidic than phenols.

The following table gives values of some Phenols and Ethanol.

Compound	Formula	pK_a
o-Nitrophenol	*o*-$O_2N—C_6H_4—OH$	7.2
m-Nitrophenol	*m*-$O_2N—C_6H_4—OH$	8.3
p-Nitrophenol	*p*-$O_2N—C_6H_4—OH$	7.1
Phenol	C_6H_5OH	10.0
o-Cresol	*o*-$CH_3—C_6H_4—OH$	10.2
m-Cresol	*m*-$CH_3—C_6H_4—OH$	10.1
p-Cresol	*p*-$CH_3—C_6H_4—OH$	10.2
Ethanol	C_2H_5OH	15.9

Answer the following questions:

(*a*) From the above data, how many times phenol is more acidic than ethanol?

(*b*) Out of phenols given in the table, which phenol is most acidic and why?

(*c*) (*i*) Arrange the following in increasing order of acidic strength:
phenol, *o*-nitro phenol, *m*-nitro phenol, *p*-nitro phenol, *p*-cresol

(*ii*) Why are phenols less acidic than carboxylic acids?

OR

(*c*) (*i*) Arrange 2, 4, 6-trinitro phenol, 3,5-dinitro phenol, 3-nitro phenol, phenol, propan-1-ol, 4-methyl phenol in increasing order of acidic character.

(*ii*) Convert phenol to 2, 4, 6-trinitro phenol.

SECTION – E

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

31. (*a*) Write equations for the following reactions:

(*i*) Hell-Volhard Zelinsky reaction of propanoic acid.

(*ii*) Decarboxylation of sodium benzoate.

(*iii*) Cross aldol condensation of ethanal and propanal.

(*b*) An organic compound (A) having molecular formula C_3H_8O on treatment with Cu at 573 K gives 'B' which does not reduce Tollens' reagent but gives yellow ppt. with I_2 and NaOH. Identify 'A' and 'B' and write chemical equations for the reactions.

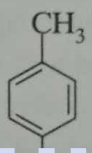
OR

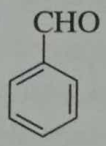
Complete the following reactions:

(*a*) $C_6H_5-\overset{\overset{O}{\|}}{C}-H + CH_3CHO \xrightarrow[298\ K]{OH^-}$

(*b*) $CH_3-\overset{\overset{O}{\|}}{C}-H + CH_3NH_2 \xrightarrow{H^+}$

(*c*) $CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3 \xrightarrow[(ii)\ Zn/H_2O]{(i)\ O_3}$

(*d*)  $\xrightarrow[(ii)\ H_3O^+]{(i)\ CrO_2Cl_2/CS_2}$

(*e*)  $\xrightarrow[273–283\ K]{conc.\ HNO_3/\ conc.\ H_2SO_4}$

32. (*a*) How does molar conductivity of strong electrolyte and weak electrolyte vary with concentration? Explain.

(*b*) $Zn(s)/Zn^{2+}(aq)\ ||\ Cu^{2+}(aq)/Cu(s)$

$E^\circ_{Zn^{2+}/Zn} = -0.76\ V,\ E^\circ_{Cu/Cu^{2+}} = +0.34\ V$

Calculate E°_{Cell} and log K_c.

(*c*) Why is F_2 best oxidising agent?

OR

(*a*) Equilibrium constant (K_c) for a given cell reaction is 10. Calculate E°_{cell}. [log 10 = 1]

$$A(s) + B^+(aq) \rightleftharpoons A^+(aq) + B(s)$$

(*b*) Four metals A, B, C, D have their standard reduction potential values are equal to –0.14 V, +0.34 V, –1.66 V and +0.80 V respectively. Arrange these metals in decreasing order of reactivity. Give reason.

(*c*) What is sign of ΔG in electrochemical cell?

33. Attempt **any five** of the following:

(*a*) Why Cr^{2+} good reducing agent?

(*b*) Why does 'Eu' show +2 oxidation slate?

(*c*) Why do Zr and Hf resemble with each other?

(*d*) Why do transition metals form complexes?

(*e*) Why are transition metals less electropositive than *s*-block element?

(*f*) Why is copper regarded as transition metal although it has $3d^{10}$?

(*g*) Why is Cr^{3+} green in colour?