ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

Pre Nurture & Career Foundation Division

For Class 6th to 10th, Olympiads & Board

ANSWER KEY (Paper Code : 33)

NATIONAL STANDARD EXAMINATION in CHEMISTRY

NSEC-2025 [23-11-2025]

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	D	C	D	D	A	B	A	D	B	D	B	C	A	B	A
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	A	A	B	NA	C	C	D	A	D	C	D	B	A	D	A
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	C	C or NA	D	C	C	B	C	C	B	B	D	B	D	C	B
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	A	C	D	ABCD	BC	AC	NA	A	D	ABD	ABC	BCD	ABCD	BD	ACD

NA = Options are Not Correct

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NSEC–2025 (EXAMINATION)

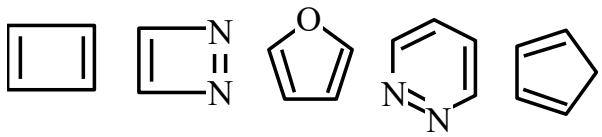
(Held On Sunday 23th NOV, 2025)

CHEMISTRY | **TEST PAPER WITH ANSWER**

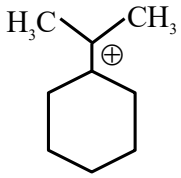
PAPER WITH SOLUTIONS

1. The correct numerical answers for the following is :

(i) The number of NOT aromatic compounds from the following is :



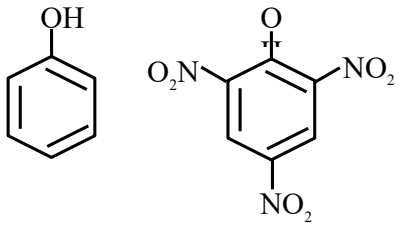
(ii) The number of α hydrogen atoms in the following structure is



(iii) The number of geometrical isomers possible in

$CH_3CH=CH-CH=CH_2$

(iv) The number of compounds more acidic than CH_3COOH from :



CF_3COOH CH_3SO_3H C_2H_5OH

(A) (i) = 3, (ii) = 6, (iii) = 2, (iv) = 3 (B) (i) = 2, (ii) = 6, (iii) = 2, (iv) = 3

(C) (i) = 2, (ii) = 7, (iii) = 4, (iv) = 2 (D) (i) = 3, (ii) = 7, (iii) = 2, (iv) = 3

Ans. **(D)**

Sol. **(i)**

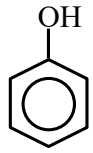
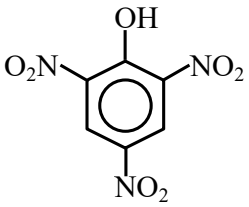
Antiaromatic Antiaromatic Aromatic Aromatic Nonaromatic

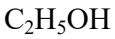
So not aromatic are 3

(ii) Number of α H are 7

(iii) 2 (Cis and Trans)

(iv)

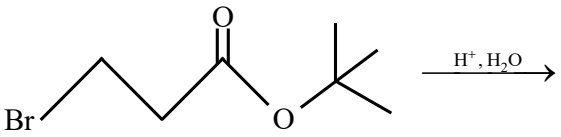



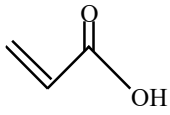
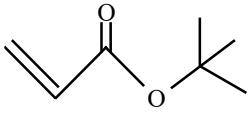
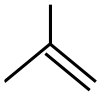
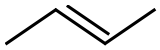
less acidic more acidic more acidic more acidic less acidic

So 3 are more acidic

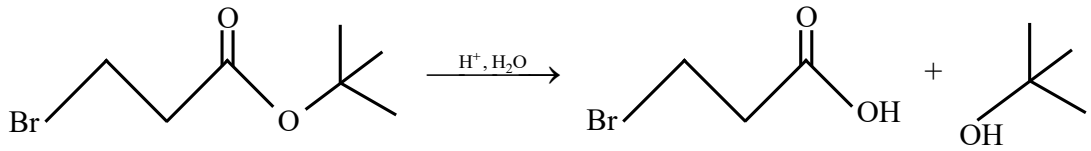
2. The following reaction is performed and multiple products are observed :



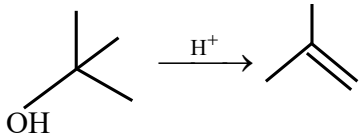
One of the product(X) can decolourize Br_2 water. The product (X) is :

(A)  (B)  (C)  (D) 

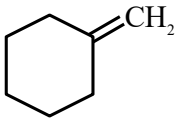
Ans. **(C)**

Sol. 

Tertiary butyl alcohol can undergo dehydration in acidic medium to give isobutene which decolorise $Br_2./H_2O$



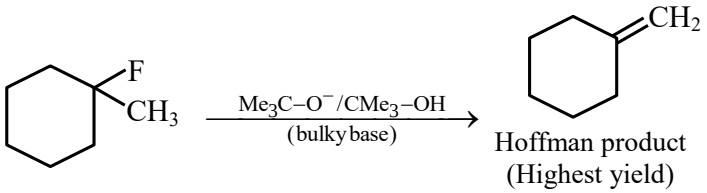
3. Compound A can be prepared from a suitable alkyl halide and appropriate reagent and conditions. The most appropriate combination of the requirements to give the highest yield is :

Compound A 

(A) 1-bromo-1-methylcyclohexane, CH_3O^-, CH_3OH
(B) 1-fluoro-1-methylcyclohexane, CH_3O^-, CH_3OH
(C) 1-bromo-1-methylcyclohexane, $(CH_3)_3CO^-$, $(CH_3)_3COH$
(D) 1-fluoro-1-methylcyclohexane, $(CH_3)_3CO^-$, $(CH_3)_3COH$

Ans. **(D)**

Sol.



Yield of Hoffmann product

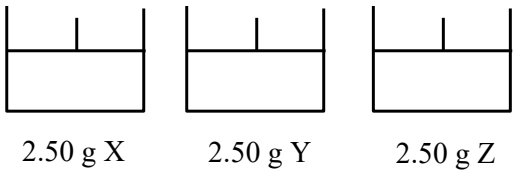
R-F > R-Cl > R-Br > R-I

Yield of Hoffmann product

$(CH_3)_3CO^-$, $(CH_3)_3COH > CH_3O^-$, CH_3OH

4. Consider three cylinders of capacity 2.24 L each fitted with piston. Each containing 2.50 g of an ideal gas (X, Y and Z) as specified below at 273 K. The pressure is not specified.

Given : Molar mass (in g mol^{-1}) as X = 40, Y = 80 and Z = 20



The correct set of statement(s) is./are

(i) The number of molecules in each cylinder is the same.

(ii) The average velocity of the molecules in each cylinder is the same.

(iii) The pressure of gas Z is the highest.

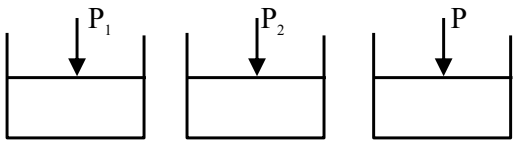
(iv) If the pressure in each cylinder is adjusted to one atmosphere at constant temperature, the volume of the gas Z will increase and those of the other two will decrease.

(A) (i) and (ii) are correct (B) (i) and (iii) are correct

(C) (ii) and (iv) are correct (D) (iii) and (iv) are correct

Ans. **(D)**

Sol.



V = 2.24	V = 2.24 L	V = 2.24 L
T = 273 K	T = 273 K	T = 273 K
$n = \frac{2.5}{40}$	$n = \frac{2.5}{80}$	$n = \frac{2.5}{20}$

(i) No. of molecules in each cylinder is different.

(ii) $U_{avg} = \sqrt{\frac{8RT}{M}} \Rightarrow U_{avg} \propto \frac{1}{\sqrt{M}}$

U_{avg} is different as molar mass is different.

(iii) $V_1T \rightarrow$ constant $\Rightarrow P \propto n$

and moles of gas is the highest in 'Z'

$\therefore$ Pressure of gas 'Z' is the highest.

(iv) $P_X = \frac{2.5}{40} \times \frac{R \times 273}{2.24} = \frac{25}{40}$ atm

$P_Y = \frac{2.5}{80} \times \frac{R \times 273}{2.24} = \frac{25}{80}$ atm

$P_Z = \frac{2.5}{20} \times \frac{R \times 273}{2.24} = \frac{5}{4}$ atm

If pressure of the gas is adjusted to 1 atm then volume of gas 'Z' will increase, whereas volume of gas X and gas Y will decrease.

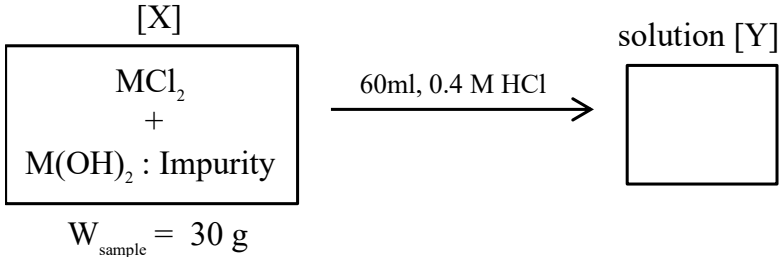
5. A sample (X) of MCl_2 was found to contain a small quantity of $M(OH)_2$ as an impurity, both of the compounds are soluble in water. In an experiment 30 g of the above sample (X) was dissolved in 60 mL of 0.04 M HCl to give solution (Y). 20 mL of 0.4 M NaOH was required to neutralise the excess HCl in solution (Y). The percentage of $M(OH)_2$ in sample (X) is :

Given : Molar mass of $M(OH)_2 = 65$ g mol^{-1}

(A) 1.7 (B) 3.5 (C) 0.17 (D) 0.35

Ans. **(A)**

Sol.



$W_{sample} = 30$ g

$[\text{Molar mass}]_{M(OH)_2} = 65$ g / mol

[Excess]

(I) $M(OH)_2 + 2HCl \rightarrow MCl_2$

8 m.mol 60ml, 0.4M

= 24 m.mol (initial)

= 16 m.mol (used)

Remaining

(II) $HCl + NaOH \rightarrow NaCl + H_2O$

8 m.mol 20 ml, 0.4M

= 8 m.mol

$\therefore$ Moles of $M(OH)_2 = 8 \times 10^{-3}$

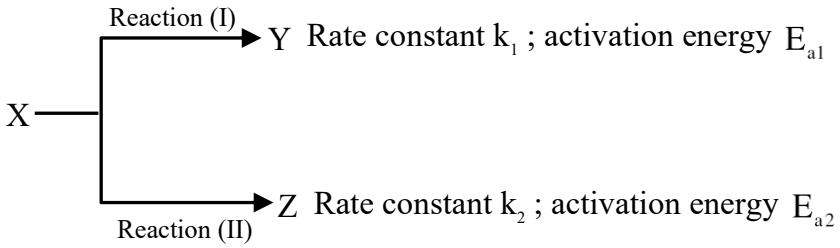
Mass of $M(OH)_2 = 8 \times 10^{-3} \times 65$ g

and % $M(OH)_2$ in sample $= \frac{W_{M(OH)_2}}{W_{sample}} \times 100$

$$= \frac{8 \times 65 \times 10^{-3}}{30} \times 100$$

$$= \frac{8 \times 65}{300} = 1.73\%$$

6. Consider the following reactions (i) and (ii) occurring at 298 K, such that $E_{a_2} = 3E_{a_1}$ and the Arrhenius constant A has the same value for both the reactions. The relation between k_1 and k_2 is :



(A) $k_1 = 3k_2 e^{E_{a2}/RT}$ (B) $k_1 = k_2 e^{2E_{a1}/RT}$ (C) $k_2 = k_1 e^{2E_{a1}/RT}$ (D) $k_2 = k_1 e^{3E_{a1}/RT}$

Ans. **(B)**

Sol. $X \rightarrow Y$

$X \rightarrow Z$

$k_1 = Ae^{-E_{a1}/RT}$

$k_2 = Ae^{-E_{a2}/RT}$

$\because E_{a_2} = 3E_{a_1}$

$\therefore k_2 = Ae^{-3E_{a1}/RT}$

$k_2 = Ae^{-E_{a1}/RT}.e^{-2E_{a1/RT}}$

$k_2 = k_1.e^{-2E_{a1/RT}}$

$k_1 = k_2.e^{2E_{a1/RT}}$

7. In the spacecrafts of NASA, the oxygen required for the astronauts is obtained from the following chemical reaction :

$$KClO_3(s) + Fe(s) \rightarrow O_2(g) + KCl(s) + FeO(s)$$

The requirement of O_2 per astronaut per day is 500 L as measured at 1 atm and 300 K. The minimum mass of $KClO_3$ (Molar mass of $KClO_3$ = 122.5 g mol^{-1}) needed for two astronauts to be in the spacecrafts for ten days in a space mission is :

(A) 49.8 kg (B) 426 g (C) 213 g (D) 498.0 kg

Ans. **(A)**

Sol. $KClO_3(s) + Fe(s) \longrightarrow O_2(g) + KCl(s) + FeO(s)$

$\frac{100}{3\times0.082}$mol $\frac{100}{3\times0.082}$mol

$\because$ Requirement of O_2 per day per astronaut = 500 L at 1 atm, 300 K

$\therefore$ Requirement of O_2 for 10 days for two astronaut = 500 × 2 × 10 L at 1 atm, 300 K

$\therefore$ Moles of O_2 required = $\frac{PV}{RT}$

$= \frac{1\times500\times2\times10}{0.082\times300}$

$= \frac{100}{3\times0.082}$mol

$\therefore$ Moles of $KClO_3$ needed = $\frac{100}{0.082}\times\frac{1}{3}$

$\therefore$ Mass of $KClO_3$ needed = $\frac{100}{0.082}\times\frac{122.5}{3}$g

$= 49796.74$ g $= 49.8$ kg

8. When 15.0 g of steam at 373 K is passed in 250.0 g of $H_2O(l)$ in closed container at 298 K at constant pressure of 1 bar, then the correct statement, if this is isolated system, will be :

(Assume that the final state is liquid water)

(A) Both the volume and entropy will increase

(B) Both the volume and entropy will decrease

(C) The volume will increase and the entropy will decrease

(D) The volume will decrease and the entropy will increase

Ans. **(D)**

Sol. Due to condensation of steam volume of system will decrease.

Since system is isolated,

$\therefore \Delta S_{sys} > 0$

Because condensation is spontaneous.

9. Consider the given equilibrium reaction at 473 K

$Li_3N\,(s) + 2H_2(g) \rightleftharpoons LiNH_2(s) + 2LiH(s)$; $\Delta H^{\circ}_{rxn} = -200\,kJ/mol$

The number of moles of $H_2(g)$ present at equilibrium can be maximized by :

	Temperature	**Pressure**
(A)	increasing	increasing
(B)	increasing	decreasing
(C)	decreasing	increasing
(D)	decreasing	decreasing

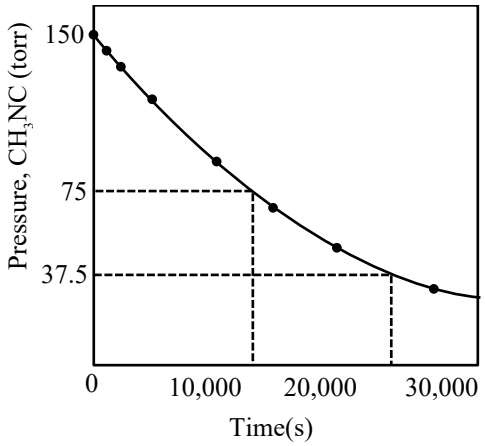
Ans. **(B)**

Sol. $Li_3N(s) + 2H_2(g) \rightleftharpoons LiNH_2(s) + 2LiH(s)$; $\Delta H^{\circ}_{rxn} = -200\ kJ/mol$

$\Rightarrow$ To increase the number of moles of H_2, the equilibrium must shift in the backward direction.

$\Rightarrow$ Since the reaction is exothermic : therefore at high temperature, reaction shifts in backward direction and pressure must be decreased.

10. The following concentration vs time plot represents the conversion of $CH_3NC(g)$ to $CH_3CN(g)$. Which of the following statements (I to IV) is/are true ?



(I) The reaction is of zero order

(II) Unit of rate constant of this reaction is s^{-1}

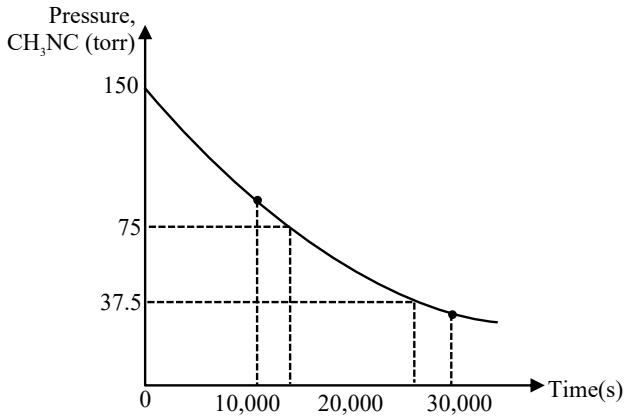
(III) Unit of rate constant of the reaction is torr s^{-1}

(IV) Unit of rate of the reaction is torr s^{-1}

(A) I only **(B)** I, II **(C)** III only **(D)** II, IV

Ans. **(D)**

Sol. $CH_3NC(g) \rightleftharpoons CH_3CN(g)$



x-axis coordinates are not matching with the Y-axis co-ordinates. But from the observations of graph and options given. The answers will be 'D'.

$\therefore\ t_{75\%} = 2 \times t_{50\%}$

11. Consider the chemical reaction $A \rightarrow C + D$

The observations for kinetic study of the above unimolecular elementary reaction at 298 K are given in the table below :

Time (minute)	[A] [M]
0	0.35
10	0.035
T	0.00035

The value of time t (minute) is:

(A) 20 (B) 30 (C) 40 (D) 35

Ans. **(B)**

Sol. For 1^{st} order reaction

$$k = \frac{1}{t}\ln\frac{a_0}{a_t}$$

$$\therefore\ \frac{1}{10}\ln\left(\frac{0.36}{0.035}\right) = \frac{1}{t}\ln\left(\frac{0.35}{0.00035}\right)$$

$$\therefore\ \frac{1}{10}\ln(10) = \frac{1}{t}\ln(1000)$$

$\therefore\ t = 30$ min.

12. Propanoic acid (PA) is an organic acid. At 298 K, the pH of a 50.0 mL sample of 0.20 M of it is 3.0. The pH of solution formed by mixing 25.0 mL 0.2 M sodium propanoate solution with 25.0 mL 0.1 M propanoic acid will be :

(A) 3.3 (B) 5.3 (C) 5.6 (D) 6.3

Ans. **(C)**

Sol. (I) CH_3CH_2COOH : pH = 3 at 298 K $\Rightarrow [H^{\oplus}] = 10^{-3}$

50 ml

0.2 M

$CH_3CH_2COOH \rightleftharpoons CH_3CH_2COO^- + H^{\oplus} : K_a$		
0.2	–	–
0.2 – x	x	x

$\Rightarrow K_a = \frac{x^2}{0.2} \Rightarrow K_a = \frac{10^{-6}}{0.2}$

$CH_3CH_2COOH_{(aq)} \rightleftharpoons CH_3CH_2COO^- + H^{\oplus}$

$K_a = \frac{[CH_3CH_2COO^-][H^{\oplus}]}{[CH_3CH_2COOH]}$

(II) $\boxed{\begin{matrix}25\text{ ml, }0.1\text{ M}\\ CH_3CH_2COOH\end{matrix}} + \boxed{\begin{matrix}25\text{ ml, }0.2\,\text{M}\\ CH_3CH_2COO^-Na^+\end{matrix}}$

$\downarrow V_f = 50$ ml

$\boxed{\begin{matrix}[CH_3CH_2COOH] = 0.05\,\text{M}\\ [CH_3CH_2COO^-Na^+] = 0.1\,\text{M}\end{matrix}}$

[Acidic buffer solution]

$$\therefore K_a = \frac{[CH_3CH_2COO^-][H^{\oplus}]}{[CH_3CH_2COOH]} \Rightarrow [H^{\oplus}]_f = [K_a]_{CH_3CH_2COOH} \times \frac{[CH_3CH_2COOH]}{[CH_3CH_2COO^-]}$$

$$\Rightarrow [H^{\oplus}]_f = \frac{10^{-6}}{0.2} \times \frac{0.05}{0.1} = \frac{10^{-6}}{0.4} = \frac{5}{2} \times 10^{-6}$$

$$\Rightarrow pH = -\log[H^{\oplus}] = -\log\left[\frac{5}{2} \times 10^{-6}\right]$$

$\Rightarrow$ pH = 6 – log 5 + log 2 = 5.6

13. M is an alkaline earth metal. 1.0 M solution of MCl_2 is added dropwise to a solution that is 0.01 M each is fluoride, sulphite, and phosphate ions. The order of precipitation of corresponding salts is :

Solid	K_{sp}
MSO_3	7×10^{-7}
MF_2	5×10^{-9}
$M_3(PO_4)_2$	1×10^{-25}

(A) $M_3(PO_4)_2$, MF_2, MSO_3 **(B)** $M_3(PO_4)_2$, MSO_3, MF_2

(C) MSO_3, MF_2, $M_3(PO_4)_2$ **(D)** MF_2, MSO_3, $M_3(PO_4)_2$

Ans. **(A)**

Sol. For precipitation of MSO_3 :

$$[M^{2+}] = \frac{7\times10^{-7}}{0.01} = 7\times10^{-5}M$$

For precipitation of MF_2 :

$$[M^{2+}] = \frac{5\times10^{-9}}{(0.01)^2} = 5\times10^{-5}M$$

For precipitation of $M_3(PO_4)_2$:

$$[M^{2+}] = \left(\frac{1\times10^{-25}}{(0.01)^2}\right)^{\frac{1}{3}} = 10^{-7}M$$

$\therefore$ Order of precipitation

$M_3(PO_4)_2 > MF_2 > MSO_3$

14. $CrCl_3.xNH_3$ can exist as an octahedral complex (P). 0.1 molal aqueous solution of this complex (P) shows a depression in freezing point of 0.558°C. The molecular formula of the complex (P) is :

(Given K_f for water : 1.86 K Kg mol^{-1})

(Assuming 100% ionization of the complex)

(A) $[Cr(NH_3)_6]Cl_3$ **(B)** $[Cr(NH_3)_5Cl]Cl_2$ **(C)** $[Cr(NH_3)_4Cl_2]Cl$ **(D)** $[Cr(NH_3)_3Cl_3]$

Ans. **(B)**

Sol. $\because \Delta T_f = i.\ K_f\ .\ m$

$0.558 = i \times 1.86 \times 0.1$

$\therefore\ i = 3$

$\therefore$ Complex is $[Cr(NH_3)_5Cl]Cl_2$

15. Aspirin ($C_9H_8O_4$) is produced by the reaction between salicylic acid ($C_7H_6O_3$) and acetic anhydride ($C_4H_6O_3$) as per the reaction $C_7H_6O_3 + C_4H_6O_3 \rightarrow C_9H_8O_4 + C_2H_4O_2$

In the reaction of 155 g salicylic acid and 105 g acetic anhydride, assuming 80% conversion of the limiting reactant, the mass of aspirin formed is :

Given molar mass in g mol^{-1} salicylic acid = 138, acetic anhydride = 102 and aspirin = 180

(A) 148 g **(B)** 162 g **(C)** 202 g **(D)** 184 g

Ans. **(A)**

Sol.

		(LR)		(M = 180 g/mol)
$C_7H_6O_3$	+	$C_4H_6O_3$	$\xrightarrow{80\%}$	$C_9H_8O_4 + C_2H_4O_2$
[Salicyclic acid]		[Acetic anhydride]		[Aspirin]
155 g		105 g		
$= \frac{155}{138}$ mol		$= \frac{105}{102}$ mol		– –

$$\frac{105}{102}\times\frac{80}{100}\text{mol}$$

$\therefore$ Mass of aspirin formed $= \frac{105}{102}\times\frac{80}{100}\times 180\,\text{g}$

$$= \frac{15120}{102} = 148.23\text{ g}$$

16. A voltaic cell is constructed as shown below

$Ni(s)|Ni^{2+}(aq) \,||\, Ag^{+}(aq) \,|\, Ag(s)$

$E^{\circ}_{Ni2+(aq)/Ni(s)} = -0.236V$, $E^{\circ}_{Ag+(aq)/Ag(s)} = 0.799$ V. The initial concentration of $Ag^{+}(aq)$ in the $Ag^{+}(aq)/Ag(s)$ half-cell is 0.005 M and the corresponding cell voltage is +0.95 V at 298 K. Identify the correct option from the following

(A) Initial $[Ni^{2+}](aq) = 0.019$ M; it will increase with time

(B) Initial $[Ni^{2+}](aq) = 0.120$ M; it will increase with time

(C) Initial $[Ni^{2+}](aq) = 0.019$ M; it will decrease with time

(D) Initial $[Ni^{2+}](aq) = 0.120$ M; it will increase with time

Ans. **(A)**

Sol. $Ni + 2Ag^{+} \rightarrow Ni^{+2} + 2Ag$

$$E = E^{\circ} - \frac{0.059}{2}\log\frac{(Ni^{+2})}{(Ag^{+})^2}$$

$$0.95 = (0.799 + 0.236) - \frac{0.059}{2}\log\frac{(Ni^{+2})}{(5\times10^{-3})^2}$$

$$\log\frac{(Ni^{+2})}{(5\times10^{-3})^2} = \frac{0.085\times2}{0.059}$$

$$= 2.88$$

$$\frac{(Ni^{+2})}{25\times10^{-6}} = 758.57$$

$[Ni^{+2}] = 0.019$

17. A certain quantity of a hydrocarbon fuel sample (C_XH_Y) is burnt in excess $O_2(g)$ to ensure complete combustion. The combustion produced 11.93 g $CO_2(g)$, 2.19 g $H_2O(g)$, and 311 kJ of heat. Mass of the fuel burnt in this combustion is

(A) 3.493 g **(B)** 14.02 g **(C)** 11.93 g **(D)** 3.250 g

Ans. **(A)**

Sol. $n_C = n_{CO_2} = \frac{11.93}{44}$

$n_H = 2 \times n_{H_2O} = \frac{2.19}{18} \times 2$

Weight of hydrocarbon = $w_C + w_H$

$= \frac{11.93}{44} \times 12 + 2 \times \frac{2.19}{18} \times 1$

$= 3.2536 + 0.2433$

$= 3.493$

18. The photon with the longest wavelength required for the electronic transition in an atom of hydrogen is :

(A) n = 1 ⟶ n = 3 **(B)** n = 2 ⟶ n = 6 **(C)** n = 3 ⟶ n = 1 **(D)** n = 2 ⟶ n = 6

Ans. **(B)**

Sol. $\lambda \rightarrow$ longest when ΔE is minimum

(a) $E_3 - E_1 = 13.6 \times \left(1 - \frac{1}{9}\right) = 13.60 \times \frac{8}{9}$ eV

(b) $E_6 - E_2 = 13.6\left(\frac{1}{4} - \frac{1}{36}\right) = 13.6 \times \frac{8}{36}$

$= 13.6 \times \frac{2}{9}$

(c) Energy is not required but emitted

(d) $E_6 - E_1 = 13.6 \times \left(1 - \frac{1}{36}\right) = 13.6 \times \frac{35}{36}$

19. Choose the correct statement

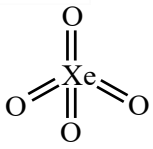
(A) XeO_4 and XeO_2F_2 have tetrahedral geometry with no lone pairs.

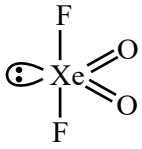
(B) XeO_2F_2 is trigonal planar with two oxygen atoms in the trigonal plane

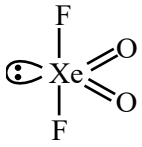
(C) XeO_4 has square planar geometry with no lone pair of electrons

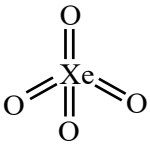
(D) XeO_2F_2 is distorted tetrahedral and XeO_4 is square planar

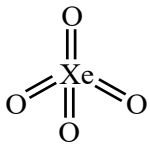
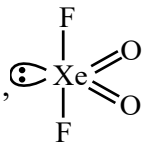
Ans. **(NA) (Options are not Correct)**

Sol. **(a)**  Tetrahedral geometry

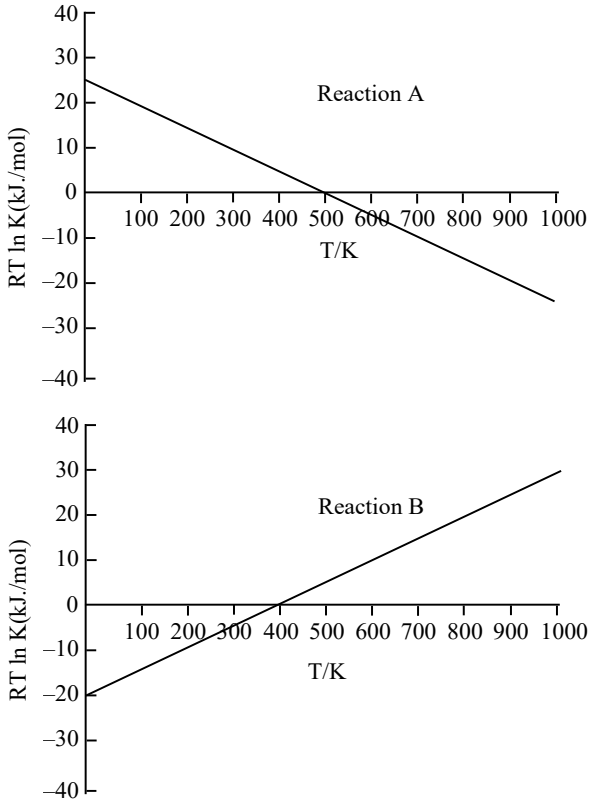
 See-Saw geometry

(b)  See-Saw geometry

(c)  Tetrahedral geometry

(d)  Tetrahedral geometry ,  See-Saw geometry

20. Consider two reactions A and B for which the variation of RT In K with temperature is given in the plots below. If the enthalpy change for the reactions are –25 kJ/mol and 20 kJ/mol, respectively for A and B, the correct statement is :



(A) The equilibrium constant for Reaction B decreases as temperature increases

(B) The entropy change for Reaction A is 50 kJ/mol.

(C) Reaction A remains spontaneous only at temperatures less than 500 K

(D) At 400 K, reaction B changes from exothermic to endothermic reaction

Ans. **(C)**

Sol. $RT \ln K = -\Delta G^\circ$

$= T\Delta S^\circ - \Delta H^\circ$

(a) $\Delta H = +ve \Rightarrow T\uparrow \Rightarrow K\uparrow$

(b) $O = 500\,\Delta S - (-25)$

$$\Delta S_A = \frac{-25\times1000}{500} = -50\ J/mol$$

(c) Below 500 K, $-\Delta G^\circ = +$

$\Delta G^\circ = -ve$ (spontaneous at standard condition)

(d) $\Delta H = +$

21. Among Ca, V, Cr and Mn, the second Ionization Energy is the highest for

(A) V **(B)** Ca **(C)** Cr **(D)** Mn

Ans. **(C)**

Sol. Among Ca, V, Cr, Mn the second ionization energy highest for Cr because in second ionization electron is removed from d^5 half filled subshell. Which is more stable configuration

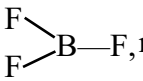
$$\underset{3d^54s^1}{Cr} \xrightarrow{IE_1} \underset{3d^54s^0}{Cr^{\oplus}} \xrightarrow{IE_2} \underset{3d^4}{Cr^{2\oplus}}$$

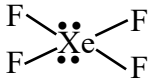
(more stable)

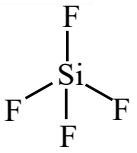
22. Among the given compounds, the permanent dipole moment is exhibited by

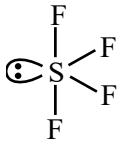
(A) BF_3 **(B)** XeF_4 **(C)** SiF_4 **(D)** SF_4

Ans. **(D)**

(a)  , non polar

(b)  , non polar

(c)  , non polar

(d)  , Polar

SF_4 is polar so it has permanent dipole

23. $HClO_4$ is used in etching of liquid crystal displays whereas $H_2C_2O_4$ is present in vegetables like spinach which causes itching to throat. Consider the following statements for these compounds

(i) $HClO_4$ is a stronger acid than $H_2C_2O_4$

(ii) $HClO_4$ is a weaker acid than $H_2C_2O_4$

(iii) $H_2C_2O_4$ is reducing agent and $HClO_4$ is oxidizing agent

(iv) The conjugate base of $HClO_4$ is stronger than the conjugate base of $H_2C_2O_4$

The correct statements are

(a) (i) and (iii) (b) (ii) and (iii) (c) (ii) and (iv) (d) (i) and (iv)

Ans. **(A)**

Sol. (I) $HClO_4$ is stronger acid than $H_2C_2O_4$

(II) $H_2C_2O_4$: Reducing agent

$HClO_4$: Oxidizing agent

24. Compounds A,B,C and D are solid trihalides, all containing the same central atom. Compounds A,B, C are pale lilac (pale purple) in colour but compound D is dark green. Compound A is insoluble in water and alcohol but rest of the three are soluble in both the solvents.

The correct statement indicating the central atom and halides present in each of the compounds is

(A) Central atom is As, halides are F^-,Cl^-,Br^-, I^- respectively

(B) Central atom is Co, halides are F^-,Cl^-,Br^-, I^- respectively

(C) Central atom is Cr, halides are F^-,Cl^-,Br^-, I^- respectively

(D) Central atom is Nd, halides are F^-,Cl^-,Br^-, I^- respectively

Ans. **(D)**

Sol. If these are halide of

NdF_3 violet

$NdCl_3$ Mauve (Light violet)

$NdBr_3$ Violet

NdI_3 Green

25. You are given a set of oxides : SrO, MoO_3 and ZrO_2. All the three show different reactions with water. Two of these oxides react with water whereas the third one is insoluble in water at room temperature (25–30°C). The statement that is correct about these oxides is

(A) MoO_3 is insoluble in water, SrO gives a basic solution and ZrO_2 gives an acidic solution in water.

(B) MoO_3 is insoluble in water, SrO gives an acidic solution and ZrO_2 gives an basic solution in water.

(C) ZrO_2 is insoluble in water, SrO gives a basic solution and MoO_3 gives an acidic solution in water.

(D) ZrO_2 is insoluble in water, MoO_3 gives a basic solution and SrO gives an acidic solution in water.

Ans. **(C)**

Sol. ZrO_2 is insoluble in water.

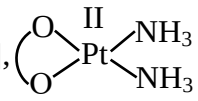
In general d-block oxide insoluble in water. SrO is basic because it belong to alkali earth metal.

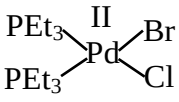
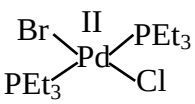
MoO_3 is acidic because Mo in +6 oxidation State. As oxidation state of metal increase Acidic nature of oxide increases.

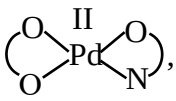
26. The complex that shows maximum number of isomers in (where gly = glycine, PEt_3 = triethylphosphine)

(A) $[Pt(ox)(NH_3)_2]$ **(B)** $[Pd(PEt_3)_2BrCl]$ **(C)** [Pd(gly)(ox)] (D) $[Pt(NH_3)(NO_2)(PEt_3)_2]^+$

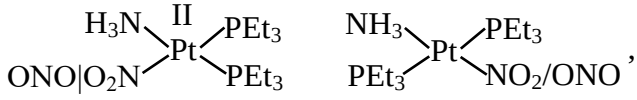
Ans. **(D)**

Sol. **(A)** $[Pt(ox)(NH_3)_2]$, 

(B) $[Pd(PEt_3)_2BrCl]$,  Cis  trans , 2 G.I.

(C) [Pd(gly)(ox)],  , No isomers

$[Pt(NH_3)(NO_2)(PEt_3)_2]^+$

(D) 

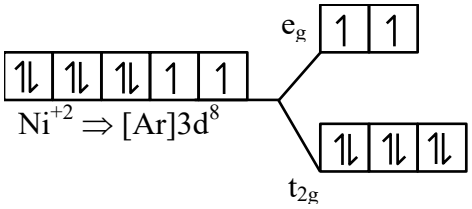
Cis trans , 4 isomers

27. The spin-only magnetic moment for $[Ni(H_2O)_6](ClO_4)_2$ should be

(A) 3.87 **(B)** 2.83 **(C)** 1.72 **(D)** 5.92

Ans. **(B)**

Sol. $[Ni(H_2O)_6](ClO_4)_2$



$\mu = \sqrt{n(n+2)}BM$

$= \sqrt{2(2+2)}BM$

$= \sqrt{8}$ BM

≈ 2.83 BM

28. The correct order of Δ_o for the following given transition metal complexes is

(A) $Rh(CN)_6^{3-} > Rh(NH_3)_6^{3+} > RhCl_6^{3-}$

(B) $Rh(NH_3)_6^{3+} > RhCl_6^{3-} > Rh(CN)_6^{3-}$

(C) $RhCl_6^{3-} > Rh(CN)_6^{3-} > Rh(NH_3)_6^{3+}$

(D) $Rh(CN)_6^{3-} > RhCl_6^{3-} > Rh(NH_3)_6^{3+}$

Ans. **(A)**

Sol. Ligand field strength order : $\overline{C}N > NH_3 > Cl^-$

Strength of ligand ↑es, Δ_o↑es

Δ_o order : $[Rh(CN)_6]^{-3} > [Rh(NH_3)_6]^{+3} > [RhCl_6]^{-3}$

29. The correct rank of bond order for O_2^+, O_2^-, CO and O_2^{2-} is

(A) 3 , 1.5 , 3 , 1 **(B)** 2 , 5 , 1 , 1 **(C)** 1.5 , 2.5 , 3 , 2 **(D)** 2.5 , 1.5 , 3 , 1

Ans. **(D)**

Sol.

species	B.O.
O_2^+	2.5
O_2^-	1.5
CO	3
O_2^{-2}	1

30. The correct basicity order in water for the following is

(A) $NMe_3 > NH_3 > NH_2NH_2 > NF_3$ (B) $NH_2OH > NH_3 > NF_3 > NMe_3$

(C) $NH_3 < NF_3 < NMe_3 < NH_2NH_2$ (D) $NMe_3 < NH_2OH < NH_3 < NF_3$

Ans. **(A)**

Sol. $NMe_3 > NH_3 > NH_2 - \boxed{NH_2} > NF_3$

+I effect -I effect (More –I effect)

31. A 1.25 g Shelcal tablet contains 1250 mg of $CaCO_3$. A student dissolved one tablet in water to make 1.0 L solution(X). 10.0 mL of solution(X) was titrated with 0.0198 M EDTA-MgEDTA mixture in the burette and found the $CaCO_3$ content matched the label claim. (Molar mass of $CaCO_3$ = 100.0 g/mol).

The correct option is

(A) The burette reading is 6.31 mL and molarity of Shelcal solution is 0.125 M

(B) The burette reading is 10.00 mL and molarity of Shelcal solution is 0.0125 M

(C) The burette reading is 6.31 mL and molarity of Shelcal solution is 0.0125 M

(D) The burette reading is 10.00 mL and molarity of Shelcal solution is 0.125 M

Ans. **(C)**

Sol. Molarity of $CaCO_3$ in solution (X) $= \frac{1250\times10^{-3}}{100}$

$= 1.25 \times 10^{-2}$ M

$\because M_1V_1 = M_2V_2$

$M = \frac{1.25\times10^{-2}\times10}{0.0198} = 6.31M$

32. When 10 mL of 0.01 M HCl was added to a mixture of 0.5 M NH_3 and 0.5 M NH_4Cl, the pH of the resultant solution will be (pK_b of NH_3 is 4.75)

(A) 9.07 (B) 9.75 (C) 9.25 (D) 8.75

Ans. **(C or NA)**

Sol. For given buffer solution

$$pOH = pK_b + \log \frac{[NH_4^+]}{[NH_3]}$$

$$pOH = 4.75 + \log\left(\frac{0.5}{0.5}\right) = 4.75$$

$$pH = 14 - 4.75 = 9.25$$

Volume of buffer solution in which 10 ml, 0.01 M HCl solution added is not given in the question. Let us assume that volume of buffer solution is 1 litre and since amount of HCl added is too small therefore pH of given buffer solution will not change significantly.

33. The correct order of CO triple bond character in the given metal carbonyl complexes is

(A) $[Fe(CO)_4]^{-2} > [Co(CO)_4]^{-1} > [Mn(CO)_6]^{+} > Ni(CO)_4$

(B) $[Ni(CO)_4] > [Mn(CO)_6]^{+} > [Co(CO)_4]^{-1} > [Fe(CO)_4]^{-2}$

(C) $[Mn(CO)_6]^{+} > [Fe(CO)_4]^{-2} > [Co(CO)_4]^{-1} > Ni(CO)_4$

(D) $[Mn(CO)_6]^{+} > Ni(CO)_4 > [Co(CO)_4]^{-1} > [Fe(CO)_4]^{-2}$

Ans. **(D)**

Sol. –ve charge on metal ↑es , synergic Bonding ↑es, metal–carbon B.O. ↑es, carbon-oxygen B.O. ↓es. So triple Bond character order will be :-

$[Mn(CO)_6]^{+} > [Ni(CO)_4]^{0} > [Co(CO)_4]^{-1} > [Fe\ (CO)_4]^{-2}$

34. Consider the following statements for the square planar complex $[Pt(en)(NCS)_2]$. Identify the correct statements.

I. It is thermodynamically more stable than $[Pt(NH_3)_2(NCS)_2]$

II. It can exhibit stereoisomerism.

III. It can exhibit structural isomerism.

IV. It is not easily soluble in polar solvents.

The correct option is

(A) I, II, IV (B) II, III, IV (C) I, III, IV (D) I, II, III

Ans. **(C)**

Sol. (I) Stability : $[Pt(en)(NCS)_2] > [Pt(NH_3)_2(NCS)_2]$

(II) $[Pt(en)\ (NCS)_2]$ does not exhibit stereo isomerism

(III) It can show linkage (structural) isomerism

(IV) Low solubility in polar solvent

35. Which of the following molecules is odd one out in its bonding properties?

(A) CO_3^{2-} (B) SO_3 (C) CH_4 (D) BF_3

Ans. **(C)**

Sol. $CO_3^{2-} = sp^2$; Trigonal planar

$SO_3 = sp^2$; Trigonal planar

$CH_4 = sp^3$; Tetrahedral

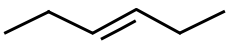
$BF_3 = sp^2$; Trigonal planar

36. Which one of the following reactions will give a product that has zero net dipole moment?

(A) Hex-3-yne with H_2-Pd/C (B) Hex-3-yne with Na in liquid ammonia

(C) Hex-2-yne with H_2-Pd/C (D) Hex-2-yne with Na in liquid ammonia

Ans. **(B)**

Sol. $H_3C-CH_2-C\equiv C-CH_2-CH_3 \xrightarrow[\text{liq.}NH_3]{\text{Na in}}$ 

The product (trans hex-3-ene) has zero dipole moment

37. Which of the following statements is **not** correct regarding the aromatic electrophilic substitution reactions of aniline or its derivatives under standard laboratory conditions?

(A) Aniline, when subjected to bromination with Br_2/H_2O, undergoes rapid tribromination to form 2,4,6-tribromoaniline as the major product.

(B) During direct nitration of aniline with a nitrating mixture, meta-substitution is observed predominantly due to protonation of the amino group under acidic conditions.

(C) The acetamido group (-$NHCOCH_3$), being less basic than –NH_2, shows stronger +M (mesomeric) effect and thus activates the ring more than the free amino group.

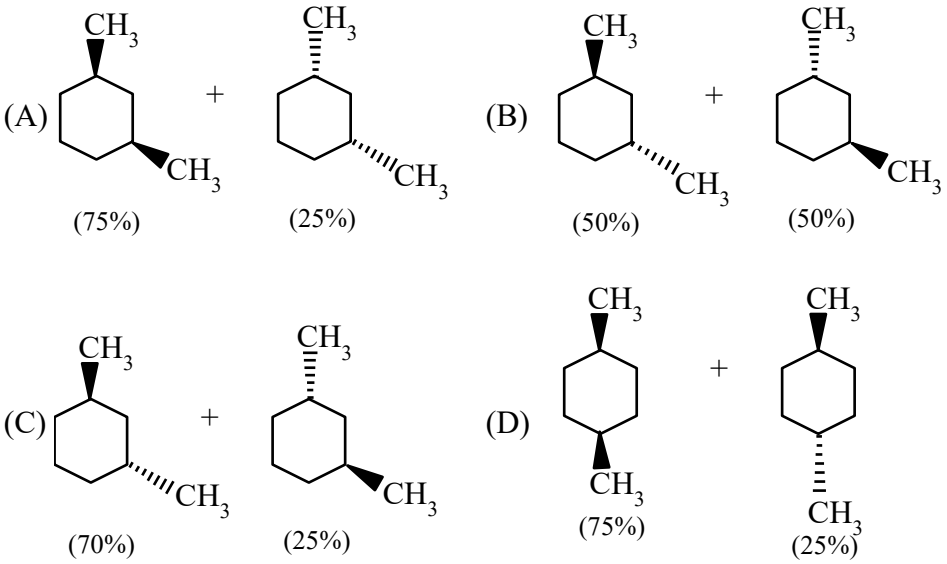
(D) Acetylation of aniline reduces its reactivity towards electrophilic substitution and facilitates controlled monosubstitution at ortho and para positions.

Ans. **(C)**

Sol.

$$\underset{\substack{\text{Moderately}\\\text{activating}}}{-NH-\overset{\overset{O}{\|}}{C}-CH_3} \; < \; \underset{\substack{\text{Strongly}\\\text{activating}}}{-NH_2}$$

38. The optically actives mixtures from the following is :



Ans. **(C)**

Sol. A and D are mixture of optically inactive compounds.

B is 100% racemic mixture.

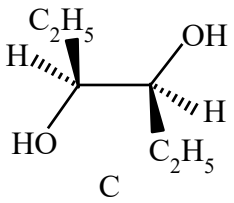
C is partially racemic mixture (optically active)

39. Alkenes can be converted to cis-diols using OsO_4 + $NaHCO_3$ and trans-diols via the epoxide followed by acid hydrolysis.

Compound **C** given below is formed from :

(i) alkene **A** by treatment with OsO_4 + $NaHCO_3$

(ii) the epoxide of alkene **B** followed by acid hydrolysis.



C

The structures of **A** and **B** are :

(A) **A** **B**

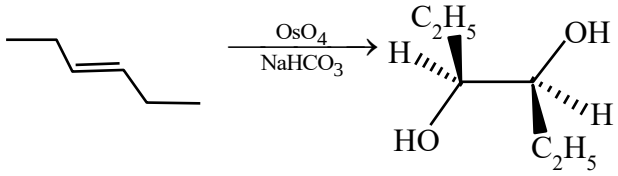
(B) **A** **B**

(C) **A** **B**

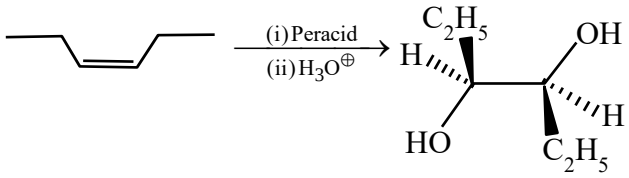
(D) **A** **B**

Ans. **(B)**

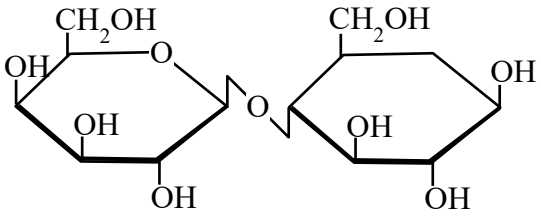
Sol.



Optically active



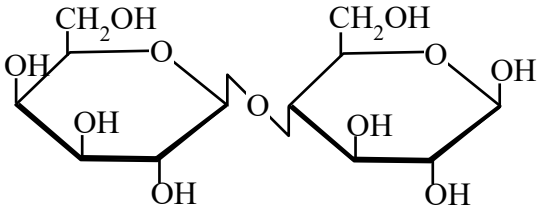
40. The disaccharide shown below undergoes enzymatic hydrolysis. The monosaccharide units formed upon complete hydrolysis of the disaccharide are



(A) Glucose and Glucose
(B) Glucose and Galactose
(C) Galactose and Fructose
(D) Galactose and Galactose

Ans. **(B)**

Sol.

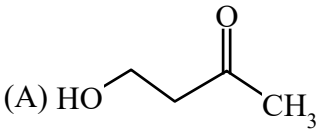


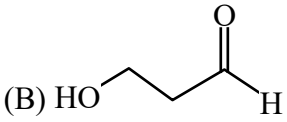
$\xrightarrow[\text{(enzyme)}]{H_2O}$ Galactose + Glucose

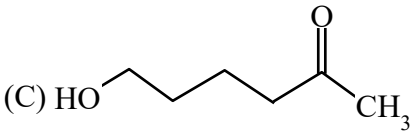
Galactose part Glucose part

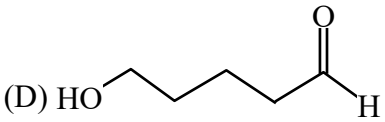
(LACTOSE)

41. Which of the following most readily forms a cyclic hemiacetal in the presence of an acid catalyst?

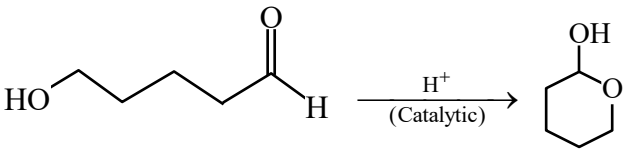
(A) 

(B) 

(C) 

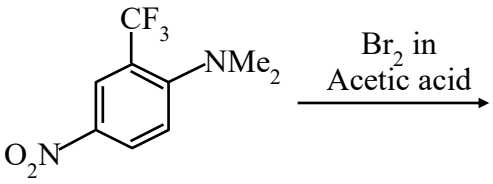
(D) 

Ans. **(D)**

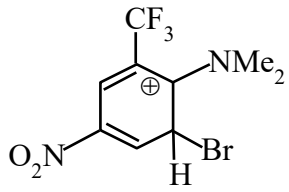
Sol. 

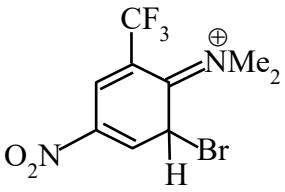
Cyclic hemiacetal (6 membered ring)

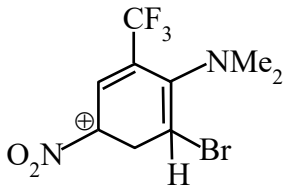
42. A medicinal chemist is exploring halogenated aromatic compounds as potential precursors for drug molecules. In one experiment, she attempts bromination of a substituted aromatic ring in the presence of acetic acid, a typical aromatic electrophilic substitution (AES) condition.

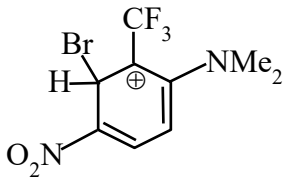


The chemist proposed an intermediate for the above reaction with the following resonance structures. Which of the following structures contributes the most to the stability of the intermediate?

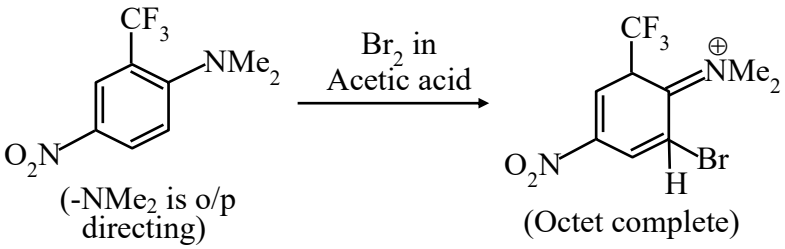
(A) 

(B) 

(C) 

(D) 

Ans. **(B)**

Sol. 

(-NMe_2 is o/p directing)

(Octet complete)

43. Which sequence of reagents, when used in the correct order, will convert benzene to m-nitro-n-propylbenzene?

(A) (i) $CH_3COCl/AlCl_3$ (ii) HNO_3/H_2SO_4 (iii) Zn/Hg, HCl

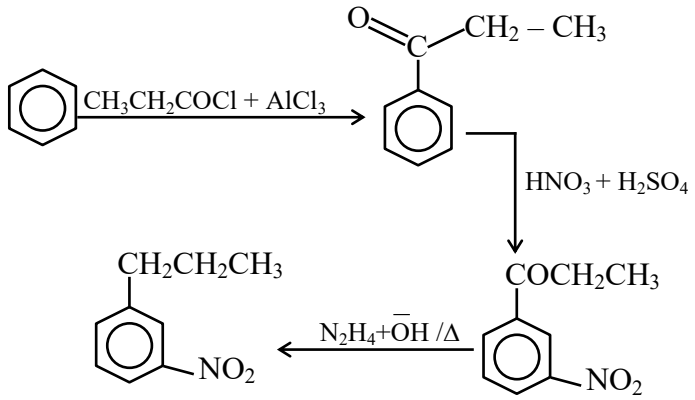
(B) (i) HNO_3/H_2SO_4 (ii) $CH_3CH_2CH_2Cl/AlCl_3$

(C) (i) HNO_3/ H_2SO_4 (ii) $CH_3CH_2COCl/AlCl_3$ (iii) $H_2NNH_2/NaOH$

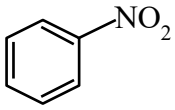
(D) (i) $CH_3CH_2COCl/AlCl_3$ (ii) HNO_3/H_2SO_4 (iii) $H_2NNH_2/NaOH$

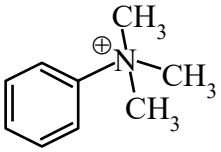
Ans. **(D)**

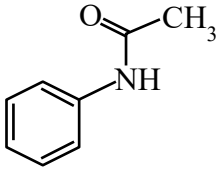
Sol.

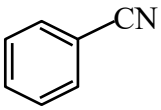


44. Which of the following compounds predominantly gives the para-nitro product as the major isomer upon nitration using a nitrating mixture ($HNO_3 + H_2SO_4$)?

(A) 

(B) 

(C) 

(D) 

Ans. **(C)**

Sol. A, B and D have meta directing groups, while (C) has o/p directing group

45. The correct order of the isoelectric points (pI) of Alanine (Ala), Arginine (Arg), and Glutamic acid (Glu) is :

(A) Ala > Arg > Glu (B) Arg > Ala > Glu

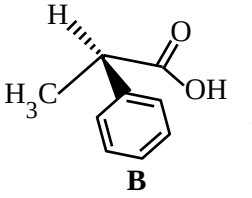
(C) Glu > Arg > Ala (D) Glu > Ala > Arg

Ans. **(B)**

Sol. Correct order of pI at isoelectric point.

Arginine	>	Alanine	>	Glutamic acid
(Basic amino acid)		(Neutral amino acid)		(Acidic amino acid)

46. Product E formed in the following chemical reaction will :



B

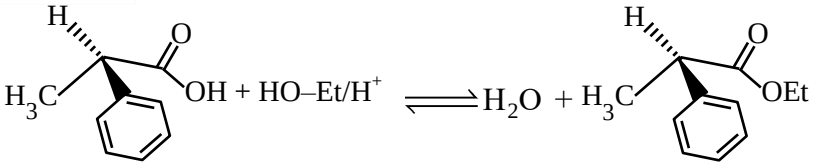
$+ HOCH_2–CH_3 \xrightleftharpoons{H^+}$ **E** $+ H_2O$

(A) Have the same configuration as **B** (B) Have inverted configuration as compared to **B**

(C) Be a racemic mixture (D) Be optically inactive.

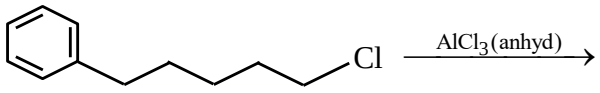
Ans. **(A)**

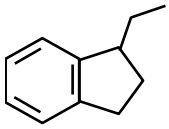
Sol.

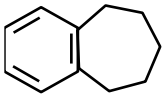


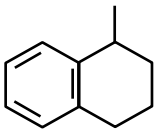
Retention of configuration

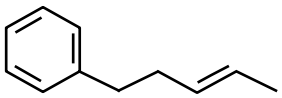
47. The most predominant product of the following reaction will be:



(A) 

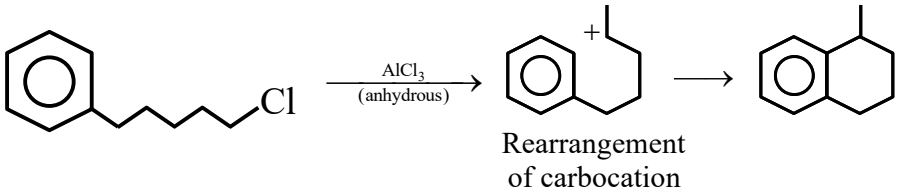
(B) 

(C) 

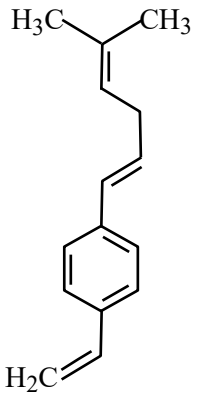
(D) 

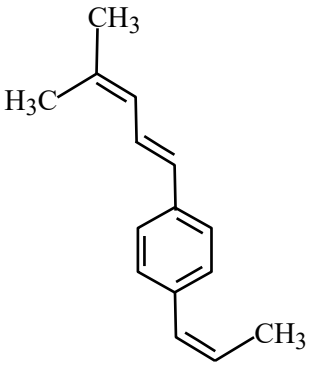
Ans. **(C)**

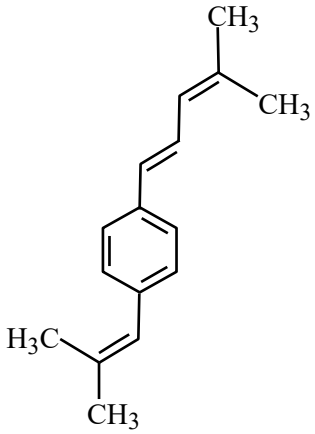
Sol.

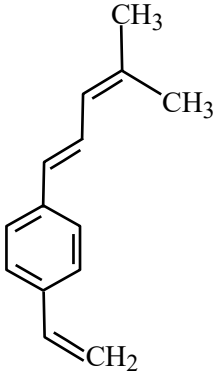


48. Which of the following molecules will react with ozone and hydrogen peroxide to form 1,4-benzene dicarboxylic acid, formic acid, oxalic acid and acetone?

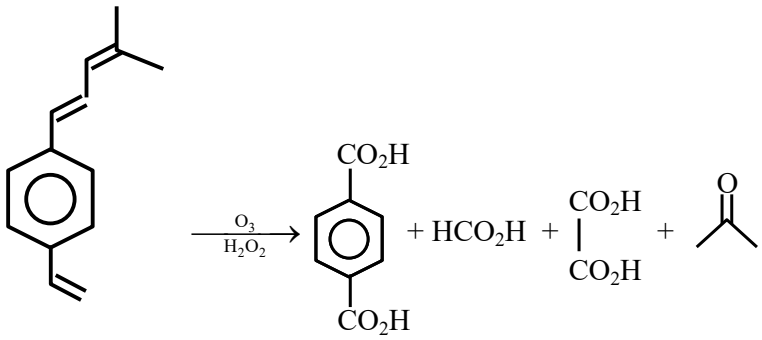
(A) 

(B) 

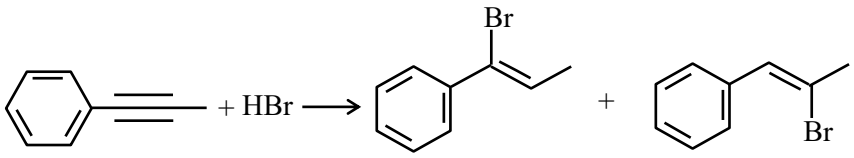
(C) 

(D) 

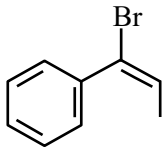
Ans. (D)

Sol. 

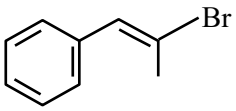
49. The following reaction was performed.



However, on investigation it was discovered that there were additional product(s) in the reaction mixture. The additional product(s) is/are

(A) 

(B) a vicinal dibromide

(C) 

(D) a geminal dibromide

Ans. (ABCD)

Sol. Compounds (A) & (C) can be formed on reaction with 1 eq. HBr (they are geometrical isomers of the given products).

Compounds (B) & (D) can be formed on reaction with 2 eq. HBr.

50. Two open beakers A and B are kept inside a sealed box. Initially, beaker A contains 30 mL of 0.050 M glucose solution and beaker B contains 30 mL of 0.035 M fructose solution. Enough time was given to ensure that the water vapour in the system is in equilibrium. Under the equilibrium conditions, Assume density of solution to be 1 gm/cm^3.

(A) Volume of solution in A decreased to 25 mL

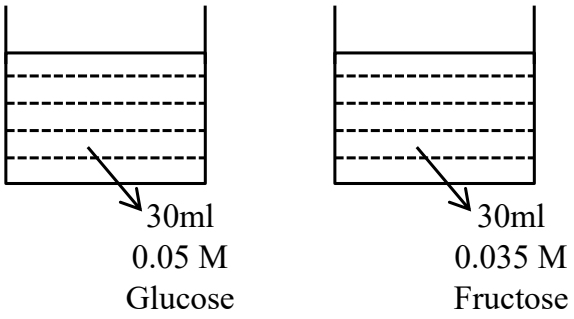
(B) Volume of solution in B decreased to 25 mL

(C) Volume of solution in A increased to 35 mL

(D) Volume of solution in B increased to 35 mL

Ans. **(BC)**

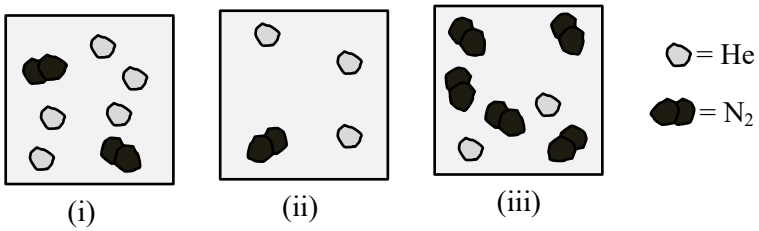
Sol.



0.035 M Fructose has lesser concentration, hence it's vapour pressure will be high and 0.05 M glucose solution has higher concentration, hence lesser vapour pressure, so evaporation occurs from fructose solution and condensation occurs in glucose solution.

Hence volume of glucose solution increases and that of fructose solution decreases.

51. Three different gaseous mixtures (i), (ii) and (iii) of helium and nitrogen are placed in boxes of equal volume as shown below :



The true statement(s) from the following is/are

(A) Box (ii) has the lowest pressure

(B) Box (ii) has the lowest partial pressure of helium

(C) Box (ii) has the lowest density

(D) Pressure of box (iii) is less than pressure of box (i)

Ans. **(AC)**

Sol.

(i)	(ii)	(iii)
2 mole N_2 5 mole He	1 mole N_2 3 mole He	5 mole N_2 2 mole He
V, T	V, T	V, T

(a) As box (ii) has lowest moles.

(b) Box (iii) has lowest partial pressure of He

(c) Box (ii) has lowest mass, hence lowest density

(d) Pressure of box (iii) is same as pressure of box (i)

52. Identify the isotonic solution(s) from the following mixtures of aqueous solutions at 298 K. (Assume complete dissociation of the electrolytes in water)

(A) 100 mL, 0.5 M glucose solution and 110 mL 0.2 M $CuSO_4$ solution.

(B) 200 mL 0.5 M acetamide solution and 300 mL 0.1 M NaCl solution.

(C) 400 mL 0.1 M $BaCl_2$ solution and 100 mL 0.2 M KCl solution.

(D) 200 mL 0.13 M $CaCl_2$ solution and 200 mL 0.125 M HCl solution.

Ans. **(NA)**

Sol. For isotonic solution $i_1C_1 = i_2C_2$

(a) Glucose $\rightarrow 1 \times 0.5 = 0.5$

$CuSO_4 \rightarrow 2 \times 0.2 = 0.4$

(b) Acetamide $\rightarrow 1 \times 0.5 = 0.5$

$NaCl \rightarrow 2 \times 0.1 = 0.2$

(c) $BaCl_2 \rightarrow 3 \times 0.1 = 0.3$

$HCl \rightarrow 2 \times 0.2 = 0.4$

(d) $CaCl_2 \rightarrow 3 \times 0.13 = 0.39$

$HCl \rightarrow 2 \times 0.125 = 0.25$

53. Alkyl lithium compounds are of interest in organic synthesis as efficient alkylating agents. Consider the following two reactions.

(i) $C_4H_9Li + C_6H_6 \rightarrow C_6H_5Li + C_4H_{10}$

(ii) $C_5H_5Li + C_6H_6 \rightarrow C_6H_5Li + C_5H_6$

The CORRECT statement(s) for the above two reactions is/are :

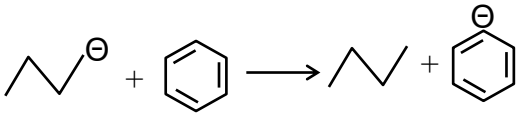
(A) Reaction (i) will proceed because the more acidic hydrocarbon will react with the Li-derivative of less acidic hydrocarbon to liberate less acidic hydrocarbon.

(B) Reaction (ii) will proceed because the less acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate more acidic hydrocarbon.

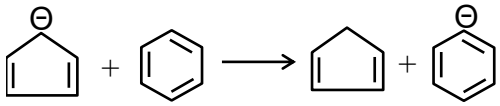
(C) Both the reactions will proceed because the more acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate less acidic hydrocarbon.

(D) Both the reactions proceed because the less acidic hydrocarbon will react with the Li-derivative of more acidic hydrocarbon to liberate less acidic hydrocarbon.

Ans. **(A)**

Sol. (i) 

This reaction proceeds forward since benzene is stronger acid than butane.

(ii) 

This reaction does NOT proceed forward since benzene is weaker acid than Cyclopentadiene

54. A mixture gave light yellow precipitate with silver nitrate which did not dissolve completely with ammonia solution. It gave positive chromyl chloride test. When organic layer test was performed with addition of excess of concentrated nitric acid, a violet coloured organic layer first formed which then changed to orange colour. Brown ring test was positive but brown coloured gas was not intensified on heating the mixture with copper turnings and concentrated sulphuric acid. Which of the anions were present?

(A) Chloride, bromide, iodide (B) Chloride, nitrate, iodide

(C) Fluoride, nitrate, bromide (D) Chloride, iodide, nitrite

Ans. **(D)**

Sol. As per information given

Cl^-, I^-, NO_2^- are possible

Cl^-= Chromyl chloride Test

I^-= Violet color in organic layer

NO_2^-= Brown Ring Test, Brown fumes not intensify with Cu & H_2SO_4

55. Consider the following half-cell reactions

$$H^+_{(aq)} + e^- \rightleftharpoons 1/2H_{2(g)} \quad E^0 = 0.00V$$

$$V^{3+}_{(aq)} + e^- \rightleftharpoons V^{2+}_{(aq)} \quad E^0 = -0.255V$$

$$VO^{2+} + e^- + 2H^+ \rightleftharpoons V^{3+}_{(aq)} + H_2O_{(\ell)} \quad E^0 = +0.337V$$

$$1/2O_{2(g)} + 2e^- + 2H^+ \rightleftharpoons H_2O_{(\ell)} \quad E^0 = +1.23V$$

Using above equations, the correct statement(s) is/are

(A) Oxidation of $V^{2+}_{(aq)}$ to $V^{3+}_{(aq)}$ by H^+ is a spontaneous reaction.

(B) Oxidation of $V^{3+}_{(aq)}$ to $V^{4+}_{(aq)}$ by H^+ is a nonspontaneous reaction.

(C) H^+ is a better oxidizing agent than O_2

(D) O_2 will be above to oxidize $V^{2+}_{(aq)}$ to $V^{3+}_{(aq)}$.

Ans. **(ABD)**

Sol.

$$V^{3+} + e^- \rightleftharpoons V^{+2} \qquad E° = -0.255\ V$$

$$H^+ + e^- \rightleftharpoons \frac{1}{2}H_2 \qquad E° = 0\ V$$

$$Vo^{+2} + e^- + 2H^+ \rightleftharpoons V^{3+} + H_2O \qquad E° = +0.337\ V$$

$$\frac{1}{2}O_2 + 2e^- + 2H^+ \rightleftharpoons H_2O \qquad E° = +1.23\ V$$

Above order is increasing order of SRP

(a) H^+ will be able to oxidise V^{+2} to V^{+3}

(b) H^+ will not be able to oxidise V^{+2} to V^{+3}

(c) O_2 is better oxidising agent than H^+

(d) O_2 will oxidize V^{+2} to V^{+3}

56. The suitable combinations of physico-chemical methods that can be used to assign the correct formula to the compound $CoCl_3.4NH_3$ are

(A) Addition of $Ag^{\oplus}$ ions

(B) Electrical conductance of aqueous solution

(C) Depression in freezing point

(D) Thermal decomposition of the complex under controlled conditions

Ans. **(ABC)**

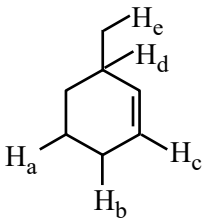
Sol. $CoCl_3.4NH_3$ can exist in $[Co(NH_3)_4Cl_2]Cl$ and is characterised by

→ Precipitation of Cl^- by Ag^+

→ Electrical conductance in water

→ Colligative properties

57. Given below is the structure of a compound X. Identify the correct statement(s) from below.



X

(A) Compound X has two vinylic protons, and two allylic protons.

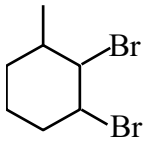
(B) Compound X (9.6 gram) will react with excess of bromine to give a dibromide (25.6 gram).

(C) The carbon radical that generated by cleavage of C–H_d bond will be more stable than that generated by cleavage of C-H_b bond.

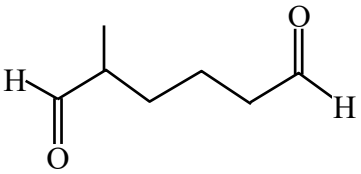
(D) Compound X on ozonolysis followed by treatment with Zn/H_2O will give a dial.

Ans. **(BCD)**

Sol. (A) False, it has 3 allylic protons

(B) True, 9.6 g (0.1 mol) compound (X) gives 0.1 mol (25.6 g) 

(C) True, due to more +I effect (3° radical)

(D) True, 

is formed

58. Which of the following statement(s) is/are incorrect for sugars?

(A) If a disaccharide is dextrorotatory, it means both its monosaccharides will also be essentially dextrorotatory.

(B) The designations (+) and (–) can also be referred to as D- and L- respectively

(C) The predominant hemiacetal form of glucose is formed by bond formation between C_1 and C_6

(D) All nucleic acids contain 2-deoxy-D-ribose as the aldopentose.

Ans. **(ABCD)**

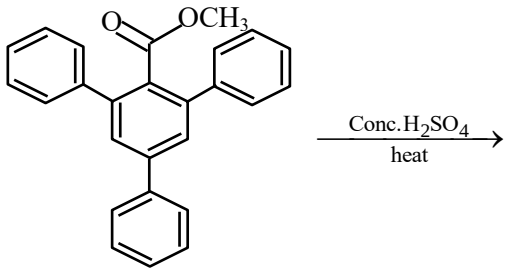
Sol. (A) False, (+) – sucrose on hydrolysis gives (+) – glucose & (–) –fructose

(B) False, (+) & (–) refer to dextrorotatory & levorotatory respectively.

(C) False, bond formation occurs between C_1 & oxygen connected to C_5

(D) False, RNA contains D-ribose

59. When the following reaction was performed, the product obtained gave a bright orange red precipitate with 2,4-dinitrophenylhydrazine and does not react with saturated solution of $NaHCO_3$



This implies :

(A) hydrolysis has taken place

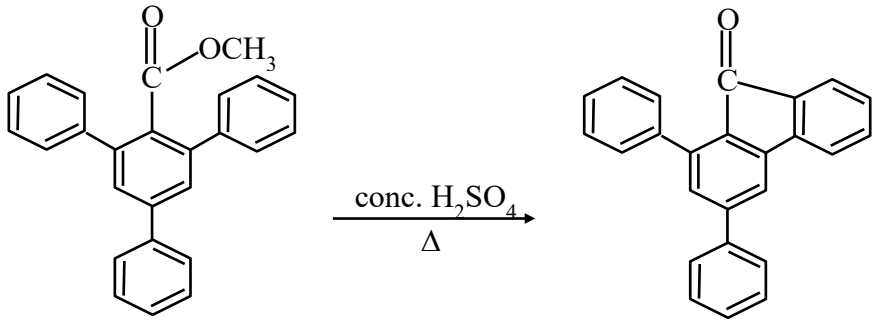
(B) intramolecular Friedal Crafts reaction has been favoured

(C) intermolecular Friedal Crafts reaction has taken place

(D) The product has a carbonyl functional group.

Ans. **(BD)**

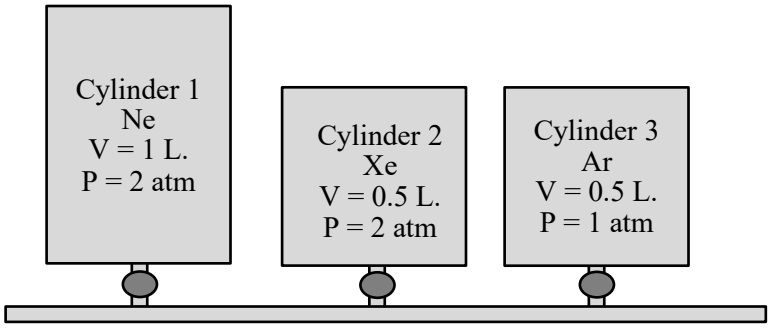
Sol.



Product

Intramolecular Friedel-Crafts acylation occurs, resulting in formation of ketone.

60. Three cylinders connected with valves are shown in the diagram. All the cylinders are at same temperature. Which of the following statement(s) is/are true once the valves are opened and the system is allowed to reach equilibrium.



NOTE: Volume of connecting tubes may be neglected.

(A) Total pressure of the system will be 1.75 atm

(B) The partial pressure of Ne in cylinder 1 will be higher than that in cylinder 2 and 3

(C) The correct order of partial pressures will be p(Ne) > p(Xe) > p(Ar)

(D) Number of moles of gas in cylinder 2 will be lower than its initial value.

Ans. **(ACD)**

Sol. After opening of all valves

(a) $P_1V_1 + P_2V_2 + P_3V_3 = P_F (V_1 + V_2 + V_3)$

$1 \times 2 + 0.5 \times 2 + 0.5 \times 1 = P_F.(1 + 0.5 + 0.5)$

$3.5 = P_F \times 2 = P_F = 1.75$ atm

(b) Partial pressure will be same for any gas.

(c) For Ne $\quad 2 \times 1 = P_F . (1 + 0.5 + 0.5) = (P_F)_{Ne} = 1$ atm

For Xe $\quad 2 \times 0.5 = P_F . (1 + 0.5 + 0.5) = (P_F)_{Xe} = 0.5$ atm

For Ar $\quad 1 \times 0.5 = P_F.(1 + 0.5 + 0.5) \Rightarrow (P_F)_{Ar} = 0.25$ atm

$\Rightarrow$ P(Ne) > P(Xe) > P(Ar)

(d) After valve is opened, in 2^{nd} container, pressure is dropped from 2 atm to 1.75 atm hence moles in cylinder-2 will decrease.

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