Solved Practice Paper-1

Class : XI—Chemistry (Theory)

Time Allowed : 3Hrs **M.M. : 70**

General Instructions :

(a) All questions are compulsory.

(b) Q. No. 1 to 5 are very short answer type questions and carry one mark each.

(c) Q. No. 6 to 12 are short answer type questions and carry 2 marks each.

(d) Q. No. 13 to 24 are short answer type questions and carry 3 marks each.

(f) Q. No. 25 to 27 are long answer type questions and carry 5 marks each.

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1. Which of the following has maximum number of significant figure ?
   (i) 0.00453 (ii) 4.8046 (iii) 5.643.

2. How are 0.5 m NaOH and 0.5 M NaOH different from each other ?

3. Explain why Na^+ is smaller in size than Na atom.

4. Draw resonating structures of CO_3^{2-} ion.

5. Define unit cell.

6. Determine the emperical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass. [Atomic mass : Fe = 55.85, O = 16.00]

7. (a) Write the electronic configuration of Cu^{2+} ion.
   (b) Why are Bohr's orbits called stationary states?

8. (a) How many subshells are associated with $n = 4$?
   (b) How many electrons will be present in the subshells having m_s value of $-\dfrac{1}{2}$ for $n = 4$?

9. (a) What do you understand by isoelectronic species ?

(b) Write a cation and an anion which is isoelectronic with Ar.

10. Give the shapes of following covalent molecules using VSEPR theory :

(i) NH_3 (ii) ClF_5

Or

(a) Use molecular orbital theory to product why Be_2 molecule does not exist.

(b) Compare the stability of O_2^+ and O_2^-.

11. Rain damages the monuments like Taj Mahal in Agra when industries are present near by. Why?

12. Discuss the relationship between Green house effect and Global warming.

13. The work function for caesium atom is 1.9 eV. Calculate.

(a) The threshold wavelength.

(b) If the caesium element is irradited with a wavelength of 500 nm, calculte the kinetic energy of ejected electron. [Given 1 eV = 1.602×10^{-19}J]

14. Use the periodic table to identify the following :

(a) A group whose elements show valence 2 and 6.

(b) A metal which can form a predominantly stable covalent halide of the formula MX.

(c) The group having metalloid, non-metal liquid as well as gas at room temperature.

15. Compare the relative stabilities of O_2^- & N_2^+ and comment on their magnetic behaviour.

16. Give reasons for the following :

(i) H_2O has higher boiling point than HF.

(ii) Ice foats on the surface of water.

(iii) KHF_2 exists but $KHCl_2$ does not.

17. What is the hybridisation of the central atom in (i) H_3O^+, (ii) XeF_2, (iii) XeF_4? What are their geometry?

18. (a) In terms of Charle's law, explain why – 273°C is the lowest temperature ?

(b) 20 mL of hydrogen measured at 15°C are heated to 35°C, what is the new volume at the same pressure.

**19.** Define van der waal's equation. The van der Waal's constants for two gases are as follows :

Gas	a (atm L^2 mol^{-1})	b(L mol^{-1})
X	1.39	0.0391
Y	3.59	0.427

Which of them more easily liquefiable and which has greater molecular size ?

20. (a) Name the different salts that causes permanent hardness of water. (any two)

(b) How do we obtain demineralised water from hard water after passing it from synthetic ion exchange resins ? Give reaction ?

21. What happen when :

(a) Boric acid is added to water.

(b) Al is treated with dil. NaOH.

(c) BF_3 is treated with NH_3

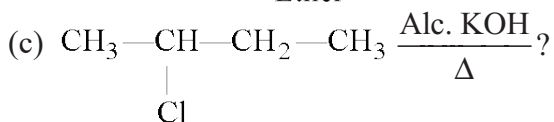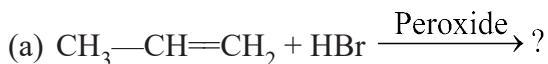**22.** Write IUPAC names of the following :

(a)   (b)

(c)
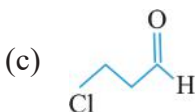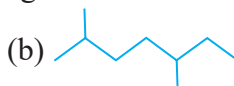
23. Write the naming reactions :

(i) Wurtz reaction

(ii) Decarboxylation of sodium salt of fatty acid

(iii) Friedal Craft alkylation reaction.

Or

Complete the following reactions :

(a) CH_3—CH=CH_2 + HBr $\xrightarrow{\text{Peroxide}}$?

(b) CH_3—Cl + Na $\xrightarrow[\text{Ether}]{\text{Dry}}$?

(c) CH_3—CH—CH_2—CH_3 $\xrightarrow[\Delta]{\text{Alc. KOH}}$?
    |
    Cl

24. (a) Mention two similarities in the behaviour of Be and Al to show that they have diagonal relationship.

(b) What is the biological importance of Na in our body ?

25. (a) What happens when :

    (i) Propene is treated with HBr.

    (ii) Benzene is treated with methyl chloride in the presence of anhydrous. $AlCl_3$.

    (iii) When methyl bromide treated with sodium metal in presence of dry ether.

 (b) Justify that phenolic group in aromatic benzene is ortho and para directing.

Or

(a) How is benzene obtained from ethyne ? What is process called ?

(b) What happens when ethyne is heated with water in the presence of mercuric sulphate and dilute hydrochloric acid ?

(c) What is Markovnikov's Kov rule ?

26. (a) Equilibrium constant for a reaction is 10. What will be the equilibrium constant for the reverse reaction ?

  (b) Write the conjugate acids for the Bronsted base OH^- and CH_3COO^-.

  (c) Determine the pH of 10^{-8} MHCl solution taking into account the H^+ produced by water also. (Given log 11 = 1.0414).

27. (a) Propanal and pentan-3-one are the ozonolysis product of an alkene. What is the structural formula of the alkene ?

  (b) An Alkyl halide (A) of formula $C_6H_{13}Cl$ on treatment with alcoholic KOH give two isomeric alkenes (B) and (C)(C_6H_{12}). Both alkenes on hydrogenation give 2, 3-dimethylbutane. Predict the structure of A, B and C.

Marking Scheme

1. 4.8046.

2. In 0.5 m NaOH, 1 mol NaOH present in 1 kg solvent while in **1.**0 M NaOH, 1 mol NaOH present in 1 L of solution.

3. Na^+ has only 2 shells and more effective nuclear charge.

4.
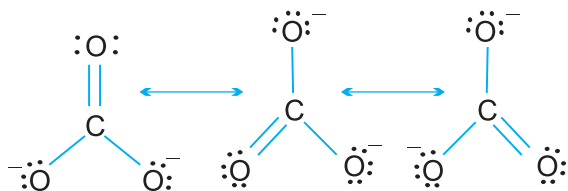


5. Correct definition of unit cell

6.

| Element	% by mass	At. mass	Relative atoms	Simple Whole number ratio	
Fe	69.9	55.85	$\dfrac{69.9}{55.85} = 1.25$	1	2
O	30.1	16.00	$\dfrac{30.1}{16.00} = 1.88$	1.5	3

Empirical formula : Fe_2O_3

7. (a) Cu^{2+} (27) : $[Ar]3d^9 4s°$.

   (b) When an electron is revolving in Bohr's orbit it does not lose energy.

8. (a) $n = 4, l = 0, 1, 2, 3$

   s, p, d, f subshells are associated with $n = 4$.

   (b) Total number of electrons in shell $n = 4$ is 32 half of this $i.e.$, 16 elements will have $m_s = -\dfrac{1}{2}$.

9. (a) The species having the same number of electrons are called isoelectronic species.
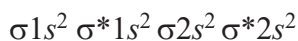
   (b) Ca^{2+}, Cl^-

10. (i)

   (ii)
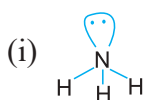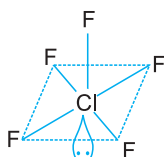
(a) M.O. configuration of Be_2 molecule is :

$\sigma 1s^2 \, \sigma^* 1s^2 \, \sigma 2s^2 \, \sigma^* 2s^2$

Bond order $= \dfrac{1}{2}(4 - 4) = 0$

Since bond order is zero, Be_2 molecule is not possible.

(b) B.O. $(O_2^+) = \dfrac{1}{2}(10 - 5) = 2.5$

B.O. $(O_2^-) = \dfrac{1}{2}(10 - 7) = 1.5$

Since B.O. of O_2^+ is more than that of O_2^-, O_2^+ is more stable.

11. Industries produce lot of oxides of Nitrogen and Sulphur which dissolve in rain water to form H_2SO_4 and HNO_3. The rain thus becomes acid rain. The marble $(CaCO_3)$ of the monuments is attacked by these acids and get decayed.

12. Green house effect traps the incoming radiations of sun. With day by day depletion fo ozone layer. More UV radiations enter the atmosphere. As an effect of the green house, they remain trapped in atmosphere, this leads to rise in temprature of the Earth, which is called Global warming.

13. (a) $W_0 = \dfrac{hc}{\lambda_0}$, $\lambda_0 = \dfrac{hc}{W_0}$

$$\lambda_0 = \dfrac{6.626 \times 10^{-34}\,Js \times 3 \times 10^8\,ms^{-1}}{1.9 \times 1.6 \times 10^{-19}\,J} = 6.538 \times 10^{-7}\,m$$

(b) $E = W_0 + K.E.$

$\dfrac{hc}{\lambda} = \dfrac{hc}{\lambda_0} + K.E.$

$K.E. = hc\left[\dfrac{1}{\lambda} - \dfrac{1}{\lambda_0}\right]$

$= 6.626 \times 10^{-34} \times 3 \times 10^8 \left(\dfrac{1}{5 \times 10^{-7}} - \dfrac{1}{6.54 \times 10^{-7}}\right)$

$= 19.878 \times 10^{-19}\left(\dfrac{1}{5} - \dfrac{1}{6.54}\right)$

$= 19.88 \times 10^{-19}\,(0.2 - 0.15)$

$= 0.994 \times 10^{-19}\,J$

14. (a) Group-16

   (b) Lithium

   (c) Group-17

15. M.O. electronic configuration of O_2^-

   $= \text{Bond order} = \dfrac{1}{2}(8-5) = \dfrac{3}{2} = 1.5$

   M.O. electronic configuration of N_2^+

   $\text{Bond order} = \dfrac{1}{2}(7-2) = \dfrac{5}{2} = 2.5$

   As bond order of $N_2^+ >$ bond order of O_2^-. Therefore, N_2^+ is more stable than O_2^-.

16. (i) Due to strong hydrogen bonding or greater intermolecular hydrogen bonding in H_2O than in H-F. H_2O forms four bond with other water molecule wheres HF forms only two H-bonds.

   (ii) Density of ice is less than (water) liquid form.

   (iii) Due to H-bonding in HF H—F.....H—F.....H—F. This can dissociate to give HF_2^- ion and hence KHF_2 exists but no H-bnding in H—Cl. So HCl_2^- ion not exist.

17. (i) sp^3, pyramidal.

   (ii) sp^3d, linear.

   (iii) dsp^2, square planar.

18. (a) At $-273°C$, volume of the gas becomes equal to zero *i.e.*, the gas ceases to exist.

   (b) According to Charle's law : $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$

   $V_1 = 20$ mL $V_2 = ?$ mL

   $T_1 = 15 + 273 = 288$ K $T_2 = 35 + 272 = 308$ K

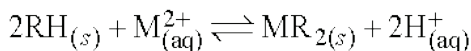 $V_2 = \dfrac{V_1 T_2}{T_1} = \dfrac{20}{288} \times 308 = 21.38$

   Volume of hydrogen gas at $35°C = 21.38$ mL

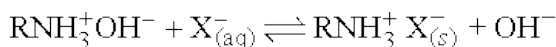**19.** (a) $\left(P + \dfrac{an^2}{V^2} \right)(V - nb) = nRT$

   (b) Greater the value of 'a', more easily the gas is liquefiable. Similarly, greater the value 'b' greater is the molecular size. Hence, gas 'y' will be more easily liquefiable and will have greater molecular size.

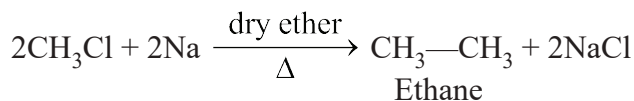**20.** (a) $CaCl_2$, $MgCl_2$

(b) In cation exchange resin

$$2RH_{(s)} + M^{2+}_{(aq)} \rightleftharpoons MR_{2(s)} + 2H^+_{(aq)}$$

In anion exchange resis

$$RNH_3^+OH^- + X^-_{(aq)} \rightleftharpoons RNH_3^+ X^-_{(s)} + OH^-$$

Finally $H^+ + OH^- \rightleftharpoons H_2O(l)$

21. (i) $B(OH)_3 + 2H_2O \rightarrow B(OH)_4^- + H_3O^+$
(ii) $2Al + 2NaOH + 6H_2O \rightarrow 2Na[Al(OH)_4] + 3H_2$
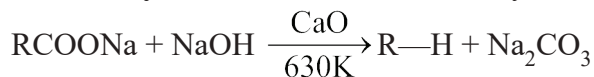(iii) $BF_3 + NH_3 \rightarrow [H_3N \rightarrow BF_3]$ (Adduct)

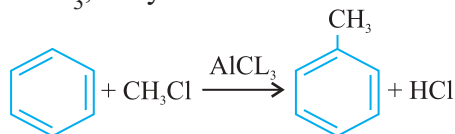**22.** IUPAC names of the compounds are:
(i) Propylbenzene
(ii) 2, 5 - Dimethylheptane
(iii) 3-Chloropropanal

23. (i) **Wurtz's reaction :**

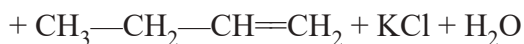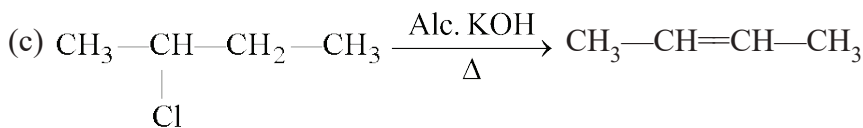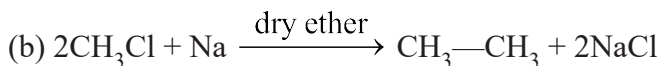$$2CH_3Cl + 2Na \xrightarrow[\Delta]{\text{dry ether}} CH_3\text{---}CH_3 + 2NaCl$$
$$\text{Ethane}$$

(ii) **Decarboxylation** of sodium salt of fatty acid with soda line.

$$RCOONa + NaOH \xrightarrow[630K]{CaO} R\text{---}H + Na_2CO_3$$

(iii) **Friedal Craft reaction:** When benzene treated with alkyl halide in presence of $AlCl_3$, Alkyl benzene in formed.

OR

(a) $CH_3\text{---}CH = CH_2 + HBr \xrightarrow{\text{Peroxide}} CH_3\text{---}CH_2\text{---}CH_2\text{---}Br$

(b) $2CH_3Cl + Na \xrightarrow{\text{dry ether}} CH_3\text{---}CH_3 + 2NaCl$

(c) $CH_3\text{---}\underset{\underset{Cl}{|}}{CH}\text{---}CH_2\text{---}CH_3 \xrightarrow[\Delta]{\text{Alc. KOH}} CH_3\text{---}CH=CH\text{---}CH_3$

$$+ CH_3\text{---}CH_2\text{---}CH=CH_2 + KCl + H_2O$$
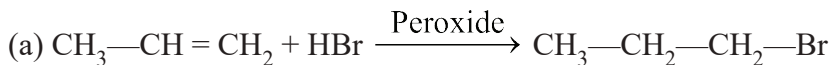
24. (a) (i) Like Al, Be is not readily attacked by acids because of the presence of an oxide film on the surface metal.

(ii) $Be(OH)_2$ dissolved in excess of NaOH to give $[Be(OH)_4]^{2-}$ just as $Al(OH)_3$ dissolve in NaOH to form $[Al(OH)_4]^{-1}$.

(b) Na^+ ions are present in blood plasma and in the interstitial fluid. These ions participate in the transmission of nerve signals and in regulating the flow of water across cell membranes.

25. (a) (i) CH_3—CH=CH_2 + HBr $\longrightarrow$ CH_3 — CH — CH_3

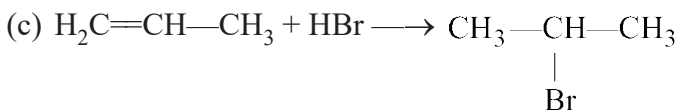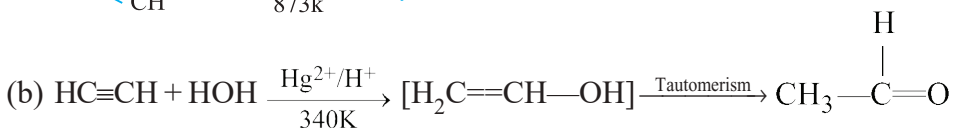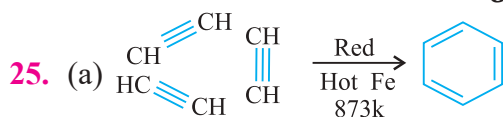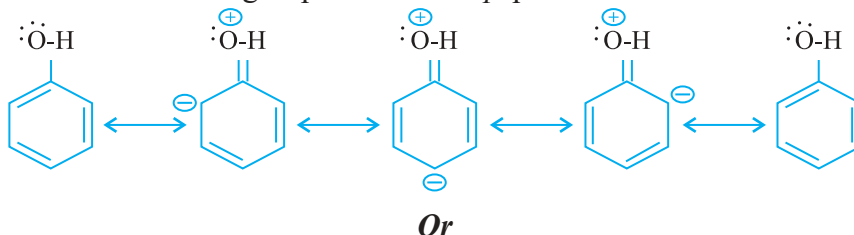$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ |

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ Br

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 2 – Bromopropane

(ii)

$+ CH_3Cl \xrightarrow[AlCl_3]{Anhy}$ (toluene) $+ HCl$

Towene

(iii) $2CH_3Br + 2Na \xrightarrow[\text{ether}]{\text{dry}} CH_3$—$CH_3 + 2NaBr$
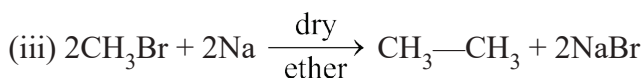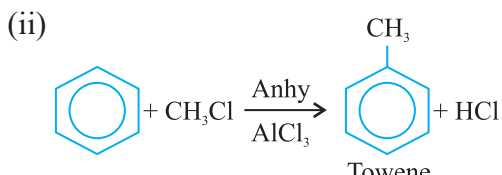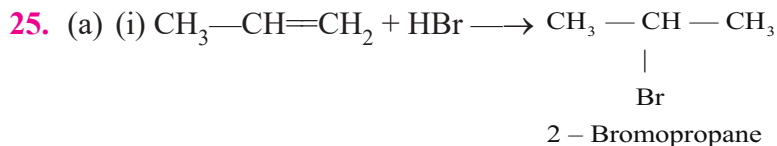
(b) This is because of + R (resonance effect) —OH group. The electron density is increased at o- and p-positions as compared to at m-position. Hence the new group will enter at p-position.

Or

25. (a)

$\xrightarrow[\text{Hot Fe} \atop 873k]{\text{Red}}$

(b) $HC\equiv CH + HOH \xrightarrow[340K]{Hg^{2+}/H^+} [H_2C{=}{=}CH{-}OH] \xrightarrow{\text{Tautomerism}} CH_3{-}\overset{\overset{\displaystyle H}{|}}{C}{=}O$

(c) $H_2C{=}CH{-}CH_3 + HBr \longrightarrow CH_3$—CH—$CH_3$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad$ |

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad$ Br

26. (i) $K = \dfrac{1}{10} = 0.1$

(ii) H_2O, CH_3COOH

(iii) Total $[H_3O^+] = [H_3O^+]_{acid} + [H_3O^+]_{H2O}$

$\qquad = 10^{-8} + 10^{-7}$

$\qquad = 11 \times 10^{-8}\,M$

$pH = -\log(H_3O^+)$

$pH = -\log(11 \times 10^{-8})$

$pH = -(\log 11 + \log 10^{-8})$

$pH = 8 - \log 11$

$pH = 8 - 1.0414 = 6.9586$

27. (a) $CH_3 - CH_2 - CH = C - CH_2 - CH_3$
$\qquad\qquad\qquad\qquad\quad |$
$\qquad\qquad\qquad\qquad\; C_2H_5$

3-Ethylhex - 3- ene

(b) (i)
$\qquad\qquad\quad CH_3$
$\qquad\qquad\qquad |$
$\qquad CH_3 - C - CH - CH_3$
$\qquad\qquad\quad | \quad\;\; |$
$\qquad\qquad\; Cl \quad CH_3$

(ii) $CH_3 - C = C - CH_3$
$\qquad\qquad\quad | \quad\;\; |$
$\qquad\qquad\; CH_3 \; CH_3$

(iii) $CH_2 = C - CH - CH_3$
$\qquad\qquad\quad\; | \quad\;\; |$
$\qquad\qquad\;\; CH_3 \; CH_3$