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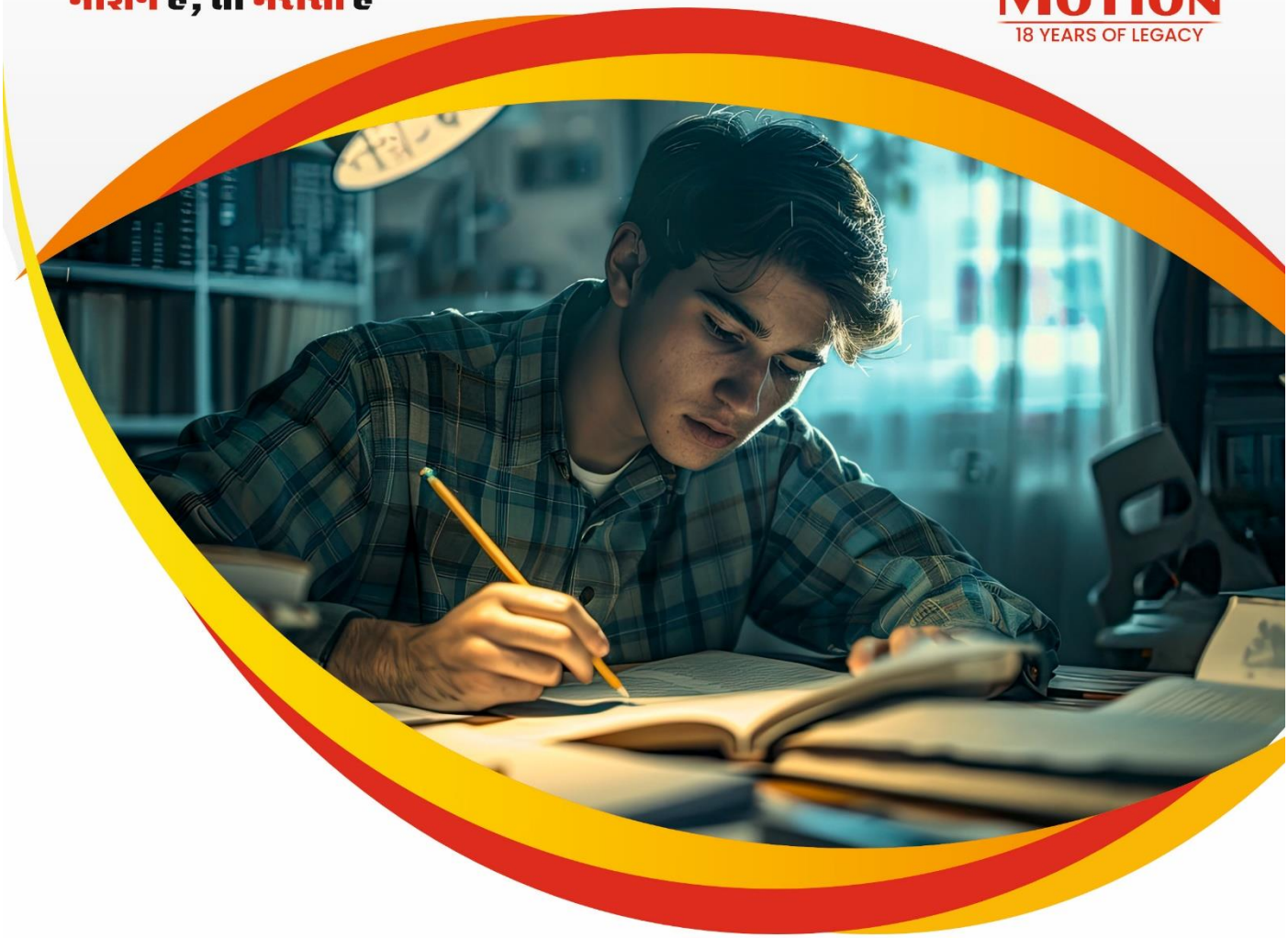


JEE ADVANCED 2025

QUESTION PAPER WITH SOLUTIONS

CHEMISTRY (PAPER-2)

SECTION 1 (Maximum Marks: 12)

- This section contains FOUR (04) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONLY ONE of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : −1 In all other cases.

1. During sodium nitroprusside test of sulphide ion in an aqueous solution, one of the ligands coordinated to the metal ion is converted to

(A) NOS^- (B) SCN^- (C) SNO^- (D) NCS^-

Sol. **A**

NOS^-

$$Na_2S + Na_2[Fe(CN)_5NO] \downarrow \rightarrow Na_4[Fe(CN)_5NOS]$$

2. The complete hydrolysis of ICl, ClF_3 and BrF_5, respectively, gives

(A) IO^-, ClO_2^- and BrO_3^- (B) IO_3^-, ClO_2^- and BrO_3^-

(C) IO^-, ClO^- and BrO_2^- (D) IO_3^-, ClO_4^- and BrO_2^-

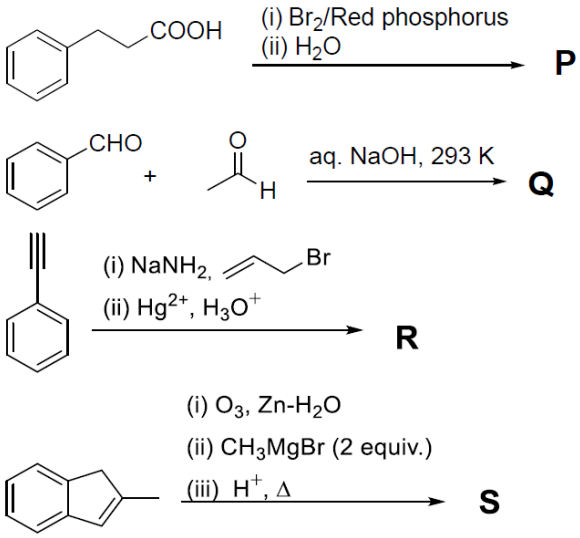
Sol. **A**

$$ICl + H_2O \rightarrow HOI + HCl$$

$$ClF_3 + 2H_2O \rightarrow HClO_2 + 3HF$$

$$BrF_5 + 3H_2O \rightarrow HBrO_3 + 5HF$$

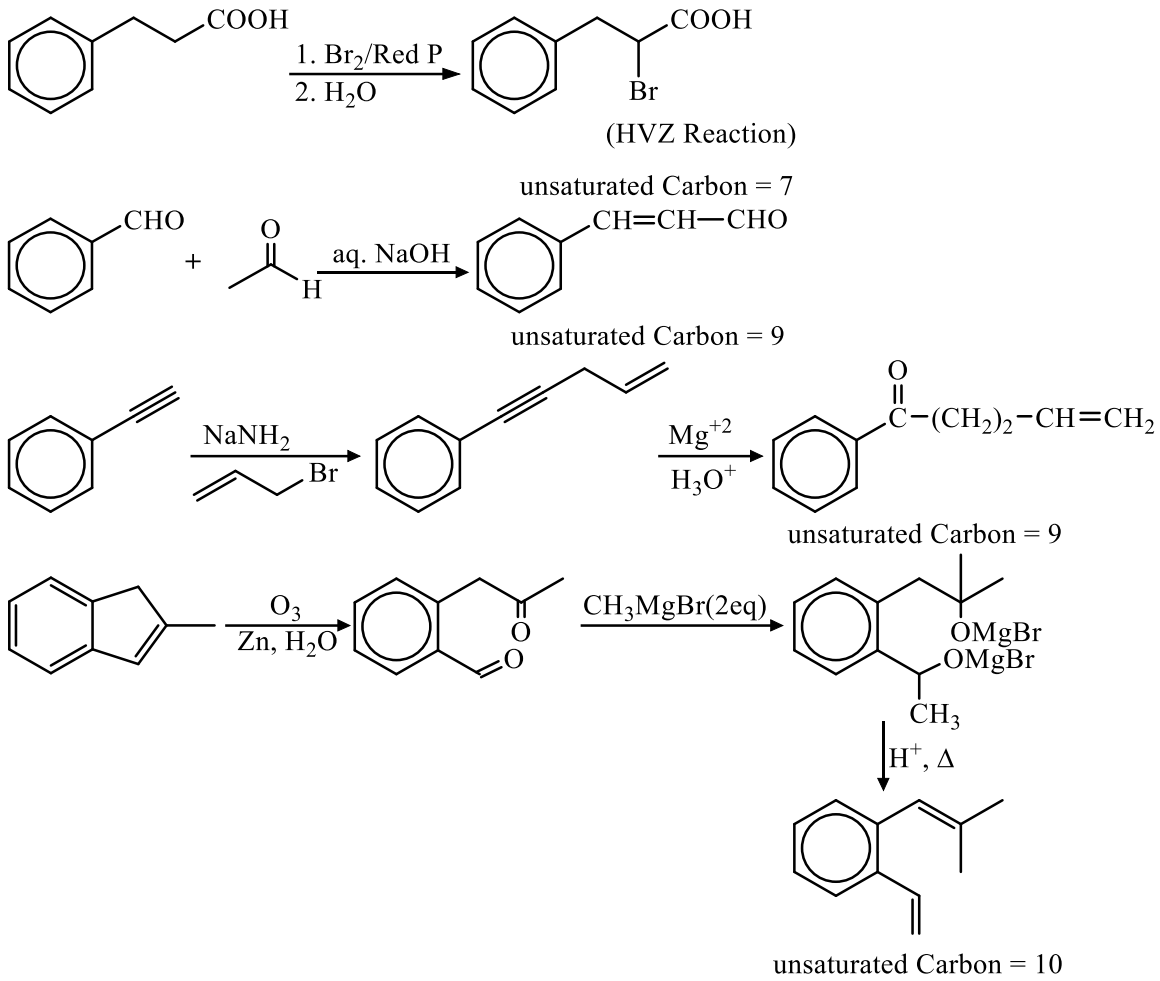
3. Monocyclic compounds P, Q, R and S are the major products formed in the reaction sequences given below.



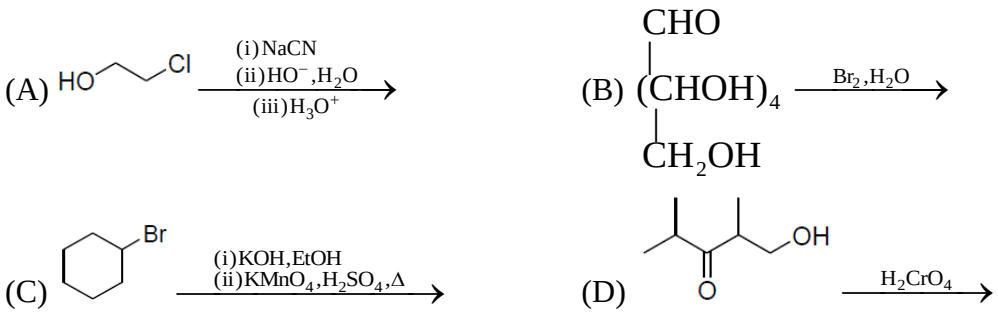
The product having the highest number of unsaturated carbon atom(s) is

(A) P (B) Q (C) R (D) S

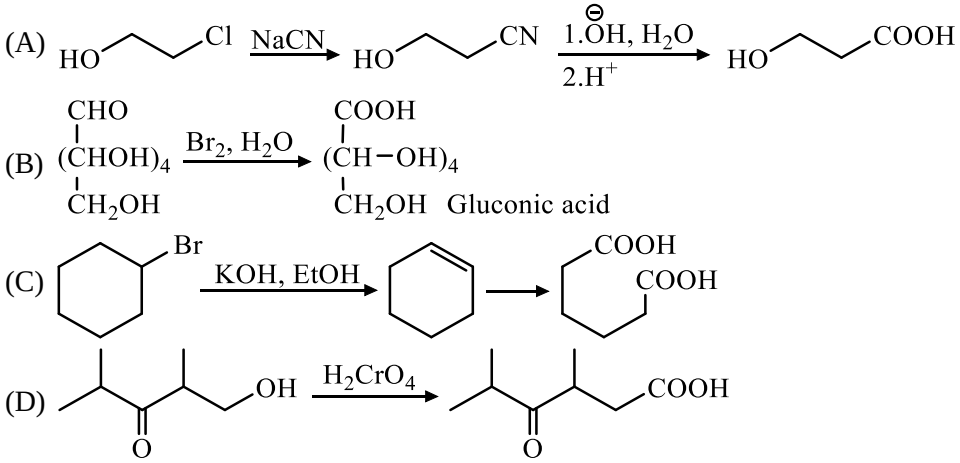
Sol. **D**



4. The correct reaction/reaction sequence that would produce a dicarboxylic acid as the major product is



Sol. **C**



SECTION 2 (Maximum Marks: 16)

- This section contains FOUR (04) questions.
- Each question has FOUR options (A), (B), (C) and (D). ONE OR MORE THAN ONE of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4 ONLY if (all) the correct option(s) is(are) chosen;

  Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;

  Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;

  Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;

  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);

  Negative Marks : −2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then choosing ONLY (A), (B) and (D) will get +4 marks;

  choosing ONLY (A) and (B) will get +2 marks;

  choosing ONLY (A) and (D) will get +2 marks;

  choosing ONLY (B) and (D) will get +2 marks;

  choosing ONLY (A) will get +1 mark;

  choosing ONLY (B) will get +1 mark;

  choosing ONLY (D) will get +1 mark;

  choosing no option (i.e. the question is unanswered) will get 0 marks; and

  choosing any other combination of options will get −2 marks.

5. The correct statement(s) about intermolecular forces is(are)

(A) The potential energy between two point charges approaches zero more rapidly than the potential energy between a point dipole and a point charge as the distance between them approaches infinity.

(B) The average potential energy of two rotating polar molecules that are separated by a distance r has $1/r^3$ dependence.

(C) The dipole-induced dipole average interaction energy is independent of temperature.

(D) Nonpolar molecules attract one another even though neither has a permanent dipole moment.

Sol. **D**

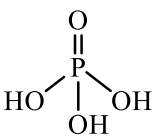
Nonpolar molecules attract one another even thought neither has permanent dipole moment.

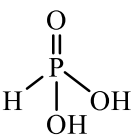
(Rest of all options are incorrect)

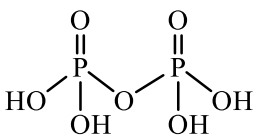
6. The compound(s) with P–H bond(s) is(are)

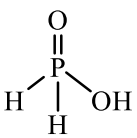
(A) H_3PO_4 (B) H_3PO_3 (C) $H_4P_2O_7$ (D) H_3PO_2

Sol. **B & D**

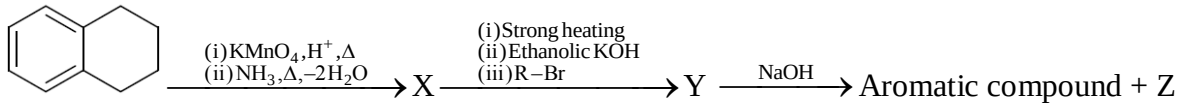
(A) 

(B) 

(C) 

(D) 

7. For the reaction sequence given below, the correct statement(s) is(are)



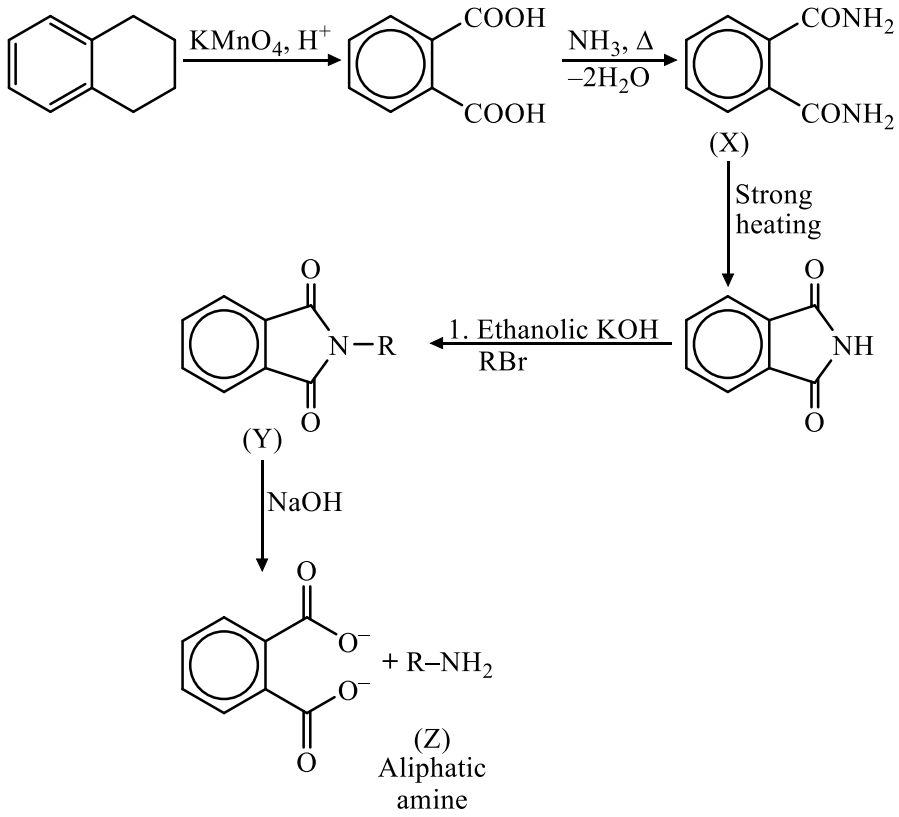
(A) Both X and Y are oxygen containing compounds.

(B) Y on heating with $CHCl_3$/KOH forms isocyanide.

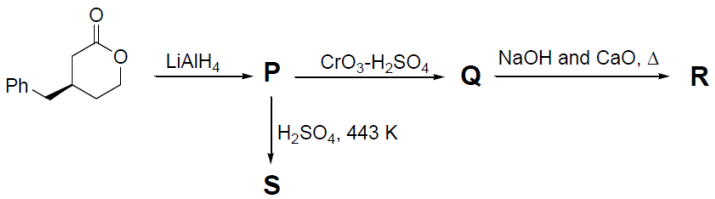
(C) Z reacts with Hinsberg's reagent.

(D) Z is an aromatic primary amine.

Sol. **AC**



8. For the reaction sequence given below, the correct statement(s) is(are)



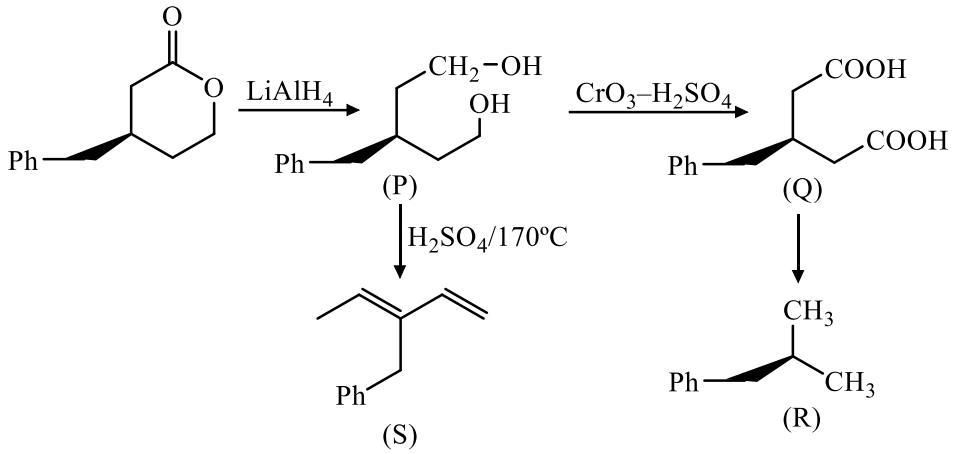
(A) P is optically active.

(B) S gives Bayer's test.

(C) Q gives effervescence with aq. $NaHCO_3$.

(D) R is an alkyne.

Sol. **BC**



SECTION 3 (Maximum Marks: 32)

- This section contains EIGHT (08) questions.
- The answer to each question is a NUMERICAL VALUE.
- For each question, enter the correct numerical value of the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- If the numerical value has more than two decimal places, truncate/round-off the value to TWO decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If ONLY the correct numerical value is entered in the designated place;
  Zero Marks : 0 In all other cases.

9. The density (in g cm^{-3}) of the metal which forms a cubic close packed (ccp) lattice with an axial distance (edge length) equal to 400 pm is _____.
Use: Atomic mass of metal = 105.6 amu and Avogadro's constant = 6×10^{23} mol^{-1}

Sol. **11**

$$d = \frac{4 \times 105.6}{6 \times 10^{23} \times 10^{-24} \times 16 \times 4} = 11$$

10. The solubility of barium iodate in an aqueous solution prepared by mixing 200 mL of 0.010 M barium nitrate with 100 mL of 0.10 M sodium iodate is $X \times 10^{-6}$ mol dm^{-3}. The value of X is _____.
Use: Solubility product constant (K_{sp}) of barium iodate = 1.58×10^{-9}

Sol. **3.95**

$$\underset{2}{Ba(NO_3)_2} + \underset{10}{2NaIO_3} \rightarrow Ba(IO_3)_2 + 2NaNO_3$$

$$1.58 \times 10^{-9} = S \times \left(2 \times 10^{-2}\right)^2$$

$$S = \frac{15.8}{4} \times 10^{-6} = 3.95 \times 10^{-6}$$

11. Adsorption of phenol from its aqueous solution on to fly ash obeys Freundlich isotherm. At a given temperature, from 10 mg g^{-1} and 16 mg g^{-1} aqueous phenol solutions, the concentrations of adsorbed phenol are measured to be 4 mg g^{-1} and 10 mg g^{-1}, respectively. At this temperature, the concentration (in mg g^{-1}) of adsorbed phenol from 20 mg g^{-1} aqueous solution of phenol will be _____.

Use: $\log_{10} 2 = 0.3$

Sol. **16**

$\log(4) = \log k + \frac{1}{n}(\log 10) \Rightarrow 0.6 = \log k + \frac{1}{n}$ …(1)

$\log 10 = \log k + \frac{1}{n}\log 16 \Rightarrow \quad 1 = \log k + \frac{1}{n}(1.2)$ ….(2)

2–1 $\Rightarrow 0.4 = \frac{1}{n}(0.2) \Rightarrow \frac{1}{n} = 2$

From (1) $0.6 = \log k + 2 \Rightarrow \log k = -1.4$

$\log \frac{x}{m} = -1.4 + 2(0.3 + 1) = 2.6 - 1.4 = 1.2$

$\log \frac{x}{m} = 1.2 \Rightarrow \frac{x}{m} = 10^{1.2} = 16$

12. Consider a reaction A + R $\longrightarrow$ Product. The rate of this reaction is measured to be k[A][R]. At the start of the reaction, the concentration of R, $[R]_0$, is 10–times the concentration of A, $[A]_0$. The reaction can be considered to be a pseudo first order reaction with assumption that k[R] = k' is constant. Due to this assumption, the relative error (in %) in the rate when this reaction is 40% complete, is _____.

[k and k' represent corresponding rate constants]

Sol. **4**

$r = k(x)(10x)$ …..(eq.1) $\quad -k' = k \times 10x$

$r = k(.6x)(9.6x)$ …..(eq.2) $\quad -k'' = k \times 9.6x$

$\%\ \text{error} = \frac{k' - k''}{k'} \times 100$

$= \frac{k \times 10x - k \times 9.6x}{k \times 10x} \times 100 = 4$

13. At 300 K, an ideal dilute solution of a macromolecule exerts osmotic pressure that is expressed in terms of the height (h) of the solution (density = 1.00 g cm^{-3}) where h is equal to 2.00 cm. If the concentration of the dilute solution of the macromolecule is 2.00 g dm^{-3}, the molar mass of the macromolecule is calculated to be $X \times 10^4$ g mol^{-1}. The value of X is _____.

Use: Universal gas constant (R) = 8.3 J K^{-1} mol^{-1} and acceleration due to gravity (g) = 10 m s^{-2}

Sol. **2.49**

$10^3 \times 10 \times 2 \times 10^{-2} = \frac{(2/M)}{10^{-3}} \times 8.3 \times 300$

$M = 2.49 \times 10^4 = 2.49 \times 10^4 = 2.49$

14. An electrochemical cell is fueled by the combustion of butane at 1 bar and 298 K. Its cell potential is $\frac{X}{F}\times10^{3}$ volts, where F is Faraday constant. The value of X is_____.

Use: Standard Gibbs energies of formation at 298 K are: $\Delta_f G^o_{CO_2} = -394 kJ\ mol^{-1}$; $\Delta_f G^o_{water} = -237 kJ\ mol^{-1}$; $\Delta_f G^o_{butane} = -18 kJ\, mol^{-1}$

Sol. **422**

$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

$\Delta G^o = [(4\times-394)+[5\times-237]-[-18]] = -1576 - 1185 + 18 = -2743$

$\Delta G^o = nfE^o$

$-2743\times10^3 = -\frac{13}{2}\times F\times E^o$

$E^o = \frac{422}{F}\times10^3 =$ Ans. 422

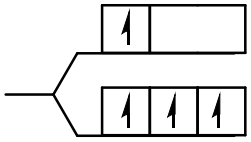
15. The sum of the spin only magnetic moment values (in B.M.) of $[Mn(Br)_6]^{3-}$ and $[Mn(CN)_6]^{3-}$ is _____.

Sol. **7.74**

$[Mn(Br)_6]^{3-} \rightarrow$ WFL

$Mn = 3d^5 4s^2$

$Mn^{3+} = 3d^4 4s^0$

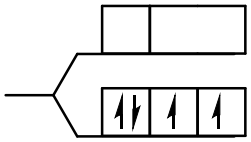


μ = 4.90 B.M.

$[Mn(CN)_6]^{3-} \rightarrow$ SFL

$Mn = 3d^5 4s^2$

$Mn^{3+} = 3d^4 4s^0$



μ = 2.84 B.M.

hence 4.90 + 2.84 = 7.74 B.M.

16. A linear octasaccharide (molar mass = 1024 g mol^{-1}) on complete hydrolysis produces three monosaccharides: ribose, 2-deoxyribose and glucose. The amount of 2-deoxyribose formed is 58.26 % (w/w) of the total amount of the monosaccharides produced in the hydrolyzed products. The number of ribose unit(s) present in one molecule of octasaccharide is _____.

Use: Molar mass (in g mol^{-1}): ribose = 150, 2-deoxyribose = 134, glucose = 180; Atomic mass (in amu): H = 1, O = 16

Sol. **2**

Octa saccharide $\xrightarrow{7H_2O}$ Ribose + 2-deoxyribose + D-glucose

Given amount of 2-deoxyribose is 58.26% (w/w) of total amount

Molar mass of product = 1024 + 7 × 18 = 1150 g/mole

Amount of 2-deoxyribose is $\frac{58.26\times1150}{100}$ = 669.99 gm/mole $\simeq$ 670 gm/mole

Total amount of remaining compound = 1150 – 670 = 480 gm/mole

Given molar mass of glucose = 180

Molar mass of Ribose = 480 – 180 = 300

No. of Ribose unit = $\frac{300}{150}$ = 2 unit

Mr.Nitin Viijay (NV SIR)

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Selection in IIT	AIR-2,4,5 (65+)	AIR-4,5 (5)	(10)	AIR-1 (5)	AIR-1 (12)	AIR-1 (16)	NA
Selection in NIT	11000+	8000+	2500+	2500+	10000+	10000+	200+
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