Self Assessment Paper

General Instructions :

Read the following instructions carefully.

(a) There are 33 questions in this question paper. All questions are compulsory.

(b) **Section A :** Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each. MCQs or Reason Assertion Type based on given passage each carrying 1 mark.

(c) **Section B :** Q. No. 17 to 25 are Short Answer Questions and carry 2 marks each.

(d) **Section C :** Q. No. 26 to 30 are Short Answer Questions and carry 3 marks each.

(e) **Section D :** Q. No. 31 to 33 are Long Answer Questions carrying 5 marks each.

(f) There is no overall choice. However, internal choices have been provided.

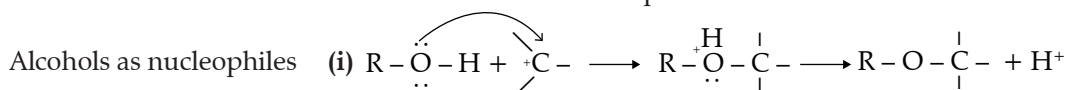*(g)* Use of calculators and log tables is not permitted.

Section 'A'

OBJECTIVE TYPE

Read the passage given below and answer the following questions : $(1 \times 4 = 4)$

Alcohols are versatile compounds. They react both as nucleophiles and electrophiles. The bond between O–H is broken when alcohols react as nucleophiles.

Alcohols as nucleophiles **(i)** $R - \overset{..}{\underset{..}{O}} - H + {}^{+}C - \longrightarrow R - \overset{+}{\underset{..}{O}} - \overset{H}{\underset{|}{C}} - \longrightarrow R - O - \overset{|}{\underset{|}{C}} - + H^+$

(ii) The bond between C–O is broke when they react as electrophiles. Protonated alcohols react in this manner

Protonated alcohols as electrophiles $R–CH_2–OH + \overset{.}{H} \to R–CH_2–\overset{.}{O}H_2$

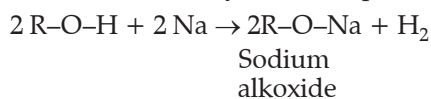Based on the cleavage of O–H and C–O bonds, the reactions of alcohols and phenols may be divided into two groups :

(a) Reactions involving cleavage of O–H bond

1. Acidity of alcohols and phenols

(i) Reaction with metals : Alcohols and phenols react with active metals such as sodium, potassium and aluminium to yield corresponding alkoxides/phenoxides and hydrogen.
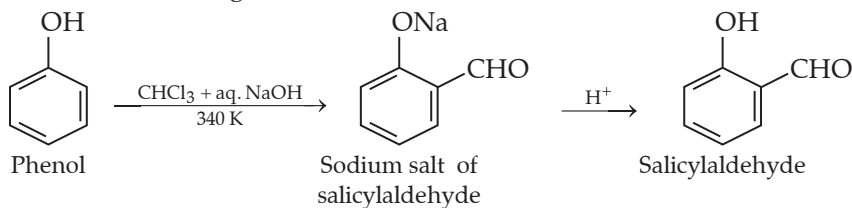
$2 R–O–H + 2 Na \to 2R–O–Na + H_2$
Sodium
alkoxide

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The following questions are multiple choice questions. Choose the most appropriate answer :

(i) Write down the decreasing order of reactivity of sodium metal towards primary, secondary and tertiary alcohols.

(a) $1°$ alc$< 2°$ alc $< 3°$ alc

(b) $1°$ alc$> 2°$ alc $> 3°$ alc

(c) $3°$ alc$< 1°$ alc $< 2°$ alc

(d) $3°$ alc$> 1°$ alc $< 2°$ alc

(ii) Name the following reaction :

Phenol $\xrightarrow[340\ K]{CHCl_3 + aq.\ NaOH}$ Sodium salt of salicylaldehyde $\xrightarrow{H^+}$ Salicylaldehyde
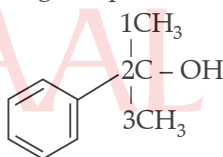
(a) Williamson's synthesis

(b) Kolbe's reaction

(c) Reimer-Tiemann reaction

(d) Sandmayer's reaction

(iii) Give the descending order of acid strength of alcohols.

(a) $RCH_2OH > RR'CHOH >> RR'R''COH$

(b) $RCH_2OH > RR'R''COH > RR'CHOH$

(c) $RCH_2OH < RR'CHOH << RR'R''COH$

(d) $RCH_2OH < RR'R''COH < RR'CHOH$

(iv) Write the IUPAC name of the following compound :

$$\begin{array}{c} 1CH_3 \\ | \\ 2C-OH \\ | \\ 3CH_3 \end{array}$$

(a) 2-methyl, 2-phenyl ethanol

(b) 2-phenyl butanol

(c) 2-Phenylpropan-2-ol

(d) 1-methyl, 1-phenyl ethanol

OR

Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution ?

(a) Butan-1-ol

(b) Butan-2-ol

(c) Both of these

(d) None of these

Q.2. Read the passage given below and answer the following questions : $(1 \times 4 = 4)$

The reaction in which a nucleophile replaces already existing nucleophile in a molecule is called nucleophilic substitution reaction. Haloalkanes are substrate in these reactions. In this type of reaction, a nucleophile reacts with haloalkane (the substrate) having a partial positive charge on the carbon atom bonded to halogen. A substitution reaction takes place and halogen atom, called leaving group departs as halide ion. Since the substitution reaction is initiated by a nucleophile, it is called nucleophilic substitution reaction.

In these questions, 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.

(i) **Assertion :** Chlorobenzene is formed by reaction of chlorine with benzene in the presence of $AlCl_3$.

Reason : $[AlCl_4]^-$ is the species that attacks the benzene ring in this reaction.

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(ii) **Assertion :** Electrophilic substitution reactions occur slowly in haloarenes.

Reason : The reason for this is -R effect of the benzene ring.

(iii) **Assertion :** Haloalkanes, though polar, are insoluble in water.

Reason : Haloalkanes do not form hydrogen bonds with water.

(iv) **Assertion :** In monohaloarenes, further electrophilic substitution occurs at ortho and para positions.

Reason : Halogen atom is a ring deactivator.

OR

Assertion : It is difficult to replace chlorine by –OH in chlorobenzene in comparison to that in chloroethane.

Reason : Carbon-chlorine (C—Cl) bond in chlorobenzene has a partial double bond character due to resonance.

Following questions (No. 3 -11) are Multiple Choice Questions carrying 1 mark each :

Q3. Solid A is a very hard electrical insulator in solid as well as in molten state and melts at an extremely high temperature. What type of solid is it ?
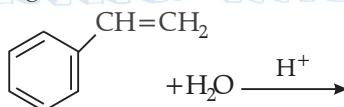
(a) Semiconductors (b) Ionic compounds

(c) Covalent compounds (d) Partial covalent compounds

Q4. Write the IUPAC name of the following :

$$CH_3— \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle C_2H_5}{|}}{C}} — \overset{|}{\underset{\underset{\displaystyle OH}{|}}{CH}} —CH_3$$

(a) 3-ethyl-3-methyl butan-2-ol (b) 3,3-dimethyl pentan-2-ol

(c) 3-methyl-3-ethyl butan-2-ol (d) 3,3-dimethyl pentanol

OR

Write the product of the following reaction :

$$+H_2O \xrightarrow{H^+}$$

(a) $C_6H_5CH_2CH_2OH$ (b) $C_6H_5OH + CH_3CH_3$

(c) $C_6H_5CH(OH)CH_3$ (d) $C_6H_5CH_2OH + CH_4$

Q5. When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after sometime because

(a) CO_2 is formed as the product.

(b) Reaction is exothermic.

(c) MnO_4^- catalyses the reaction.

(d) Mn^{2+} acts as auto-catalyst.

**Q6.** In Clemmensen reduction carbonyl compound is treated with _____.

(a) zinc amalgam + HCl (b) sodium amalgam + HCl

(c) zinc amalgam + nitric acid (d) sodium amalgam + HNO_3

OR

The best method for preparing primary amines from alkyl halides without changing the number of carbon atoms in the chain is

(a) Hoffmann Bromamide reaction (b) Gabriel phthalimide synthesis

(c) Sandmeyer reaction (d) Reaction with NH_3

Q7. Which of the following expressions is correct for the rate of reaction given below ?

$5Br^- (aq) + BrO_3^- (aq) + 6H^+ (aq) \rightarrow 3Br_2 (aq) + 3H_2O (l)$
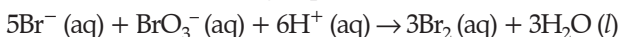
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    (a) $\dfrac{\Delta[Br^-]}{\Delta t} = 5\dfrac{\Delta[H^+]}{\Delta t}$

    (b) $\dfrac{\Delta[Br^-]}{\Delta t} = \dfrac{6}{5}\dfrac{\Delta[H^+]}{\Delta t}$

    (c) $\dfrac{\Delta[Br^-]}{\Delta t} = \dfrac{5}{6}\dfrac{\Delta[H^+]}{\Delta t}$

    (d) $\dfrac{\Delta[Br^-]}{\Delta t} = 6\dfrac{\Delta[H^+]}{\Delta t}$

Q8. IUPAC name of $CrCl_3(py)_3$ is

    (a) Trichloridotripyridinechromium(III)   **(b)** Tripyridinetrichlorochromium(III)

    (c) Tripyridinotrichlorochromium(VI)   **(d)** Trichloridotripyridinechromium(VI)

<div align="center">OR</div>

    IUPAC name of $[Pt(NH_3)_2Cl(NO_2)]$ is :

    (a) Platinum diaminechloronitrite

    (b) Chloronitrito-N-ammineplatinum(II)

    (c) Diamminechloridonitrito-N-platinum(II)

    (d) Diamminechloronitrito-N-platinum(II)

Q9. A compound is formed by two elements M and N. The element N forms ccp and atoms of M occupy $\dfrac{1}{3}$ rd of tetrahedral voids. What is the formula of the compound ?

    (a) MN_3 **(b)** M_2N_3

    (c) M_3N_2 **(d)** M_3N_4

Q10. What is the formula for the following compound ?

    Dichloridobis(ethane-1,2-diamine) platinum (IV) nitrate

    (a) $[PtCl_2(en)_2](NO_3)_2$

    (b) $[PtCl_2(NO_3)_2(en)_2]$

    (c) $[PtCl_2](NO_3)_2(en)_2$

    (d) $[Pt(NH_3)BrCl(NO_2)]^-$

Q11. Which stoichiometric defect does not change the density of the crystal ?

    (a) Frenkel defect   **(b)** Schottky defect

    (c) Interstitial defect   **(d)** F-centres

<div align="center">OR</div>

    The anion D:\Pagination\OSBO\Nov\02-11-2020\pack\01 On Tips- 12 Folder\Links which is occupied by an electron is known as

    (a) Interstitial defect   **(b)** F-centres

    (c) Frenkel defect   **(d)** Schottky defect

In the following questions (Q. No. 12 – 16) 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.

Q12. Assertion (A) : Coagulation power of Al^{3+} is more than Na^+.

    Reason (R) : Greater the valency of the flocculating ion added, greater is its power to cause precipitation (Hardy-Schulze rule).

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OR

Assertion (A) : Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted.

Reason (R) : For weak electrolytes degree of dissociation increases with dilution of solution.

Q13. Assertion (A) : $[Cr(H_2O)_6]Cl_2$ and $[Fe(H_2O)_6]Cl_2$ are reducing in nature.

Reason (R) : Unpaired electrons are present in their *d*-orbitals.

Q14. Assertion (A) : Hydrolysis of (–)-2-bromooctane proceeds with inversion of configuration.

Reason (R) : This reaction proceeds through the formation of a carbocation.

Q15. Assertion (A) : Formaldehyde is a planar molecule.

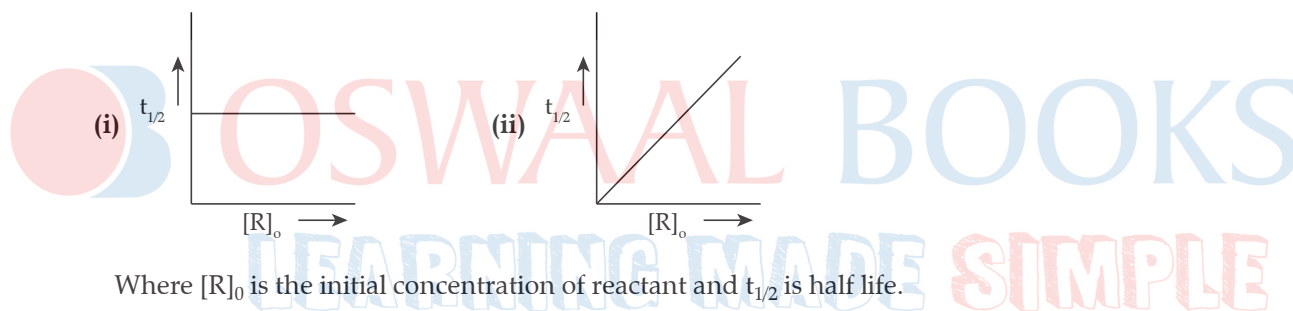**Reason (R) :** It contains sp^2 hybridised carbon atom.

Q16. Assertion (A) : Acetanilide is less basic than aniline.

Reason (R) : Acetylation of aniline results in decrease of electron density on nitrogen.

Section 'B'

The following questions (Q.No 17 – 25) are Short Answer Type – I and carry 2 marks each.

Q17. Define order of reaction. Predict the order of reaction in the given graphs :

Where $[R]_0$ is the initial concentration of reactant and $t_{1/2}$ is half life.

OR

Why are powdered substances more effective adsorbents than their crystalline forms ?

Q18. Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g mol^{-1}) in 250 g of water. (K_f of water = 1.86 K kg mol^{-1})

Q19. How will you carry out the following conversions

(a) Ethanal to Propanone.
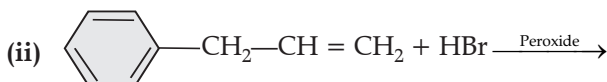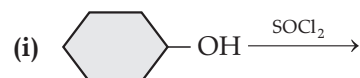
(b) Toluene to Benzoic acid.

Q20. For the reaction

$2N_2O_5$ (g) → $4NO_2$ (g) + O_2 (g),

the rate of formation of NO_2 (g) is 2.8×10^{-3} M s^{-1}. Calculate the rate of disappearance of N_2O_5 (g).

OR

A current of 1.50A was passed through an electrolytic cell containing $AgNO_3$ solution with inert electrodes. The weight of silver deposited was 1.50 g. How long did the current flow ? (Molar mass of Ag = 108 g mol^{-1}, 1F = 96500 C mol^{-1}).

Q21. Draw the structure of major monohalo product in each of the following reactions :

(i) ⬡— OH $\xrightarrow{SOCl_2}$

(ii) ⬡—CH_2—$CH = CH_2$ + HBr $\xrightarrow{Peroxide}$

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OR

How will you carry out the following conversion :

(i) 2-Bromopropane to 1-bromopropane

(ii) Benzene to p-chloronitrobenzene

Q22. Out of $\left[CoF_6\right]^{3-}$ and $\left[Co(en)_3\right]^{3+}$, which one complex is,

(i) Paramagnetic,

(ii) More stable,

(iii) Inner orbital complex and

(iv) High spin complex

(Atomic number of Co = 27)

OR

Discuss the factors affecting stability of coordination complexes.

Q23. What are the transition elements ? Write two characteristics of the transition elements.

Q24. Give reasons :

(i) Electrophilic substitution in aromatic amines takes place more readily than benzene.

(ii) CH_3CONH_2 is a weaker base than $CH_3CH_2NH_2$.

Q25. Write any two differences between Physisorption and Chemisorption.

OR

(a) Write the dispersed phase and dispersion medium of milk.

(b) Why is adsorption exothermic in nature ?

Section 'C'

(Q.No 26 – 30) are Short Answer Type II carrying 3 marks each.

Q26. Give reasons:

(i) Acetylation of aniline reduces its activation effect.

(ii) CH_3NH_2 is more basic than $C_6H_5NH_2$.

(iii) Although –NH_2 is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline.
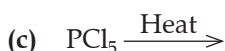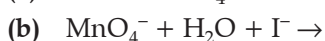
OR

How will you convert the following :
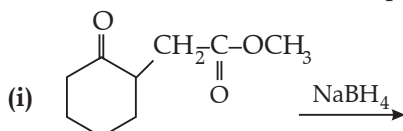
(i) Nitrobenzene into aniline,

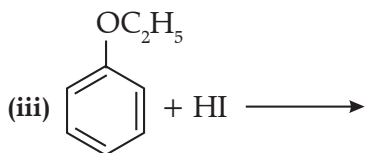(ii) Ethanoic acid into methanamine,

(iii) Aniline to N-phenylethanamide.

(Write the chemical equations involved.)

Q27. Complete and balance the following chemical equations :

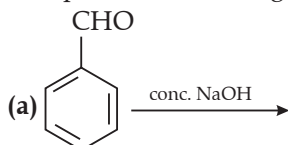(a) $Fe^{2+} + MnO_4^- + H^+ \rightarrow$

(b) $MnO_4^- + H_2O + I^- \rightarrow$

(c) $PCl_5 \xrightarrow{\text{Heat}}$

Q28. Write the structures of the main products in the following reactions :

(i)

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(ii) [benzene ring with CH=CH$_2$ substituent] $+ H_2O \xrightarrow{H^+}$

(iii) [benzene ring with OC$_2$H$_5$ substituent] $+ HI \longrightarrow$

OR

Complete the following equations :

(a) [benzene ring with CHO substituent] $\xrightarrow{\text{conc. NaOH}}$

(b) $CH_3COCH_3 \xrightarrow{\text{LiAlH}_4}$

(c) $CH_3-COOH \xrightarrow[\text{(b) H}_2\text{O}]{\text{(a) Cl}_2/\text{P}}$
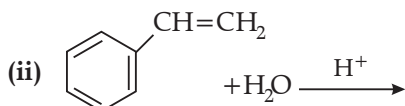
Q29. (a) Write the product when D-glucose reacts with conc. HNO_3.

   (b) Amino acids show amphoteric behaviour. Why ?

   (c) Name the products obtained after the hydrolysis of lactose.

Q30. (a) Write the formula of the following coordination compound : Iron(III) hexacyanoferrate(II).

   (b) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_o < P$.

Section 'D'

(Q.No 31 to 33) are Long Answer Type carrying 5 marks each.

Q31. (i) Give reasons for the following :

   (a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

   (b) Aquatic animals are more comfortable in cold water than in warm water.

   (c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

   (ii) Give reasons :

   (a) Cooking is faster in pressure cooker than in cooking pan.

   (b) Red Blood Cells (RBC) shrink when placed in saline water but swell in distilled water.

OR

   (i) Define the following terms:

   (a) Ideal solution

   (b) Osmotic pressure.

   (ii) Calculate the boiling point elevation for a solution prepared by adding 10 g CaCl$_2$ to 200 g of water, assuming that CaCl$_2$ is completely dissociated. (K_b for water = 0.512 K kg mol^{-1}; Molar mass of CaCl$_2$ = 111 g mol^{-1})

Q32. (a) Write the cell reaction and calculate the e.m.f. of the following cell at 298 K :

   Sn (s) | Sn^{2+} (0.004 M) || H$^+$ (0.020 M) | H$_2$ (g) (1 bar) | Pt (s)   (Given : E°$_{Sn^{2+}/Sn}$ = $-$ 0.14V)

   (b) Give reasons :

   (i) On the basis of E° values, O$_2$ gas should be liberated at anode but it is Cl$_2$ gas which is liberated in the electrolysis of aqueous NaCl.

   (ii) Conductivity of CH$_3$COOH decreases on dilution.

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OR

(a) For the reaction

$2AgCl$ (s) $+ H_2$ (g) (1 atm) $\rightarrow 2Ag(s) + 2H^+$ (0.1 M) $+ 2Cl^-$ (0.1 M),

$\Delta G° = - 43600$ J at 25°C.

Calculate the e.m.f. of the cell.

$[\log 10^{-n} = -n]$

(b) Define fuel cell and write its two advantages.

Q33. (a) When concentrated sulphuric acid was added to an unknown salt present in a test tube a brown gas (A) was evolved. This gas intensified when copper turnings were added to this test tube. On cooling, the gas (A) changed into a colourless solid (B).

  (i) Identify (A) and (B).

 (ii) Write the structures of (A) and (B).

(iii) Why does gas (A) change to solid on cooling ?

(b) Arrange the following in the decreasing order of their reducing character :

HF, HCl, HBr, HI
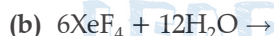
(c) Complete the following reaction :

$XeF_4 + SbF_5 \longrightarrow$

OR

(i) Account for the following:

  (a) Reducing character decreases from SO_2 to TeO_2.

  (b) $HClO_3$ is a stronger acid than HClO.

  (c) Xenon forms compounds with fluorine and oxygen only.

(ii) Complete the following equations:

  (a) $4NaCl + MnO_2 + 4H_2SO_4 \rightarrow$

  (b) $6XeF_4 + 12H_2O \rightarrow$

❑❑❑