JEE–MAIN EXAMINATION – JUNE, 2022

27 June S - 01 Paper Solution

SECTION-A

1. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**

Assertion (A) : At 10°C, the density of a 5M solution of KCl [atomic masses of K and Cl are 39 & 35.5 g mol^{-1}]. The solution is cooled to -21°C. The molality of the solution will remain unchanged.

Reason (R) : The molality of a solution does not change with temperature as mass remains unaffected with temperature.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**

(B) Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**

(C) **(A)** is true but **(R)** is false

(D) **(A)** is false but **(R)** is true

Ans. (A)

Sol. Molality is independent of temperature and hence both assertion and reason are true.

2. Based upon VSEPR theory, match the shape (geometry) of the molecules in List-I with the molecules in List-II and select the most appropriate option

List-I (Shape)	**List-II (Molecules)**
(A) T-shaped	(I) XeF_4
(B) Trigonal planar	(II) SF_4
(C) Square planar	(III) ClF_3
(D) See-saw	(IV) BF_3

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

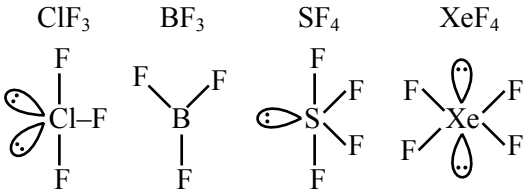
(B) (A) – (III), (B) – (IV), (C) – (I), (D) – (II)

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

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

Ans. (B)

Sol.



3. Match List-I with List-II

	List-I	**List-II**
(A)	Spontaneous process	(I) $\Delta H < 0$
(B)	Process with $\Delta P = 0$, $\Delta T = 0$	(II) $\Delta G_{T,P} < 0$
(C)	$\Delta H_{reaction}$	(III) Isothermal and isobaric process
(D)	Exothermic process	(IV) [Bond energies of molecules in reactants] - [Bond energies of product molecules

Choose the correct answer from the options given below:

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

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

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

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

Ans. (B)

Sol. (A) For a spontaneous process $\Delta G_{T,P} < 0$

(B) $\Delta P = 0 \rightarrow$ Isobaric process

$\Delta T = 0 \rightarrow$ Isothermal process

(C) $\Delta H_{reaction}$ = (Σ Bond energies of reactants) - (Σ bond energies of products)

(D) $\Delta H < 0$ is for exothermic reaction

4. Match List-I with List-II

List-I	**List-II**
(A) Lyophilic colloid	(I) Liquid-liquid colloid
(B) Emulsion	(II) protective colloid
(C) Positively charged	(III) $FeCl_3$ + NaOH
(D) Negatively charged colloid	(IV) $FeCl_3$ + hot water

Choose the correct answer from the options given below:

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

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

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

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

Ans. (A)

Sol. (A) Protective colloids are lyophilic colloids

(B) Emulsions are liquid in liquid colloidal solutions

(C) $FeCl_3$ + hot water forms positively charged colloidal solution of hydrated ferric oxide.

(D) $FeCl_3$ + NaOH forms negatively charged colloidal solution due to preferential adsorption of OH^- ions

5. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason(R)

Assertion (A): The ionic radii of O^{2-} and Mg^{2+} are same.

Reason (R) : Both O^{2-} and Mg^{2+} are isoelectronic species

In the light of the above statements, choose the correct answer from the options given below

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)

(B) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(C) (A) is true but (R) is false

(D) (A) is false but (R) is true

Ans. (D)

Sol. Ionic radius of O^{2-} is more than that of Mg^{2+}

Both O^{2-} and Mg^{2+} are isoelectronic with 10 electrons

6. Match List-I with List-II

List-I	**List-II**
(A) Concentration of gold ore	(I) Aniline
(B) Leaching of alumina	(II) NaOH
(C) Froth stabiliser	(III) SO_2
(D) Blister copper	(IV) NaCN

Choose the correct answer from the options given below.

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

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

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

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

Ans. (B)

Sol. Gold is concentrated by cyanidation

Leaching of alumina is done by NaOH

Froth stabiliser is aniline

Blister copper has condensed SO_2 on the surface

7. Addition of H_2SO_4 to BaO_2 produces:

(A) BaO, SO_2 and H_2O (B)$BaHSO_4$ and O_2

(C) $BaSO_4$, H_2 and O_2 (D) $BaSO_4$ and $H_2O_{2=}$

Ans. (D)

Sol. $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$

This is a common method to prepare hydrogen peroxide

8. $BeCl_2$ reacts with $LiAlH_4$ to give

(A) Be + $Li[AlCl_4]$ + H_2

(B) Be + AlH_3 + LiCl + HCl

(C) $BeH_2 + LiCl + AlCl_3$

(D) $BeH_2 + Li[AlCl_4]$

Ans. (C)

Sol. $2BeCl_2 + LiAlH_4 \rightarrow 2\ BeH_2 + LiCl + AlCl_3$

This is the method to prepare BeH_2

9. Match List-I with List-II

List-I **(Si-Compounds)**	List-II **(Si-Polymeric/other products)**
(A) $(CH_3)_4Si$	(I) Chain silicone
(B) $(CH_3)Si(OH)_3$	(II) Dimeric silicone
(C) $(CH_3)_2Si(OH)_2$	(III) Silane
(D) $(CH_3)_3Si(OH)$	(IV) 2D – Silicone

Choose the correct answer from the options given below:

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

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

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

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

Ans. (D)

Sol. $(CH_3)_4Si$ is a silane

$(CH_3)Si(OH)_3$ polymerise to form 2D silicone

$(CH_3)_2Si(OH)_2$ polymerise to form chain silicone

$(CH_3)_3Si(OH)$ form dimer $(CH_3)_3Si\text{-}O\text{-}Si(CH_3)_3$

10. Heating white phosphorus with conc. NaOH solution gives mainly

(A) Na_3P and H_2O (B) H_3PO and NaH

(C) $P(OH)_3$ and NaH_2PO_4 (D) PH_3 and $NaH_2PO_{2=}$

Ans. (D)

Sol. $P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_2 + PH_3$

11. Which of the following will have maximum stabilization due to crystal field?

(A) $[Ti(H_2O)_6]^{3+}$ (B) $[Co(H_2O)_6]^{2+}$

(C) $[Co(CN)_6]^{3-}$ (D) $[Cu(NH_3)_4]^{2+}$

Ans. (C)

Sol. Co^{3+} has maximum effective nuclear charge and CN^- is the strongest ligand in the given options

12. Given below are two statements:

Statement I: Classical smog occurs in cool humid climate. It is a reducing mixture of smoke, fog and sulphur dioxide

Statement II: Photochemical smog has components, ozone, nitric oxide, acrolein, formaldehyde, PAN etc.

In the light of above statements, choose the **most appropriate** answer from the options give below

(A) Both **Statement I** and **Statement II** are correct

(B) Both **Statement I** and **Statement II** are incorrect

(C) **Statement I** is correct but **statement II** is = incorrect

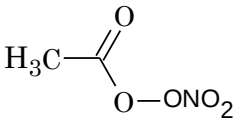
(D) **Statement I** is incorrect but **Statement II** is = correct

Ans. (A)

Sol. Classical smog occurs in cool humid climate. It is a reducing mixture of smoke, fog and sulphur dioxide

Photochemical smog has components, ozone, nitric oxide, acrolein, formaldehyde, PAN etc.

$CH_4 + O_3 \rightarrow HCHO + H_2O + CH_2 = CH - CHO +$



(PAN - peroxyacetyl nitrate)

13. Which of the following is structure of a separating funnel?

(A) 

(B) 

(C) 

(D) 

Ans. (A)

Sol. It is used to separate liquid-liquid mixture which is immiscible with different densities

14. **'A'** and **'B'** respectively are:

A $\xrightarrow[(2)\,Zn-H_2O]{(1)O_3}$ Ethane-1,2-dicarbaldehyde + Glyoxal/Oxaldehyde

B $\xrightarrow[(2)\,Zn-H_2O]{(1)O_3}$ 5-oxohexanal

(A) 1-methylcyclohex-1, 3-diene & cyclopentene

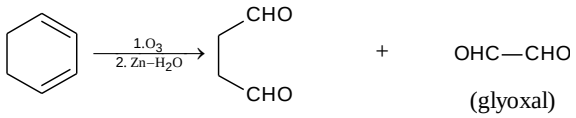
(B) Cyclohex-1, 3-diene & cyclopentene

(C) 1-methylcyclohex-1,4-diene & 1-methylcyclopent-1-ene

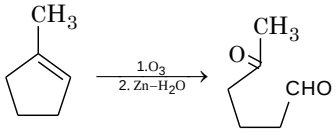
(D) Cyclohex-1,3-diene & 1-methylcyclopent-1-ene

Ans. (D)

Sol.

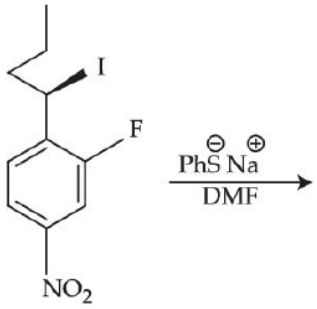


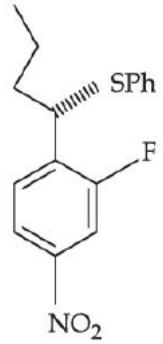
ethane-1, 2-dicarbaldehyde

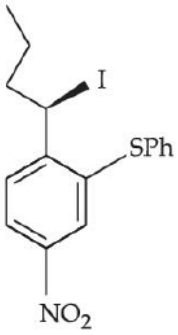


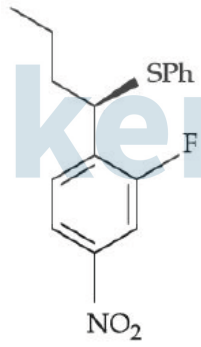
5-oxohexanal

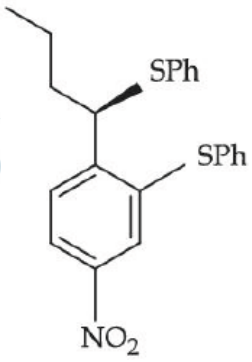
15. The major product of the following reaction is:



(A) 

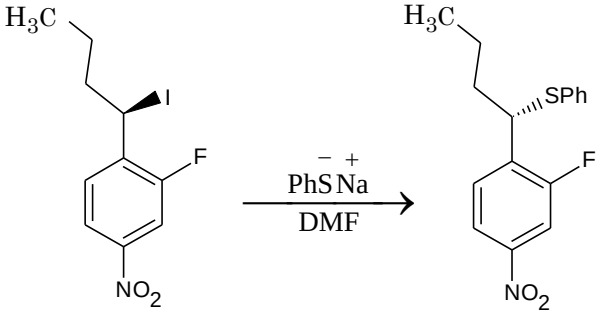
(B) 

(C) 

(D) 

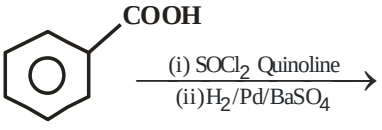
Ans. (A)

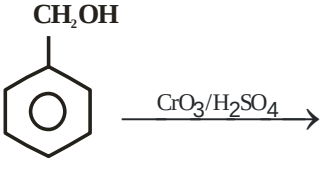
Sol.

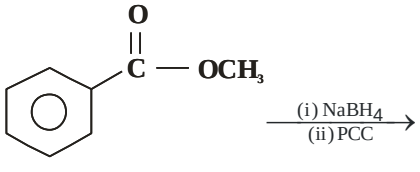


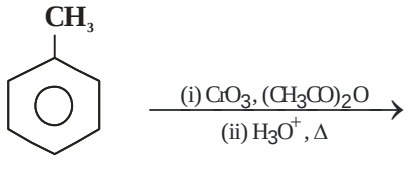
It is bimolecular nucleophilic substitution (SN^2) which occur at benzylic carbon by inversion in contiguration. This reaction cannot undergo substitution at benzene ring

16. Which of the following reactions will yield benzaldehyde as a product?

(A) 

(B) 

(C) 

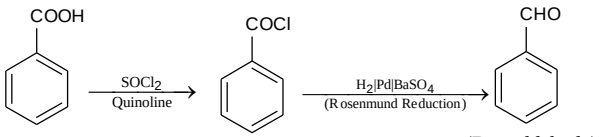
(D) 

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

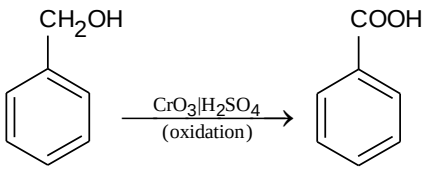
(C) (A) and (D) (D) (A) and (C)

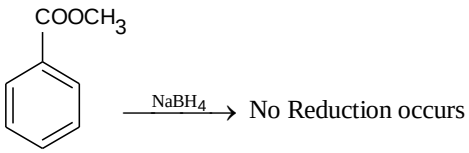
Ans. (C)

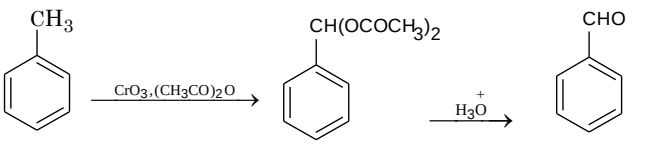
Sol.



(Benzaldehyde)







(Benzaldehyde)

17. Given below are two statements:

Statements-I : In Hofmann degradation reaction, the migration of only an alkyl group takes place from carbonyl carbon of the amide to the nitrogen atom.

Statement-II : The group is migrated in Hofmann degradation reaction to electron deficient atom.

In the light of the above statement, choose the **most appropriate** answer from the options given below:

(A)Both **Statement-I** and **Statement-II** are correct

(B) Both **Statement-I** and **Statement-II** are incorrect

(C) **Statement-I** is correct but **Statement-II** is= incorrect

(D)=**Statement-I** is incorrect but **Statement-II** is= correct

Ans. (D)

Sol. $R - CO - NH_2 + Br_2 + NaOH \rightarrow$

$R - NH_2 + Na_2CO_3 + NaBr + H_2O$

$R - CO - NH_2 + \bar{O}H \rightarrow R - CO - \bar{N}H \xrightarrow{Br_2}$

$R - CO - NH - Br \xrightarrow{OH^-} R - CO - \bar{N} - Br$

$\xrightarrow{\text{migration of } \bar{R}} R - NCO \xrightarrow{2\bar{O}H} RNH_2 + CO_3^{2-}$

In this reaction of alkyl as well as aryl group can migrate to electron deficient nitrogen atom.

18. Match List-I with List-II

List-I **(Polymer)**	List-II **(Used in)**
(A) Bakelite	(I) Radio and television Cabinets
(B) Glyptal	(II) Electrical switches
(C) PVC	(III) Paints and Lacquers
(D) Polystyrene	(IV) Water pipes

Choose the correct answer from the options given below:

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

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

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

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

Ans. (A)

Sol. Bakelite- It is thermosetting polymer used for making electrical switches.

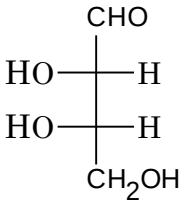
Glyptal – manufacture of paints and lacquers

PVC – manufacture of water pipes, rain coats, hand bags

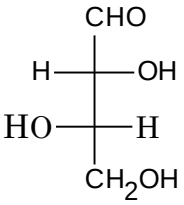
Polystyrene – manufacture of radio and television cabinets

19. L-isomer of a compound 'A' ($C_4H_8O_4$) gives a positive test with $[Ag(NH_3)_2]^+$. Treatment of 'A' with acetic anhydride yield triacetate derivative. Compound 'A' produces an optically active compound (B) and an optically inactive compound (C) on treatment with bromine water and HNO_3 respectively, compound (A) is:

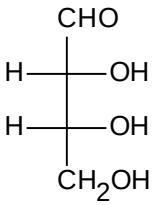
(A)



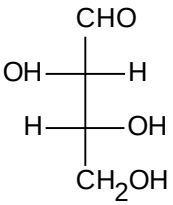
(B)



(C)

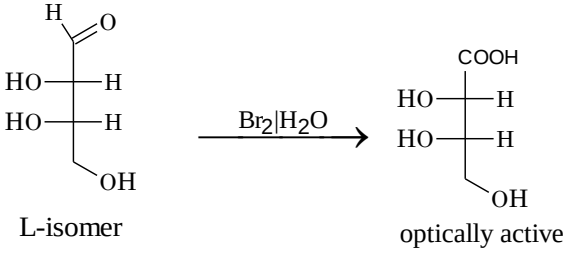


(D)

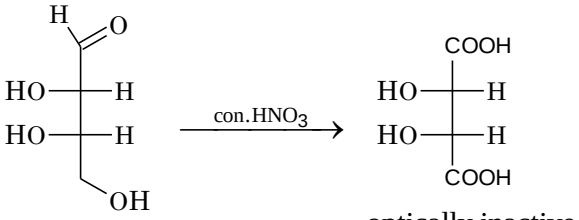


Ans. (A)

Sol.



L-isomer — optically active

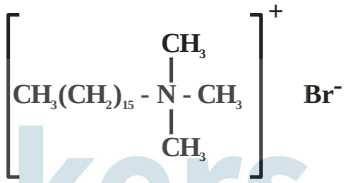


L-isomer — optically inactive

20. Match List-I with List-II

List-I

(A)



(B)

(C) $C_{17}H_{35}COO^-Na^+ + Na_2CO_3 + \text{Rosinate}$

(D) $CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$

List-II

(I) Dishwashing powder

(II) Toothpaste

(III) Laundry soap

(IV) Hair conditioner

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

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

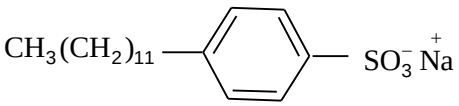
(C) (A) – (IV), (B) – (III), (C) – (II), (D) – (I)

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

Ans. (B)

Sol. **(A)** $\left[CH_3(CH_2)_{15}-N(CH_3)_3\right]^+ Br^-$

is cationic detergents used in hair conditioner



(B)

Is anionic detergent used in tooth pastes

(C) $C_{17}H_{35}COO^-Na^+ + Na_2CO_3 + Rosinate$ is used as laundary soap

(D) $CH_3(CH_2)_{16}COO(CH_2CH_2O)_NCH_2CH_2OH$ is non-ionic detergents formed from stearic acid and poly ethylene glycol used as liquid dishwashing detergents

SECTION-B

1. Metal deficiency defect is shown by $Fe_{0.93}O$. In the crystal, some Fe^{2+} cations are missing and loss of positive charge is compensated by the presence of Fe^{3+} ions. The percentage of Fe^{2+} ions in the $Fe_{0.93}O$ crystals is _____ . (Nearest integer)

Ans. (85)

Sol. In $Fe_{0.93}O$ for every 93 Fe ions 14 are Fe^{+3} and (93 – 14) = 79 are Fe^{+2} ions

$\therefore$ **%** $Fe^{+2} = \frac{79}{93}\times 100 = 84.9\%$

$\therefore$ nearest integer = 85%

2. If the uncertainty in velocity and position of a minute particle in space are, 2.4×10^{-26} (ms^{-1}) and $10^{-7}(m)$ respectively. The mass of the particle in g is _____ (Nearest integer)

(Given : $h = 6.626 \times 10^{-34}$ Js)

Ans. by NTA (22)

Allen Ans. (22)

Sol. $\Delta V = 2.4 \times 10^{-26}$ ms^{-1}

$\Delta x = 10^{-7}$ m

$\because \Delta p.\Delta x = \frac{h}{4\pi}$

$\therefore m\Delta V.\Delta x = \frac{h}{4\pi}$

$\Rightarrow m\times 2.4\times 10^{-26}\times 10^{-7} = \frac{6.626\times 10^{-34}}{4\times\pi}$

$m = \frac{6.626}{9.6\times\pi}\times 10^{-1}$

m = 0.02198 kg

m = 21.98 gm

nearest integer = 22

3. 2g of a non-volatile non-electrolyte solute is dissolved in 200 g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 8. The elevation in boiling points of A and B are in the ratio $\frac{x}{y}$ (x : y). The value of y is_____ (Nearest integer)

Ans. (8)

Sol. Given : $\frac{(K_b)_A}{(K_b)_B} = \frac{1}{8}$

$\therefore \frac{(\Delta T_B)_A}{(\Delta T_B)_B} = \frac{(K_b)_A.m}{(K_b)_B.m} = \frac{1}{8} = \frac{x}{y}$

$\because \frac{x}{y} = \frac{1}{8}$

$\therefore y = 8$ (nearest integer)

4. $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

In an experiment, 2.0 moles of NOCl was placed in a one-litre flask and the concentration of NO after equilibrium established, was found to be 0.4 mol/L. The equilibrium constant at 30°C is _____ $\times 10^{-4}$.

Ans. (125)

Sol. $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

t=0	2M	-	-
$t=t_{eq}$	(2-x)M	x M	$\frac{x}{2}$ M

$\because x = 0.4M$

$\therefore [NOCl]_{eq} = 1.6$ M

$[NO]_{eq} = 0.4$ M

$[Cl_2]_{eq} = 0.2$ M

$$\Rightarrow K_c = \frac{[NO]^2[Cl_2]}{[NOCl]^2} = \frac{[0.4]^2[0.2]}{[1.6]^2}$$

$$K_c = \frac{32}{2.56} \times 10^{-3}$$

$K_c = 12.5 \times 10^{-3}$

$K_c = 125 \times 10^{-4}$

Integer answer is 125

5. The limiting molar conductivities of NaI, $NaNO_3$ and $AgNO_3$ are 12.7, 12.0 and 13.3 mS m^2 mol^{-1}, respectively (all at 25°C). The limiting molar conductivity of AgI at this temperature is _____ mS m^2 mol^{-1}

Ans. (14) Sol.

Given

(1) λ_m^∞ (NaI) = 12.7 mS m^2 mol^{-1}

(2) λ_m^∞ ($NaNO_3$) = 12.0 mS m^2 mol^{-1}

(3) λ_m^∞ ($AgNO_3$) = 13.3 mS m^2 mol^{-1}

λ_m^∞ (Ag I) = (1) + (3) - (2)

= 12.7 + 13.3 – 12.0

= 26.0 – 12.0

λ_m^∞ (Ag I) = 14.0

6. The rate constant for a first order reaction is given by the following equation:

$$\ln k = 33.24 - \frac{2.0 \times 10^4 K}{T}$$

The Activation energy for the reaction is given by _____ kJ mol^{-1}. (In Nearest integer)

(Given: R = 8.3 J K^{-1} mol^{-1})

Ans. (166)

Sol. $\ln k = \ln A - \frac{E_A}{RT}$

Given: $\ln k = 33.24 - \frac{2.0 \times 10^4}{T}$

$\therefore$ on comparing $\frac{E_A}{R} = 2.0 \times 10^4$

$\therefore E_A = 2.0 \times 10^4 \times R$

$\Rightarrow E_A = 2.0 \times 10^4 \times 8.3$ J

$\Rightarrow E_A = 16.6 \times 10^4$J = 166 kJ

7. The number of statement(s) correct from the following for copper (at no. 29) is/are _____

(A) Cu(II) complexes are always paramagnetic

(B) Cu(I) complexes are generally colourless

(C) Cu(I) is easily oxidized

(D) In Fehling solution, the active reagent has Cu(I)

Ans. (3)

Sol. A,B,C are correct and D is incorrect because Fehling solution has Cu(II)

8. Acidified potassium permanganate solution oxidises oxalic acid. The spin-only magnetic moment of the manganese product formed from the above reaction is _____ B.M. (Nearest Integer)

Ans. (6)

Sol. $2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 10CO_2 + 8H_2O$

Mn^{2+} has 5 unpaired electrons therefore the magnetic moment is $\sqrt{35}$ BM

9. Two elements A and B which form 0.15 moles of A_2B and AB_3 type compounds. If both A_2B and AB_3 weigh equally, then the atomic weight of A is _____ times of atomic weight of B.

Ans. (2)

Sol. Given : Molar mass of $A_2B = AB_3$

$\therefore (2A + B) = (A + 3B)$ $\begin{bmatrix} A \rightarrow \text{Atomic wt.of A} \\ B \rightarrow \text{Atomic wt.of B} \end{bmatrix}$

$\Rightarrow A = 2B$

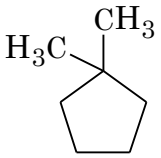
$\therefore$ atomic wt. of A is 2 times of atomic wt. of B

Integer answer is 2

10. Total number of possible stereoisomers of dimethyl cyclopentane is _____

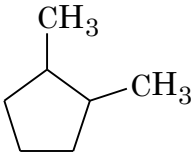
Ans. (6)

Sol. Dimethyl cyclopentane



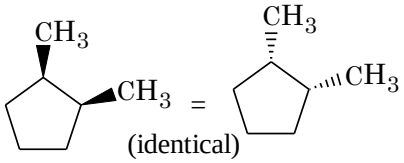
1,1-dimethylcyclopentane

no stereoisomer



1,2-dimethylcyclopentane

will show stereo isomerism, Its stereo isomers are



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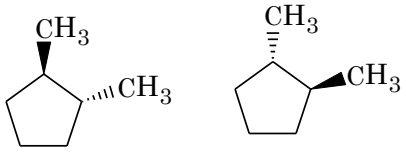
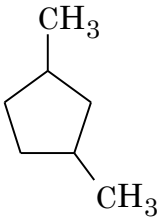
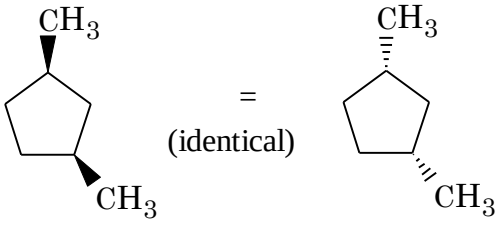


(enantiomers)



1,3-dimethylcyclopentane

will show stereo isomerism, Its stereo isomers are



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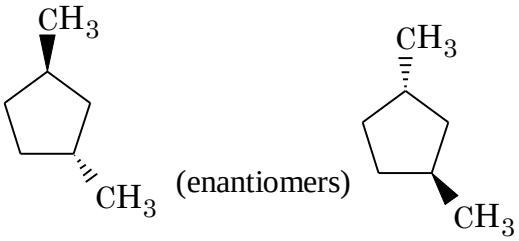

(enantiomers)