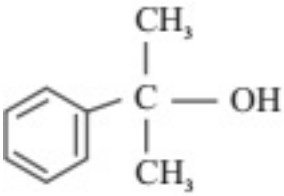
CBSE Class 12 Chemistry
Sample Paper-15

Time Allowed : 3 Hours] [Max. Marks : 70

General Instructions:

i. All questions are compulsory.
ii. Questions number 1 to 5 are urey short-answer questions and carry 1 mark each.
iii. Questions number 6 to 10 are short-answer questions and carry 2 marks each.
iv. Questions number 11 to 22 are also short-answer questions and carry 3 marks each.
v. Question number 23 is a value based question and carries 4 marks.
vi. Questions number 24 to 26 are long-answer questions and carry 5 marks each.
vii. Ues log tables, if necessary. Use of calculators is not allowed.

1. Arrange the following hydrides of Group-16 elements in the decreasing order of their reducing character:
   H_2O, H_2S, H_2Se H_2Te
2. What is the role of desorption in the process of catalysis?
3. Write the IUPAC name of the following compound:



4. Among the isomers of pentane (C_5H_{12}), write the. one which on photochemical chlorination yields a single monochloride.
5. What is the formula of a compound in which the element P forms ccp lattice and atoms of Q occupy 1/3rd of tetrahedral voids?
6. In a galvanic cell, the following cell reaction occurs:
   $Zn\ (s) + 2\ Ag^+\ (aq) \rightarrow Zn^{2+}\ (aq) + 2\ Ag\ (s)$ $E°_{cell} = + 1.56V$
   a. Is the direction of flow of electrons from zinc to silver or silver to zinc?
   b. How will concentration of Zn^{2+} ions and Ag^+ ions be affected when the cell functions?

7. In the following ions :

   Mn^{3+}, V^{3+}, Cr^{3+}, Ti^{4+}

   (Atomic no : Mn = 25, V = 23, Cr = 24, Ti = 22)

   a. Which ion is most stable in an aqueous solution?
   b. Which ion is the strongest oxidizing agent?
   c. Which ion is colourless?
   d. Which ion has the highest number of unpaired electrons?
8. Do the following conversions in not more than two steps :
   a. Propene to Acetone
   b. Propanoic acid to 2-hydroxy propanoic acid

      OR

      Write the reaction involved in the following :
      a. Etard reaction
      b. Wolff-Kishner reduction
9. What is meant by elevation in boiling point? Why is it a colligative property?
10. a. Write the IUPAC name of the following complex :

       $[Co(NH_3)_4\ CI\ (NO_2)]CI$

    b. Write the formula for the following :

       Dichloridobis (ethane-l, 2-chainine) cobalt(III) chloride
11. Account for the following :
    a. $CuCl_2$ is more stable than CU_2CI_2.
    b. Atomic radii of 4d and 5d series elements are nearly same.
    c. Hydrochloric acid is not used in permanganate titrations.
12. Define the following terms :
    a. Analgesic
    b. Anionic detergent
    c. Antacid
13. The electrical resistance of a column of 0.05 M KOH solution of diameter 1 cm and length 45.5 cm is 4.55×10^3 ohm. Calculate its molar conductivity.
14. Define the following terms with an example in each :
    a. Lyophobic colloids
    b. Homogeneous catalysis

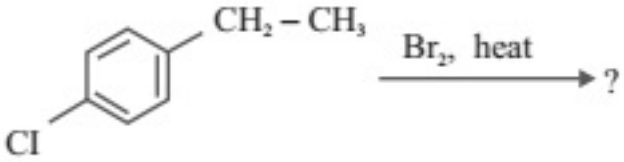
c. O/W emulsion

OR

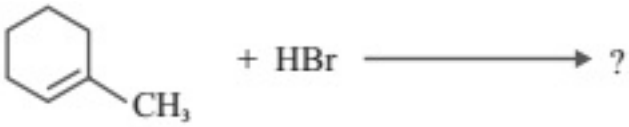
Write three differences between Physisorption and Chemisorption.

15. Draw the structures of the major monohalo product for each of the following reactions:

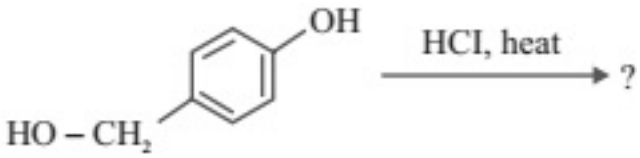
a.



b.



c.



16. A solution of glucose (Molar mass = 180 g mol^{-1}) in water has a boiling point of 100.20°C. Calculate the freezing point of the same solution. Molal constants for water Kf and Kb are 1.86 K kg mol^{-1} and 0.512 K kg mol^{-1} respectively.

17. a. Write the name of the method used for the refining of the following metals:
    i. Titanium
    ii. Germanium
    iii. Copper

    b. Write the name of the method of concentration applied for the following ores:
    i. Zinc blende
    ii. Haematite
    iii. Bauxite

18. a. What is the radius of sodium atom if it crystallizes in bcc structure with the cell edge of 400 pm?

    b. Examine the given detective crystal:

X^+	Y^-	X^+	Y^-	X^+
Y^-	Z^{2+}	Y^-	X^+	Y^-
X^+	Y^-	O	Y^-	X^+
Y^-	X^+	Y^-	X^+	Y^-

i. Write the term used for this type of defect.

ii. What is the result when XY crystal is doped with divalent (Z^{2+}) impurity?

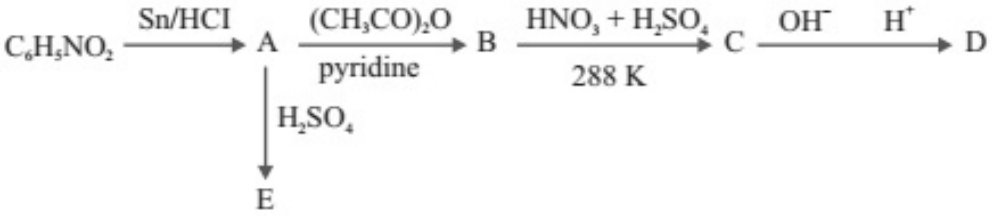
19. Give reasons:
    a. Propanone is less reactive than ethanal towards nucleophilic addition reactions.
    b. $O_2N - CH_2 - COOH$ has lower pKa value than CH_3COOH.
    c. $(CH_2)_3CH - CHO$ undergoes aldol condenstion whereas $(CH_3)_3C - CHO$ does not.
20. Write the names and structures of the monomers of the following polymers:
    1. Neoprene
    2. Buna-N.
    3. PHBV
21. a. Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta > P$.
    b. Write the hybridization and magnetic character of $[CoF_6]^{3-}$ (At. no. of Co = 27)
22. What happens when
    a. $(CH_3)_3C - O - CH_3$ is treated with HI,
    b. Anisole is treated with CH_3COCl / anhydrous $AICI_3$,
    c. Phenol is treated with Br_2 / CS_2?

    Write chemical equations in support of your answer.
23. After watching a programme on TV about the presence of carcinogens (cancer causing agents) Potassium bromate and Potassium iodate in bread and other bakery products, Veena, a class XII student, decided to make others aware about the adverse effects of these carcinogens in foods. She consulted the school principal and requested him to instruct the canteen contractor to stop selling sandwiches, pizzas, burgers and other bakery products to the students. The principal took an immediate action and instructed the canteen contractor to replace the bakery products with some proteins and vitamins-rich food like fruits, salads, sprouts, etc.

The decision was welcomed by the parents and students.

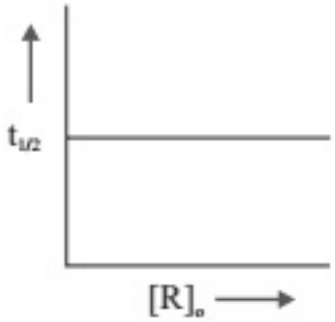
a. What are the values (at least two) displayed by Veena?
b. Which polysaccharide component of carbohydrates is commonly present is bread?
c. Write the two types of secondary structures of proteins.
d. Give two examples of water soluble vitamines.

24. Write the structures of A, B, C, D and E in the following reactions:

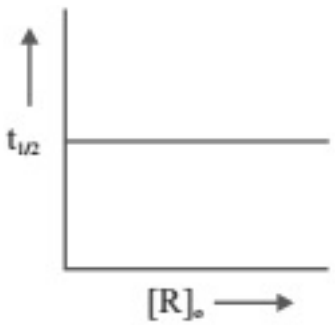


a. Write the structures of the main products when benzene diazonium chloride reacts with the following reagents:
   i. CuCN
   ii. CH_3CH_2OH
   iii. Cu / HCl
b. Arrange the following in the increasing order of their basic strength:
   CH_3NH_2, $(CH_3)_2NH$, $C_6H_5NH_2$, $C_6H_5CH_2NH_2$

25. a. A first order reaction is 75% completed in 40 minutes. Calculate its $t_{1/2}$.
b. Predict the order of the reaction in the given plots:
   i.



   ii.



Where $[R]_0$ is the initial concentration of reactant.

(Given : log 2 = 0.3010, log 4 = 0.6021)

OR

The following data were obtained for the reaction:$2NO + O_2 \rightarrow 2NO_2$

Experiment	[NO]/M	$[O_2]$/M	Initial rate of formation of NO_2/M min^{-1}
1	0.3	0.2	7.2×10^{-2}
2	0.1	0.1	6.0×10^{-3}
3	0.3	0.4	2.88×10^{-1}
4	0.4	0.1	2.40×10^{-2}

iii. Find the order of reaction with respect to NO and O_2.

iv. Write the rate law and overall order of reaction.

v. Calculate the rate constant (k).

26. a. Account for the following :

i. BiH_3 is the strongest reducing agent in Group 15 elements hydrides.

ii. CI_2 acts as a bleaching agent.

iii. Noble gases have very low boiling points.

b. Draw the structures of the following :

i. $H_4P_2O_7$

ii. $XeOF_4$

OR

iii. Although nitrogen and chlorine have nearly same electronegative yet nitrogen forms hydrogen bonding while chlorine does not. Why?

iv. What happens when F_2 reacts with water?

v. Write the name of the gas evolved when Ca_3P_2 is dissolved in water.

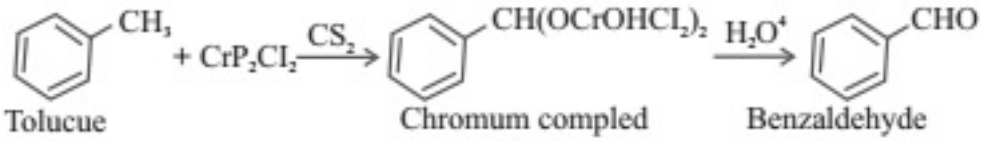
vi. Write the formula of a noble gas species which is isostructural with IBr^-.

vii. Complete the equation :

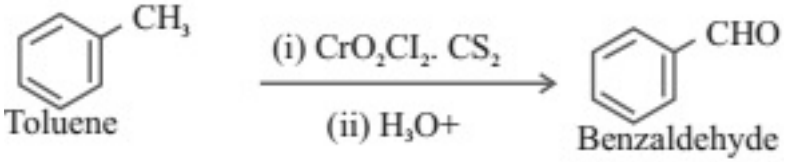
$[Fe(H_2O)_6]^{2+} NO \rightarrow$

Answer Points

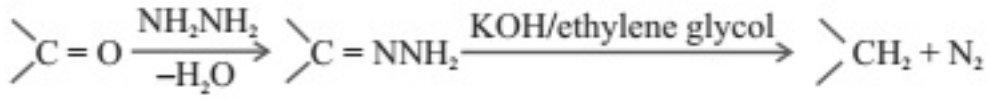
1. $H_2Te > H_2Se > H_2S > H_2O$
2. To make the surface available again for more reaction to occur/ To remove the product formed from the surface of the catalyst.
3. 2- Phenylpropan-2-ol
4. Neopentane, $C(CH_3)_4$
5. P_3Q_2
6. a. Zine to silver
   b. Concentration of Zn^{2+} ions will increase and Ag^{+} lions will decrease.
7. a. Cr^{3+}
   b. Mn^{3+}
   c. Ti^{4+}
   d. Mn^{3+}
8. a.



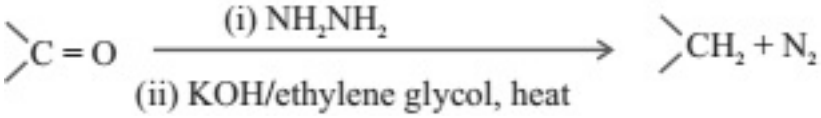
   OR
   b. Etard reaction



   c. Wolff-Kishner reduction:



   or



9. The increase in boiling point of the solvent in a solution when a non-volatile solute is added.
   Because it depends upon molality / the number of solute particles rather than-their

nature/$\Delta T_b \propto m$.

10. a. Tetraamminechloridonitrito-N-cobalt (lll) chloride
    b. $[COCI_2(en)_2]CI$
11. a. In $CuCI_2$, Cu is in +2 oxidation state which is more stable due to high hydration enthalpy as compared to Cu_2Cl_2 in which Cu is in +1 oxidation state.
    b. Due to lanthanoid conraction
    c. Because HCI is oxidised to chlorine.
12. a. Drugs that reduce or abolish pain without causing impairment of consciousnes, mental confusion or paralysis.
    b. Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons/alkylbenzene sulphonate of detergents whose anionic part is involved in cleansing action.
    c. Anacids are chemical compounds which are used for the treatment of excess acid produced in the stomach.
13. $A = \pi r^2$

    = 3.14 × 0.5 × 0.5 cm^2

    = 0.785 cm^2

    l = 45.5 cm

    $\rho = R \times A/1$

    $\rho = 4.55 \times 10^3\Omega \times 0.785cm^2/45.5cm$

    $\rho = 78.5\Omega$ cm conductivity, k = 1/p

    = 1/78.5 S cm^{-1} = 0.0127 S cm^{-1}

    Molar conductivity Am = k × 1000/C

    = 0.0127 S cm^{-1} × 1000/0.05 mol/xm^3

    = 254.77 S cm^2 mol^{-1}

    OR

    $A = \pi r^2$

    = 3.14 × 0.5 × 0.5 cm^2

    = 0.785 cm^2

    l = 45.5 cm

    $= G^* = l/A = 4.45 \times 10^3\Omega$

= 1.27×10^{-2} S cm^{-1}

= 57.96 cm^{-1}

l = G*/R

$= 57.96\ cm^{-1}/4.55 \times 10^{3}\Omega$

= 1.27×10^{-2} S cm^{-1}

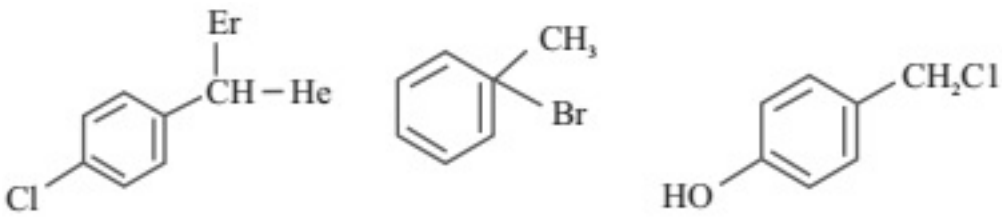
Am = K × 1000/C

= [1.27×10^{-2} S cm^{-1}] × 1000 / 0.05 mol/cm^3

= 254.77 S cm^2 mol^{-1}

14. a. The particles of the dispersed phase have no affinity for the dispersion medium/solvent repelling (hating) colloidal sols.
    Example: metal and their sulphids
    b. The reactant and the catalyst are in the same phase.
    $CH_3COOCH_3(l) + H_2O(l)$ $CH_3COOH(aq) + CH_3OH(aq)$
    c. Oil is dispersed in water/Oil is dispersed phase and water is dispersion medium.
    Ex- milk (or any other correct example)
    OR

Physisorption	Chemisorption
Because of van der Waals forces	Caused by chemical bond formation
Reversible	Irreversible
Enthalpy of adsorption is low(20-40 kJ/mol)	Enthalpy of adsorption is high(80-240)kJ/mol

15. 

16. Given : T_b of glucose solution = 100.20°C

$\Delta T_b = K_b.m$

m = 0.20/ 0.512

m = 0.390 mol/kg

$\Delta T_f = K_f.m$

$\Delta T_f = 1.86K\ kg/mol \times 0.390 mol/kg$

$\Delta T_f = 0.725K$

Freezing point of solution = 273.15 k – 0.725

= 272.425 K

17. a. i. Vapour phase refining/ van Arkel method 76.
    ii. Zone refining 77.
    iii. Electrolytic refining b.
    b. i. Froth floation process
    ii. Magnetic separation
    iii. Leaching
18. a. For bcc structure

    a = 4r/ or r = a/4

    r = × 400 pm /4

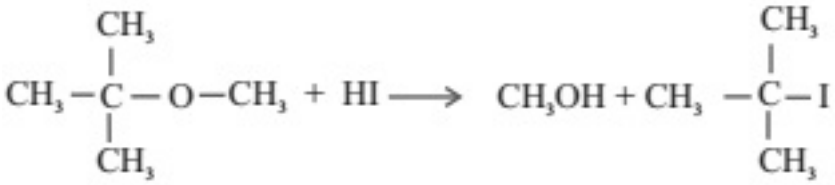
    = 1.732 × 400 pm/4

    = 173.2 pm h
    b. i. Impurity defect
    ii. Cationic vacancies are created.
19. a. Due to steric hindrance and +1 effect caused by two alkyl groups in propanone.
    b. Due to electron withdrawing nature of $–NO_2$ group which increases the acidic strength and decreases the pKa value.
    c. $(CH_3)_2CH$-CHO has one a -H atom whereas a- H atom is absent in $(CH_3)_3C$-CHO.
20. a. Chloroprene, $CH_2=C(CI)-CH=CH_2$
    b. 1,3-Butadiene & Acrylonitrile

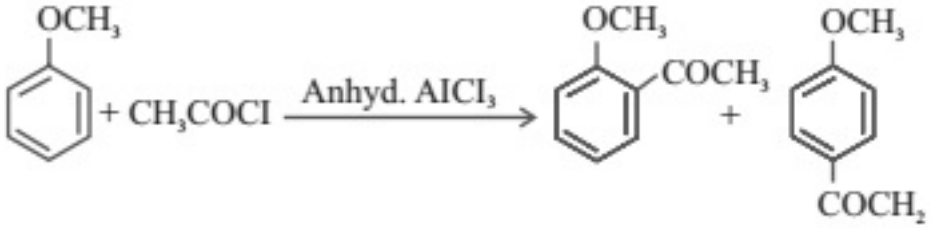
    $CH_2 = CH – CH = CH_2$ & $CH_2= CHCN$
    c. 3-Hydroxy butanoic acid & 3-Hydroxy pentanoic acid

    $CH_3CH(OH)CH_2COOH$ & $CH_3CH_2CH(OH)CH_2COOH$
21. a. It is the magnitude of difference in energy between the two sets of d orbital i.e. t_{2g} and e_g

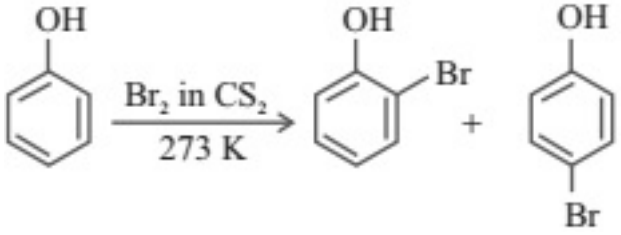
    $t_{2g}^4 eg^\circ$
    b. sp^3d^2, paramagnetic
22. a. Methanol and 2-methyl-2-iodopropane are formed.



b. 2-Methoxy acetophenone and 4-Methoxy acetophenone are formed



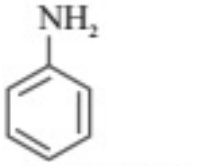
c. o-Bromophenol and p-Bromophenol are formed.



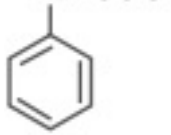
(Award full marks if the student writes only equation)

23. a. Concerned, caring, socially alert, leadership (or any other 2 values)
    b. starch
    c. α -Helix and β -pleated sheets
    d. Vitamin B / B_1 / B_2 / B_6 / C (any two)

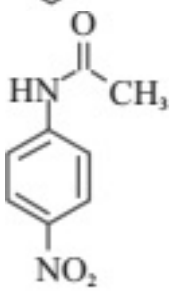
24. A.

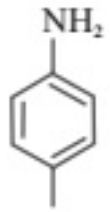


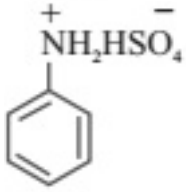
B.

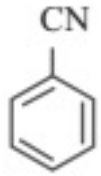


C.

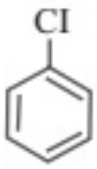


D. 

E. 

a. i. 

ii. 

iii. 

b. $C_6H_5NH_2 < C_6H_5CH_2NH_2 < CH_3NH_2 < (CH_3)_2\ NH$

c. Add $NaNO_2$ + HCI to both the compounds at 273K followed by addition of phenaol.

Aniline gives orange dye (or any other correct test)

25. a. $k = \frac{2.303}{t}\log\frac{[A]_0}{[A]}$

$= \frac{2.303}{40}\log\frac{100}{25}$

$= \frac{2.303}{40}\log 4$

$= \frac{2.303}{40} \times 0.6021$

= 0.0347 min^{-1}

$= t_{1/2} = \frac{0.693}{k}$

$= t_{1/2} = \frac{0.693}{0.0347 min^{-1}}$ = 19.98, min 20 min

b. i. first order reaction

ii. Zero order reaction

OR

iii. Rate = k $[NO]^{x}$ $[O2]^{y}$

7.2×10^{-2} = k $[0.3]^{x}$ $[0.2]^{y}$ --------- Eqn (1)

6.0×10^{-3} = k $[0.1]^{x}$ $[0.1]^{y}$ --------- Equ (2)

2.88×10^{-1} = k $[0.3]^{x}$ $[0.4]^{y}$ ------- Equ (3)

2.40×10^{-2} = k $[0.4]^{x}$ $[0.1]^{y}$ ------- Equ (4)

Dividing equ 4 by eqn 2

$$\frac{2.40\times10^{-2}}{6.0\times10^{-3}} = \frac{k[0.4]\times[0.1]^{y}}{k[0.1]\times[0.1]^{y}}$$

x = 1

Dividing equ 3 by equ 1

$$\frac{2.88\times10^{-1}}{7.2\times10^{-2}} = \frac{k[0.3]\times[0.4]^{y}}{k[0.3]\times[0.2]^{y}}$$

y = 2

order w.r.t. NO = 1, order w.r.t. O_2 is 2

iv. Rate law

Rate = k $[NO]^{1}$ $[O_2]^{2}$, The overall order of the reaction is 3.

v. rate constant $k = \frac{rate}{[NO]^{1}[O_2]^{2}} = \frac{7.2\times10^{-2}}{0.3\times(0.2)^{2}}$

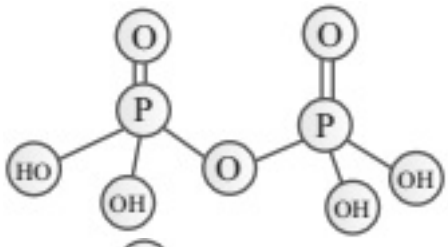
k = 6.0 mol^{-2} L^{2} min^{-1}

26. a. i. Thermal stability of hydrides decreases down the group/ Bond dissociation enthalpy decreases down the group.

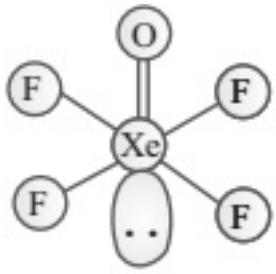
ii. Because Cl_2 in presence of moisture liberates nascent oxygen.

iii. Interatomic interactions are weak

b. i.



ii.



OR

a. Size of nitrogen is smaller than Chlorine.
b. $2F_2 + 2H_2O + \rightarrow 4HF + O_2$ / HF and O_2 are produced
c. PH_3 Phosphine
d. XeF_2
e. $[Fe(H_2O)_6]^{2+}$ NO → $[Fe(H_2O)_5(NO)]^{2+}$ H_2O