PRE-BOARD Examination - 2020-21
Subject - Chemistry

Time – 3 Hours　　　　　　**Class - XII**　　　　　　**M.M.- 70**

Instruction :

1. There are 33 questions in this question paper. All questions are compulsory.

2. Section A : Question number 1 and 2 are case based questions having four MCQs or Assertion-Reason type based on given passage each carrying 1 mark and questions 3 to 16 are MCQs and Assertion-Reason type questions carrying 1 mark each.

3. Section B : Question number 17 to 25 are short answer type I questions and carry 2 marks each.

4. Section C : Question number 26 to 30 are short answer type II questions carrying 3 marks each.

5. Section D : Question number 31 to 33 are long answer questions carrying 5 marks each.

Section - A

Passage based questions :

Q.1. Read the passage given below and answer the following questions :

　　Elimination and substitution reactions can occur simultaneously. When alkyl halide reacts with nucleophile, it may undergo either substitution via S_N1 and S_N2 or elimination reaction. It depends upon the nature of alkyl halide, strength and size of nucleophile, conditions of the reaction.

　　Primary alkyl halide will prefer SN2 reaction i.e., nucleophilic substitution reaction via S_N2 mechnaism. Secondary alkyl halide can undergo substitution or elimination depending upon the strength of the nucleophile. Stronger nucleophile like $^-OC_2H_5$ will bring out elimination whereas nucleophiles like OH^- will bring out substitution. Tertiary alkyl halide will undergo substitution or elimination depending upon stability of carbocation or the more substituted alkene.

　　The following questions (i - iv) are multiple choice questions. Choose the most appropriate answer :

(i)　When ethyl chloride is treated with aq, KOH we get :

　　(a)　methanol　　　　　(c)　ethanoic acid

　　(b)　ethanol　　　　　　(d)　ethanol

(ii)　Which of the following would undergo SN2 reaction faster?

　　(a)　$CH_3 CH_2 Br$　　　　(c)　$(CH_3)_3 C - Br$

　　(b)　$CH_3 CH Br CH_3$　　(d)　None of these

(iii)　Racemisation will take place in :

　　(a)　S_N1 reaction　　　　(c)　climination reaction

　　(b)　S_N2 reaction　　　　(d)　None of these

(iv)　The product formed in the following reaction :

$(CH_3)_3 - C\ Br + KOH(alc.) \longrightarrow A$: Identify A from the given options.

(a) $H_3C\ CH_2\ CH_3$

(c) $(H_3C)_2\ OH$

(b) $(H_3C)_3\ C\ OH$

(d) $(H_3C)_2\ C = CH_2$

Q.2. Solid surface has a tendency to attract and retain the molecules of the phase with which it comes in contact. The process in which molecular species are accumulated at the surface rather than in the bulk of a solid or liquid phase is termed as adsorption eg. water vapour on silica gel, H_2, O_2, NH_3 on activated charcoal.

The surface particles of the adsorbent are not surrounded by atoms or molecules of their kind on all sides and hence they possess unbalanced or residual attractive forces responsible for adsorption. The extent of adsorption increases with increase of surface area per unit mass of adsorbent at a given temperature and pressure.

During adsorption, there is always decrease in surface energies. ΔH of adsorption is always negative. As molecules of gas are held on the surface of solid adsorbent hence entropy decreaces in adsorption ΔG has to be negative.

Weak van der waals forces are responsible for physical adsorption and chemical bonds are responsible for chemical adsorption.

In these questions (i) to (iv), 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 of assertion

(b)   Assertion and reason both are correct statements but reason is not correct explanation of assertion.

(c)   Assertion is correct statement but reason is incorrect statement.

(d)   Assertion is incorrect statement but reason is correct statement.

(i)   Assertion : Adsorption is not a surface phenomenon.

Reason : Adsorption is an exothermic process.

(ii)   Assertion : The molecules on the surface have higher energy.

Reason : During adsorption, the surface of the solid is in a state of stress.

(iii)   Assertion : The enthalpy of physisorption is greater than chemisorption.

Reason : Molecules of adsorbate and adsorbent are held by van der Waals forces in physisorption and by chemical bonds in chemisorption.

(iv)   Assertion : For adsorption, ΔG is negative.

Reason : Adsorption is an exothermic process accompanied by decrease in randomness.

Q.3. Contribution of each atom per unit cell at a face centre in a fcc unit cell is

(a)   1

(b)   2

(c)   0.5

(d)   2.5

Q.4. The difference between the electrode patentials of two electrode when no current

is drawn through the cell is called :

    (a)   cell potential   (b)   cell emf

    (c)   potential difference   (d)   cell voltage

Q.5. If the concentrations are expressed in mol L^{-1} and time is s, then the unit of the rate constant for the first order reaction is :

    (a) $mol\ L^{-1}\ S^{-1}$ (b) $mol^{-1}\ L\ S^{-1}$

    (c) S^{-1} (d) $mol^2\ L^{-2}\ S^{-1}$

Q.6. Which one of the following molecule contains no $\wedge$ bond?

    (a) H_2O (b) NO_2

    (c) SO_2 (d) CO_2

Q.7. Which among the following is the most reactive :

    (a) I_2 (b)   ICl

    (c) Cl_2 (d) Br_2

Q.8. Phenol is less acidic than :

    (a)   ethanol   (b)   O-nitrophenol

    (c)   O-methylphenol   (d)   O-methoxyphenol

Q.9. The reagent which does not react with both acetone and benzaldehyde is :

    (a)   sodium hydrogensulphite   (b)   Phenyl hydrazine

    (c)   Fehling's solution   (d)   Grignard reagent

Q.10. Which of the following compounds will give butanone on oxidation with alkaline $KMnO_4$ solution?

    (a)   Butan-1-01   (b)   Butan-2-01

    (c)   Both of these   (d)   None of these

Q.11. Which of the following does not react with Hinsberg's reagent?

    (a) $C_2H_5NH_2$ (b) $(C_2H_5)_2NH$

    (c) $(C_2H_5)_3\ N$ (d) CH_3NH_2

In the following questions (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.

Q.12. Assertion : In close packing of spheres, a tetrahedral void is surrounded by four spheres whereas an actahedral void is surrounded by six spheres.

Reason : A tetrahedral void has a tetrahedral shape where as an actahedral void has an octahedral shape.

Q.13. Assertion : Conductivity of an electrolyte increases with decrease in

concentration.

Reason : Number of ions per unit volume decreases on dilution.

Q.14. Assertion : Reactions of higher order are rare.

Reason : The chances of simultaneous multi-molecular collisions are extremely small.

Q.15. Assertion : 2-chloro-3-methylbutane on treatment with alcoholic potash gives 2-methyl but -2-ene as major product.

Reason : Above reaction occurs according to Saytzeff rule.

Q.16. Assertion : Methoxyethane reacts with HI to give ethanol and iodomethane.

Reason : Reaction of ether with HI follows S_N2 mechanism.

Section - B

Q.17. Calculate the emf of the following cell at 298K $Al_{(s)} | Al^{3+}$ (0.15ᵐ) $\| Cu^{2+}$ (0.025ᵐ)

$| Cu_{(s)}$ Given $E^0{}_{Al^{3+}|Al} = -1.66\,V$ $E^0 Cu^{2+}|Cu = +0.34\,V$ $\log 0.15 = -0.8239$
$\log 0.025 = -1.6020$

Q.18. Draw the structures of the following :

(i) ClF_3 (ii) XeF_4

Q.19. Scandium (z = 21) is a transition element but Zn (z = 30) is not. Explain.

Or

Why do transition elements exhibit higher enthalpies of atomization?

Q.20. (i) Write the electronic configuration of iron (z = 26) ion in the following complex ion and predict its magnetic behaviour : $\left[Fe(H_2O)_6\right]^{2+}$
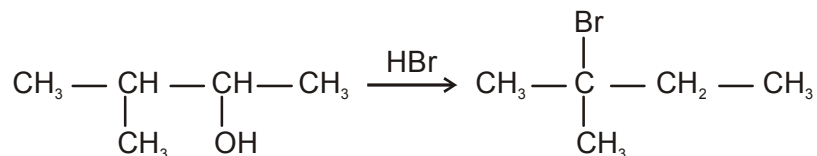
(ii) Write the IUPAC name of the coordination complex : $\left[CoCl_2(en)_2\right]NO_3$

Or

(i) Predict the geometry of $\left[Ni(CN)_4\right]^{2-}$ (Ni, z = 28)

(ii) Calculate the spin only magnetic moment of $\left[Cu(NH_3)_4\right]^{2+}$ ion (Cu, z = 29)

Q.21. When 3-methylbutan-2-01 is treated with HBr, the following reaction takes place:

$$CH_3 - CH - CH - CH_3 \xrightarrow{HBr} CH_3 - \underset{CH_3}{\overset{Br}{C}} - CH_2 - CH_3$$

(with CH_3 and OH substituents on the left molecule)

Give a mechanism for this reaction.

Q.22. Name the reagents in the following reactions :

(i) Bromination of phenol of 2, 4, 6 - tribromophenol

(ii) Butan-2-one to butan-2-01

Q.23. Write the IUPAC names of :

(i) $(CH_3CH2)N\,CH_3$

(ii) $m - BrC_6H_4NH_2$

Q.24. Three amino acids are given below :

Alanine $CH_3CH\,(COOH)\,(NH_2)$

aspartic acid $HOOC\text{-}CH_2CH\,(COOH)\,(NH_2)$

lysine $H2N\text{ - }(CH_2)_4\text{ - }CH\,(COOH)\,(NH_2)$

make two tripeptides using these amino acids and mark the peptide linkage in both cases.

Q.25. A DNA strand has the base sequence :   ATGCAT

What would be the base sequence in complementany DNA strand and the RNA formed?

Section - C

Q.26. A metal crystallises into two cubic system face centred cubic (fcc) and body centred cubic (bcc) whose unit cell lengths are 3.5 and $3.0 \overset{0}{A}$ respectively. Calculate the ratio of densities of fcc and bcc.

Q.27. The C-14 content of an ancient piece of wood was found to have three tenths of that in living trees. How old is that piece of wood?

(log 3 = 0.4771 log 7 = 0.8540 half life of C-14 = 5730 years)

Or

The following results have been obtained during the kinetic studies of the reaction:

$$P + 2Q \longrightarrow R + 2S$$
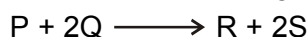
Exp.	Intitail P (mol L^{-1})	Initial Q (mol L^{-1})	Initial rate of formation of R (M min^{-1})
1.	0.10	0.10	3.0×10^{-4}
2.	0.30	0.30	9.0×10^{-4}
3.	0.10	0.30	3.0×10^{-4}

Determine the rate law expression for the reaction.

Q.28. (i) Write the formula of the following compounds :

(a) Sodium hexanitrito-N-Cobaltate (iii)

(b) Tetraaquadichloridochromium (iii) chloride

(ii) Calculate the oxidation state of Cu in $\left[Cu(NH_3)_4\right]SO_4$

Q.29. (i) Arrange the following in decreasing order of bond dissociation enthalpy

$F_2,\ Cl_2,\ Br_2,\ I_2$

(ii) Bi does not form p - p   bonds

Give reason for the observation.

(iii) Electron gain enthalpy of oxygen is less negative than sulphur. Justify

Or

Give reasons for the following

(i) H_2S is more acidic than H_2O

(ii) Fluorine exhibits only (-1) oxidation state

(iii) Helium forms no real chemical compound.

Q.30. Arrange the following in increasing order of property specified :

(i) aniline, ethanamine, N-ethylethanamine (solubility in water)

(ii) Ethanoic acid, ethanamine, ethanol (boiling point)

(iii) Methanamine, N, N-dimethylmethanamine and N-methylmethanamine

(basic strength in aqueous phase)

Section - D

Q.31. (i) Define each of the following :

(a) Osmotic pressure   (b) Ebullioscopic constant

(ii) At some temperature, the vapour pressure of pure C6H6 is 0.256 bar and that of pure $C_6H_5CH_3$ (toluene) is 0.0925 bar. If the mole fraction of toluene in solution is 0.6. Then,

(a) What will be the total pressure of the solution?

(b) What will be the mole fraction of each component in vapour phase?

Or

(i) Define each of the following :

(a) Colligative propertics   (b) Cryoscopic constant

(ii) 100 mg of a protein is dissolved in enough water to make 10.0 ml of a solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25⁰C, what is the molar mass of protein?(R=0.0821L atm mol^{-1} k^{-1} and 760mm Hg=1atm

Q.32. (i) Write down the electronic configuration of

(a) Cr^{3+} (b) Cu^+

(Cr, Z = 24 Cu, z = 29)

(ii) Describe the cause of the following variations :

(a) Cr^{2+} is stronger reducing agent than Fe2+

(b) E^0 (M^{2+} | M) value of copper is positive (+0.34V)

(c) Cobalt (ii) is stable in aqueous solution but in the presence of complexing reagent, it is easily oxidised. (Fe, Z = 26; Co Z = 27)

OR

(i) Calculate the magnetic moment of a divalent ion in aequeous solution,

$[Fe(CN)_6]^{3-}$ if atomic number of Fe is 26.

(ii) Explain the following :

(a) Why does Cu not displace hydrogen from acid?

(b) Why E^0 values for Mn, Ni and Zn are more negative than expected?

(c) Why first ionisation of Cr is lower them that of Zn?

(Mn, Z = 25; Ni, z = 28, Zn, Z = 30)

Q.33. An organic compound A $(C_7H_6Cl_2)$ on treatment with NaOH solution gives another compound B (C_7H_6O). B on oxidation gives an acid C $(C_7H_6O_2)$ which on treatment with a mixture of conc. HNO_3 and H_2SO_4 give a compound F $(C_7H_5NO_4)$. B on treatment with conc. NaOH gives compounds D (C_7H_8O) and E (C_6H_5COONa). Deduce the structures of A, B, C, D and E.
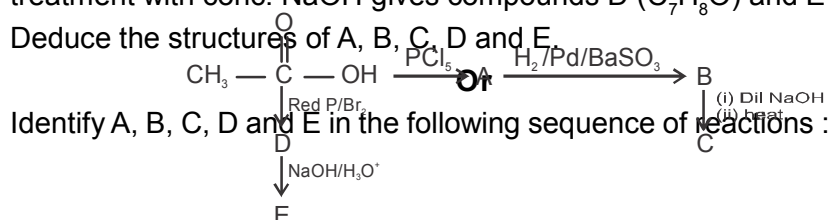
Identify A, B, C, D and E in the following sequence of reactions :

$$CH_3 - \overset{\overset{O}{\|}}{C} - OH \xrightarrow{PCl_5} A \xrightarrow{H_2/Pd/BaSO_3} B$$

(Red P/Br$_2$) ↓ ↓ (i) Dil NaOH (ii) heat

D ← ← C

↓ NaOH/H$_3$O$^+$

E