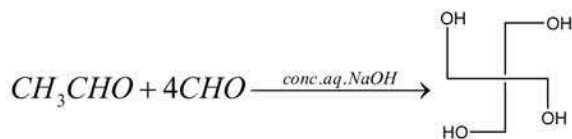# CHEMISRY

SECTION – I
(SINGLE CORRECT CHOICE TYPE)

This section contains 10 multiple choicse questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONLY ONE is correct

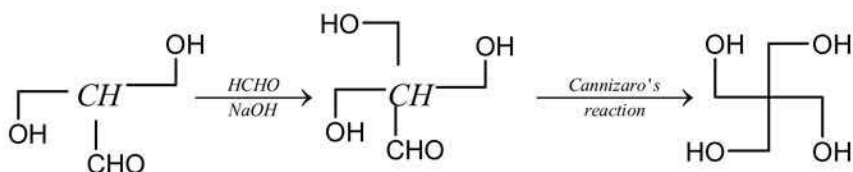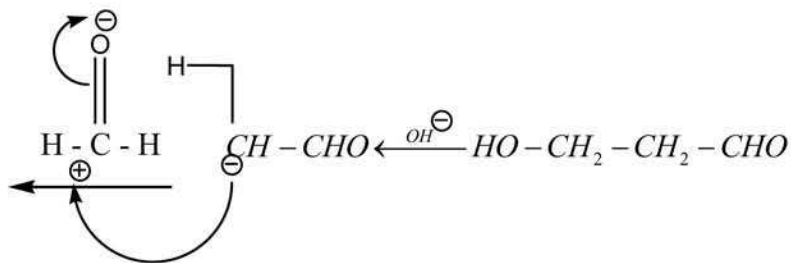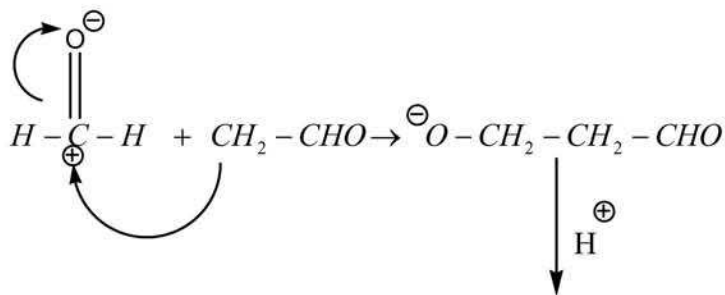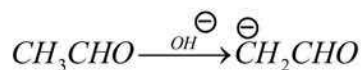21. The number of aldol reaction(s) that occurs in the given transformation is

$$CH_3CHO + 4CHO \xrightarrow{conc.aq.NaOH}$$

a) 1   b) 2   c) 3   d) 4

Ans : C

$$CH_3CHO \xrightarrow{\overset{\ominus}{OH}} \overset{\ominus}{C}H_2CHO$$

$$H-\overset{\overset{\ominus}{O}}{\underset{\oplus}{C}}-H \; + \; CH_2-CHO \rightarrow \overset{\ominus}{O}-CH_2-CH_2-CHO$$

$$\downarrow \overset{\oplus}{H}$$

$$H-\overset{\overset{\ominus}{O}}{\underset{\oplus}{C}}-H \quad \overset{\ominus}{C}H-CHO \xleftarrow{\overset{\ominus}{OH}} HO-CH_2-CH_2-CHO$$
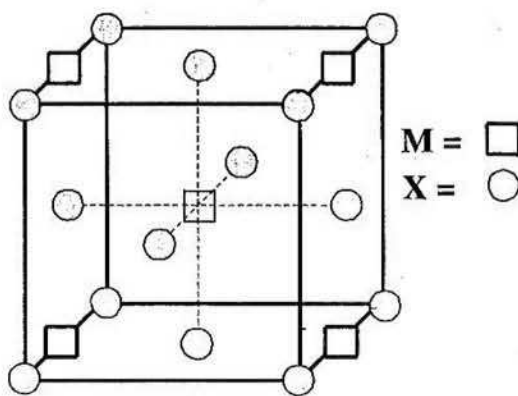

Number of aldol reaction = 3

22. A compound M_pX_p has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is
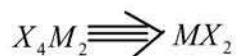

M = □
X = ○

a) MX   b) MX_2 c) M_2X d) M_5X_{14}

Ans : B

X :   Corner $8 \times \dfrac{1}{8} = 1$

       Face center $6 \times \dfrac{1}{2} = \dfrac{3}{\underline{4}}$

M :   Edge centre $4 \times \dfrac{1}{4} = 1$

       Body center $1 \times 1 = \dfrac{1}{\underline{2}}$

$X_4 M_2$

$X_4 M_2 \Longrightarrow MX_2$

23. The carbonyl functional group (–COOH) is present in

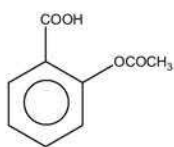a) picric acid   b) barbituric acid   c) ascorbic acid   d) aspirin

Ans : D
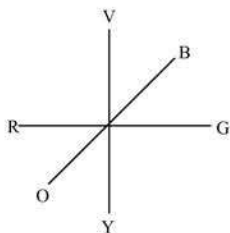
Acetyle salicylic acid = Asprin

24. The colour of light absorbed by an aqueous solution of $CuSO_4$ is :

    a) organe-red   b) blue-green   c) yellow   d) violet
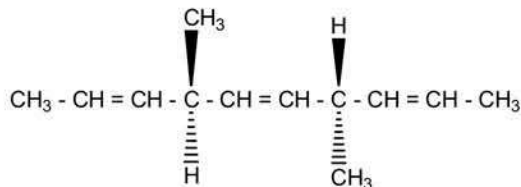
Ans : A

Orange - red is absorbed

Based up on Munshell wagon wheel

25. The number of optically active products obtained from the complete ozonolysis of the given compound is :
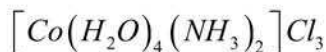

    a) 0   b) 1   c) 2   d) 4

Ans : A

As the ozonolysis products do not have chiral centres, number of optically active products = 0
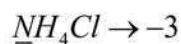
26. As per IUPAC nomenclautre, the name of the complex $\left[Co(H_2O)_4 (NH_3)_2 \right] Cl_3$ is

    a) Tetraaqudiaminecobalt (III) chloride   b) Tetraaquadiamminecobalt (III) chloride

    c) Diammineteraaquacobalt (III) chloride   d) Diamminetetraaquacobalt (III) chloride

Ans : D

$$\left[Co(H_2O)_4 (NH_3)_2 \right] Cl_3$$

Diammineteraaquacobalt (III) chloride

27. Which ordering of compound is according to the decreasing order of the oxidation state of nitrogen ?

    a) HNO_3, NO, NH_4Cl, N_2 b) HNO_3, NO, N_2, NH_4Cl

    c) HNO_3, NH_4Cl, NO, N_2 d) NO, HNO_3, NH_4Cl, N_2

Ans : B

$HN\underline{O}_3 \rightarrow +5$

$\underline{N}O \rightarrow +2$

$N_2 \rightarrow 0$

$\underline{N}H_4Cl \rightarrow -3$

Decreasing order of

O -S = HNO_3, NO, N_2, NH_4Cl
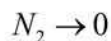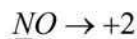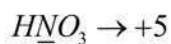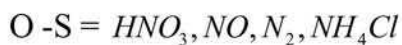
28. For one mole of a van der Waals gas when b = 0 and T = 300 K, the PV vs. I/V plot is shown below. The value of the van der Waals constant a (atm. liter^2 mol^{-2}) is
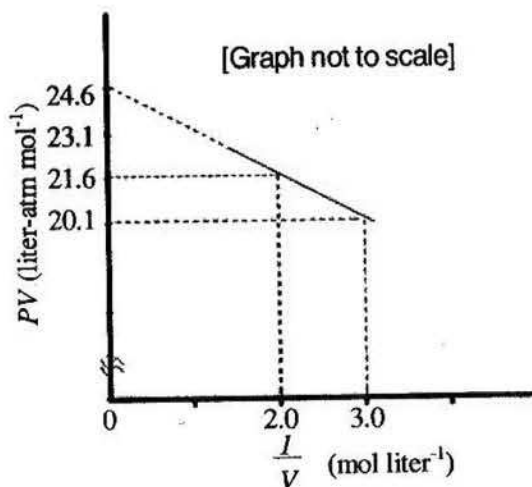
a) 1.0   b) 4.5   c) 1.5   d) 3.0

Ans : C

$$\left(P + \frac{n^2 a}{v^2}\right)(v - nb) = nRT \text{ ,}$$

n = 1, b = 0

$$\left(p + \frac{q}{v^2}\right)(v - b) = RT$$

$$pv + \frac{a}{v} = RT$$

$$pv = RT - \frac{a}{v}$$

$$y = c + mx \therefore |m| = |a| = |slop| = \frac{21.6 - 20.1}{3 - 2} = 1.5 \; atm.\left(t^2 \, mole^{-2}\right)$$

29.   In allene (C_3H_4), the type(s) of hybridisation of the carbon atoms is (are)

a) sp and sp^3 b) sp and sp^2 c) only sp^2 d) sp^2 and sp^3

Ans : B

$$H_2C = C = CH_2$$

$$sp^2 \quad sp \quad sp^2$$
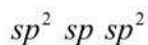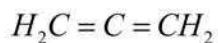
30.   The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius]

a) $\dfrac{h^2}{4\pi^2 m a_0^2}$ b) $\dfrac{h^2}{16\pi^2 m a_0^2}$ c) $\dfrac{h^2}{32\pi^2 m a_0^2}$ d) $\dfrac{h^2}{64\pi^2 m a_0^2}$

Ans : C

$$\text{mvr} = \frac{nh}{2\pi}$$

$$\text{v} = \frac{nh}{2\pi mr}$$

for second Bohr's orbit

$$r_2 = 4\,a_0$$

$$\therefore \text{V} = \frac{h}{4\pi m a_0}$$

$$V^2 = \frac{h^2}{16\pi^2 m^2 a_0^2}$$

$$\text{K.E} = \frac{1}{2}mv^2 = \frac{h^2}{32\pi^2 m a_0^2}$$

SECTION – II
(MULTIPLE CORRECT ANSWER TYPE)

This section contains 5 multiple choicse questions. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which ONE or More are correct.

31. Which of the following molecules, in prue form, is (are) unstable at room temperature ?

a) b) c) d)

Ans : BC

cyclobutadiene and cyclopentadien are anti aromatic.

32. Which of the following hydrogen halides react(s) with $AgNO_3(aq)$ to give a precipitate that dissolves in $Na_2S_2O_3(aq)$?

a) HCl   b) HF   c) HBr   d) HI

Ans : ACD

$$AgNO_3 + HX \rightarrow AgX \downarrow HNO_3$$
$$\text{aq} \qquad\qquad\qquad \text{aq}$$

$$AgX + 2Na_2S_2O_3 \rightarrow Na_3\left[Ag(S_2O_3)_2\right] + NaX$$
$$\text{s} \qquad \text{aq} \qquad\qquad\qquad\qquad \text{aq}$$

AgF is soluble

33. Choose the correct reason(s) for the stability of the lyophobic colloidal particles >

a) Preferential adsorption of ions on their surface from the solution

b) Preferential adsorption of solvent of their surface the solution

c) Attraction between different particles having opposite charges on their surface

d) Potential difference between the fixed layer and the diffused layer of opposite charges around the coolidal particles

Ans : AD

34. For an ideal gas, consider only P-V work in going from an initial state X to the final state Z. The can be reached by either of the two paths shown in the figure. Which of the following choice(s) is (are) correct ? [Take ΔS as change in entropy and w as work done]
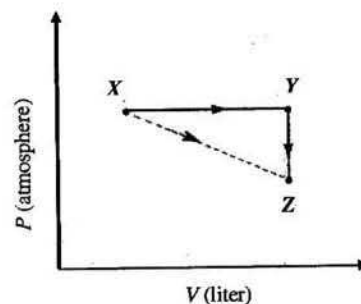
a) $\Delta S_{x \to z} = \Delta S_{x \to y} + \Delta S_{y \to z}$

b) $W_{x \to z} = w_{x \to y} + w_{y \to z}$

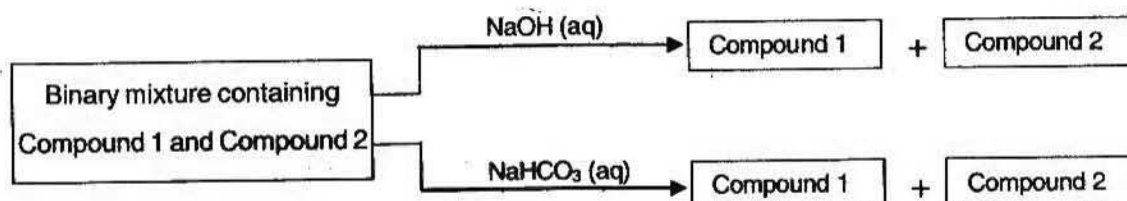c) $w_{x \to y \to z} = w_{x \to y}$

d) $\Delta S_{x \to y \to z} = \Delta S_{x \to y}$

Ans : AC

Based up on the given graph

$$\Delta S_{x \to y} = \Delta S_{x \to y} + \Delta S_{y \to z}$$

$$W_{x \to y \to z} = W_{x \to y}$$

35. Identify the binary mixtrue(s) that can be separated into individual compounds, by differential extraction,a s shown in the given scheme.

a) C_2H_5OH and C_6H_5COOH

b) C_6H_5COOH and $C_6H_5CH_2OH$

c) $C_6H_5CH_2OH$ and C_6H_5OH

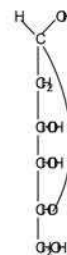d) $C_6H_5CH_2OH$ and $C_6H_5CH_2COOH$

Ans : BD

Benzyl alcohol is insoluble in both NaOH and $NaHCO_3$,

SECTION – III
(INTEGER ANSWER TYPE)
This section contains 5 questions. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

36. When the following aldohexose exists in its B-configuration, the total number

of stereoisomrs in its pyranose form is :

Ans : 8

As the configration at C-5 is fixed, (D-configration), then only 4 stero isomers are possible solution

37. 29.2% (w/w) HCl stock solution has a densityh of 1.25 g mL^{-1}. The molecular weight of HCl is 36.5 g mol^{-1}. The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4 M HCl is :

Ans : 8

Molarity of stock solution $= \dfrac{10 \times d \times x}{GMW}$
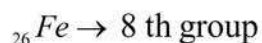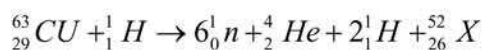
$= \dfrac{10 \times 1.25 \times 29.2}{36.5}$

$=10M$

$V_1 M_1 = V_2 M_2$

$V_1 \times 10 = 200 \times 0.4$

$V_1 = 8 ML(approx)$

38. The periodic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction yielding element X as shown below. To which group,element X belongs int he periodic table ?

Ans : 8

$^{63}_{29}CU + ^{1}_{1}H \rightarrow 6^{1}_{0}n + ^{4}_{2}He + 2^{1}_{1}H + ^{52}_{26}X$

$_{26}Fe \rightarrow$ 8 th group

39. An organic compound undergoes first-order decomposition. The time taken for its decomposition to 1/8 and 1/10 of its initial concentration are $t_{1/8}$ and $t_{1/10}$ respectively. What is the

Ans : 9

$$t_{\frac{1}{8}} = \frac{2.303}{k} \log \frac{a}{\frac{a}{8}}$$

$$t_{\frac{1}{10}} = \frac{2.303}{k} \log \frac{a}{\frac{a}{10}}$$

$$\frac{t_{\frac{1}{8}}}{t_{\frac{1}{10}}} = \frac{\log 8}{\log 10}$$

$$\frac{t_{\frac{1}{8}}}{t_{\frac{1}{10}}} = 3 \log 2$$

$$\therefore \frac{t_{\frac{1}{8}}}{t_{\frac{1}{10}}} \times 10 = 9$$

40. The substituents R_1 and R_2 for nine peptides are listed in the table given below. How many of these peptides are positively charged at pH = 7.0 ?

Ans : 4

At pH below pI(Isoelectric point) Aminoacid exist as Cation. As BasicAminoacids of pH around 9-8, these are expected to exists as cation of pH=7IV,VI,VIII,IX.