CHEMISTRY
JEE-MAIN (August-Attempt)
27 August (Shift-2) Paper

SECTION - A

1. Which one of the following tests used for the identification of functional groups in organic compounds does not use copper reagent?

(1) Seliwanoff's test (2) Barfoed's test

(3) Biuret test for peptide bond (4) Benedict test

Sol. (1)

This test used to detect the presence of aldose and ketose reagent : resorcinol and conc hcl it is used to detect monosaccharide by seduction of cu(II) Cu(I).

Used to detect presence of peptide bond protein by seduction on of Cu(II) into Cu(I).

It is used to detect aldehyde and ketone by reduction of Cu(II) into Cu(I)

2. Choose the correct statement from the following :

(1) Among the alkali metal halides, LiF is least soluble in water

(2) The low solubility of CsI in water is due to its high lattice enthalpy

(3) The standard enthalpy of formation for alkali metal bromides becomes less negative on descending the groups.

(4) LiF has least negative standard enthalpy of formation among alkali metal fluorides.

Sol. (1)

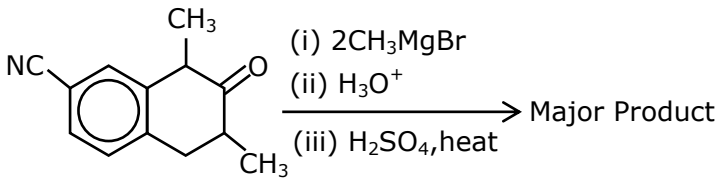
Standard enthalpy of formation for alkali metal bromides becomes more negative on desending down the group.

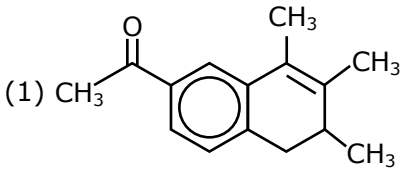
1. In case of CsI, lattice energy is less, but Cs^+ is having less hydration enthalpy due to which it is less soluble in water.

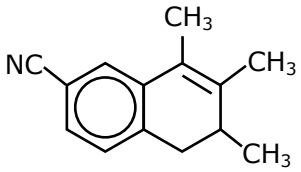
2. For alkali metal fluorides, the solubility in water increases from lithium to caesium. LiF is least soluble in water.

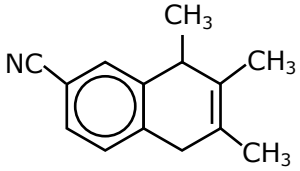
2. Standard enthalpy of formation for LiF is most negative among alkali metal fluorides.

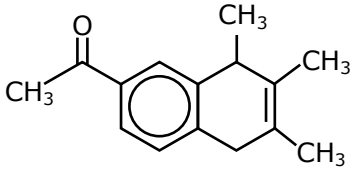
3. Which one of the following is the major product of the given reaction?



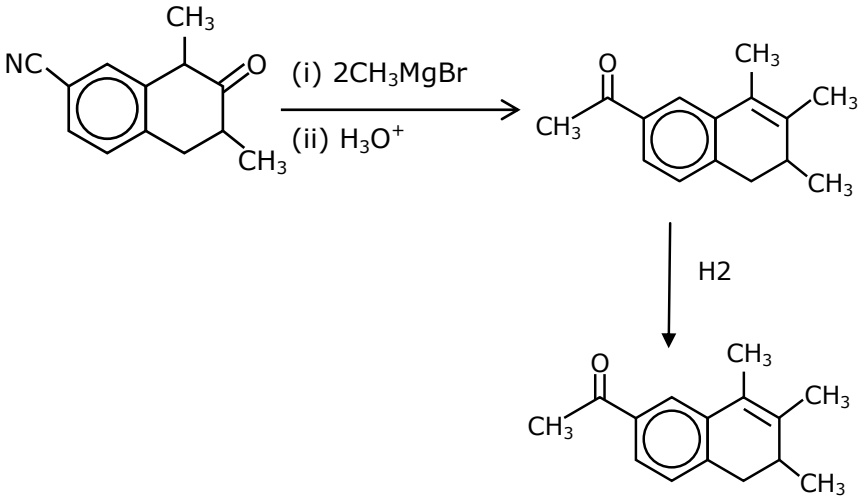
(1) 

(2) 

(3) 

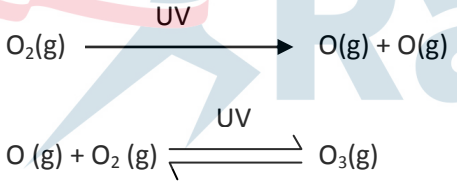
(4) 

Sol. **1**



4. In stratosphere most of the ozone formation is assisted by
(1) visible radiations (2) ultraviolet radiation
(3) γ-rays (4) cosmic rays

Sol. (2)
Ozone in the stratosphere is a product of UV radiations acting on dioxygen (O_2) molecules.



5. Potassium permanganate on heating at 513K gives a product which is
(1) paramagnetic and green (2) diamagnetic and colourless
(3) paramagnetic and colourless (4) diamagnetic and green

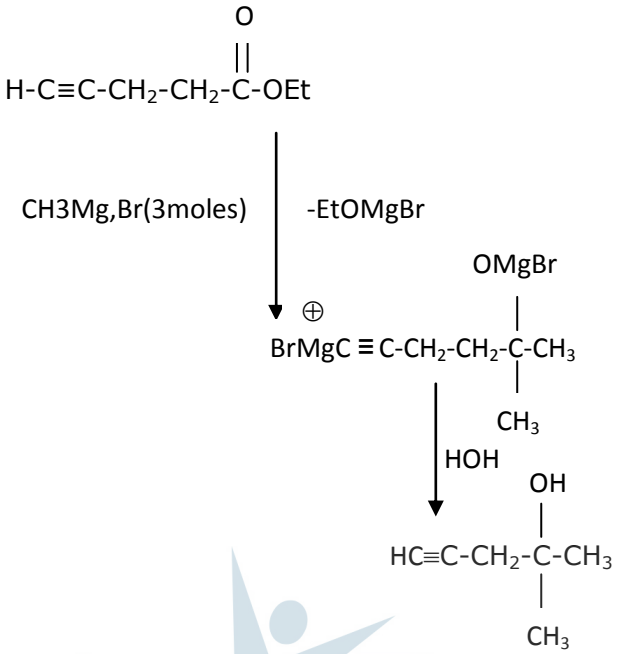
Sol. (1)

$$2KMnO_4 \xrightarrow[200^oC]{\Delta} K_2MnO_4 + MnO_2 + O_2$$

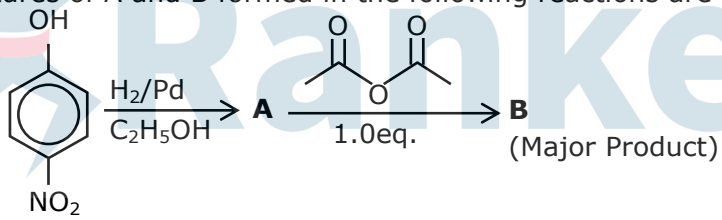
In K_2MnO_4, manganese oxidation state is +6 and hence it has one unpaired e-.

6. Given below are two statements :
Statement I : Ethyl pent-4-yn-oate on reaction with CH_3MgBr gives a 3°alcohol.
Statement II : In this reaction one mole of ethyl pent-4-yn-oate utilizes two moles of CH_3MgBr.
In the light of the above statements choose the most appropriate answer from the options given below :
(1) statement I is true but statement II is false
(2) both statement I and statement II are true
(3) both statement I and statement II are false
(4) statement I is false but statement II is true

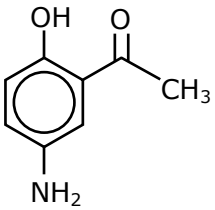
Sol. (1)
Statement 1 is true
But it consume 3 moles of G R
So statement 2 is false



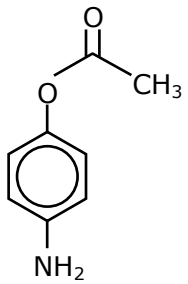
7. The correct structures of A and B formed in the following reactions are :

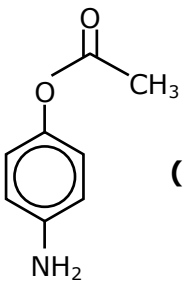


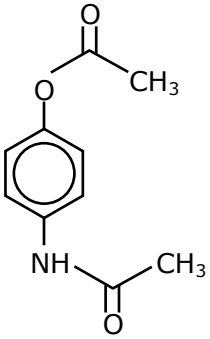
(1) **(A) :** 

(B) : 

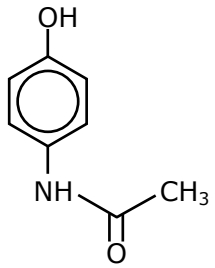
(2) **(A) :** 

(B) : 

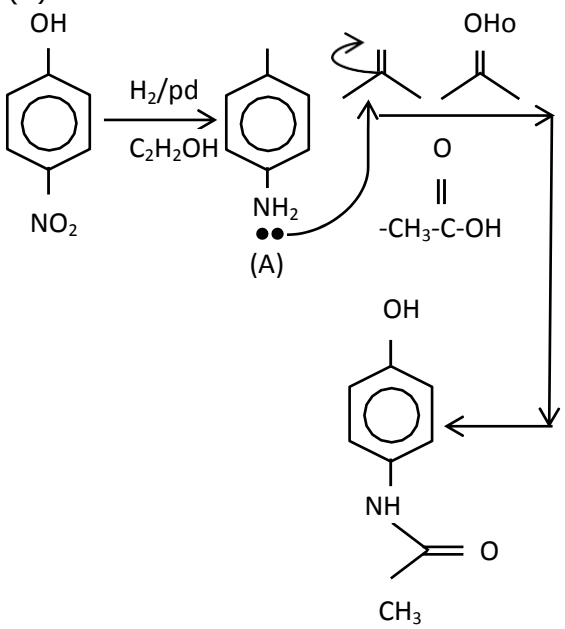
(3) **(A) :** 

(B) : 

(4) **(A) :** 

(B) : 

Sol. (4)



8. The oxide that gives H_2O_2 most readily on treatment with H_2O is :

(1) Na_2O_2 (2) $BaO_2.8H_2O$ (3) PbO_2 (4) SnO_2

Sol. (1)

(1) $PbO2 + 2H_2O \rightarrow pb(OH)_4$

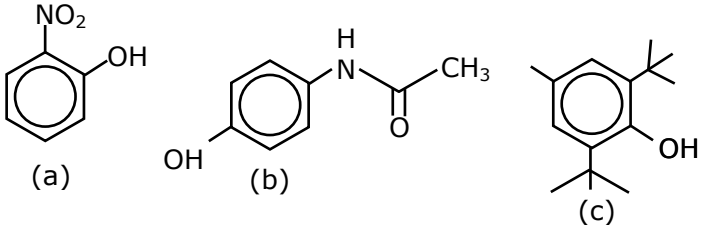
(2) $Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$

This reaction is possible at room temperature

3. $SnO_2 + 2H_2O \rightarrow Sn(OH)_4$

4. Acidified BaO_2. $8H_2O$ gives H_2O_2 after evaporation

9. The compound/s which will show significant intermolecular H-bonding is/are :



(1) (c) only (2) (b) only (3) (a) and (b) only (4) (a), (b) and (c)

Sol. (2)

(a) Shows intra molecular H-bonding

(b) Shows significant intermolecular H-bonding

(c) It do not show intermolecular H-bonding due to steric hindrance.

10. The correct order of ionic radii for the ions, P^{3-}, S^{2-}, Ca^{2+}, K^+, Cl^- is :

(1) $Cl^- > S^{2-} > P^{3-} > Ca^{2+} > K^+$ (2) $P^{3-} > S^{2-} > Cl^- > K^+ > Ca^{2+}$

(3) $P^{3-} > S^{2-} > Cl^- > Ca^{2+} > K^+$ (4) $K^+ > Ca^{2+} > P^{3-} > S^{2-} > Cl^-$

Sol. (2)

$P^{3-} > S^{2-} > C^{1-} > K^{+} > Ca^{2+}$

(Correct order of ionic radii)

all the given species are isoelectronic species.

In isoelectronic species size increases with increase of negative charge and size decreases with increasein positive charge.

11. Which one of the following is formed (mainly) when red phosphorus is heated in sealed tube at 803K?

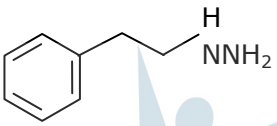
(1) Yellow phosphorus (2) White phosphorus

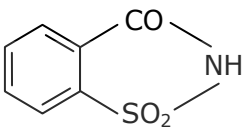
(3) β-black phosphorus (4) α-black phosphorus

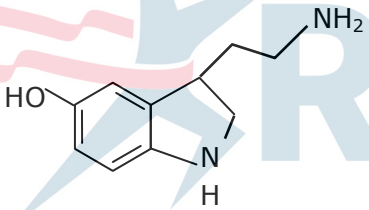
Sol. (4)

When red phosphorus is heated in a sealed tube at803 K, α-black phosphorus is formed.

Q.12 Which one of the following chemicals is responsible for the production of HCl in the stomach leading to irritation and pain?

(1) 

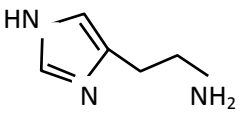
(2) 

(3) 

(4) 

Sol. (4)

Histamine stimulate the secretion of HCl



Q.13 Lyophilic sols are more stable than lyophobic sols because,

(1) The colloidal particles have positive charge.

(2) The Colloidal particles are solvated.

(3) There is a strong electrostatic repulsion between the negatively charged colloidal particles.

(4) The colloidal particles have no charge.

Sol. (2)

In the lyophilic colloids, the colloidal particles areextensively solvated.

Q.14 Which one of the following reactions will not yield propionic acid?

(1) $CH_3CH_2CH_2Br+Mg,CO_2$ dry ether/H_3O^+

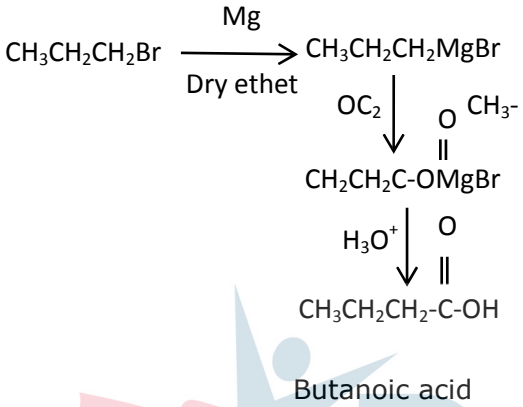
(2) $CH_3CH_2CCl_3+OH^-/H_3O^+$

(3) $CH_3CH_2COCH_3+OI^-/H_3O^+$

(4) $CH_3CH_2CH_3+KMnO_4(Heat),OH^-/H_3O^+$

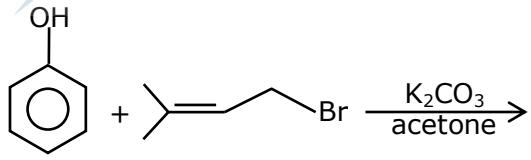
Sol. (1)

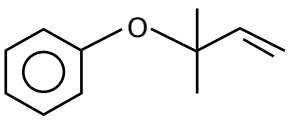
All gives propanoic acid as product but option 4gives butanoic as product

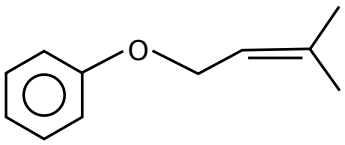


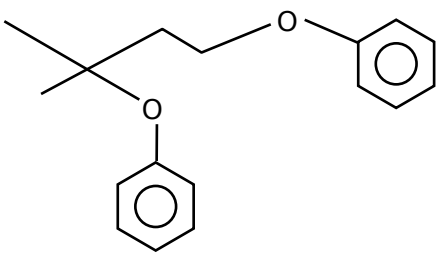
Butanoic acid

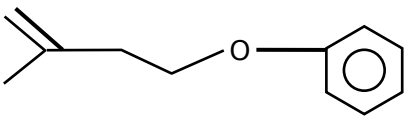
Q.15 The major product of the following reaction, if it occurs by S_N2 mechanism is :



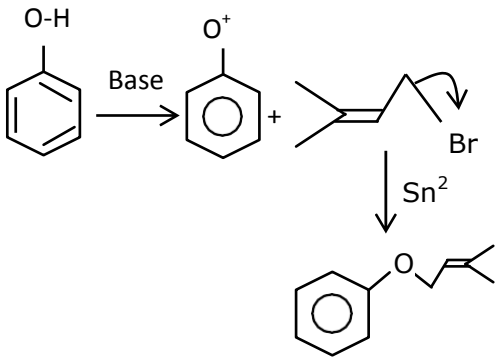
(1) 

(2) 

(3) 

(4) 

Sol. (2)



Q.16 Hydrolysis of sucrose gives :

(1) α-D-(+)-Glucose and β-D-(-)-Fructose

(2) α–D-(-)-Glucose and α-D-(+)-Fructose

(3) α-D-(+)-Glucose and α-D-(-)-Fructose

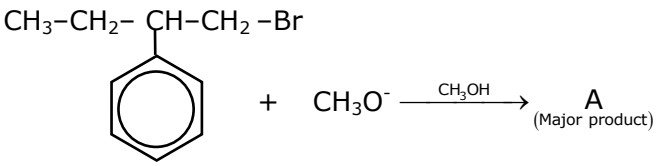
(4) α-D-(-)-Glucose and β-D-(-)-Fructose

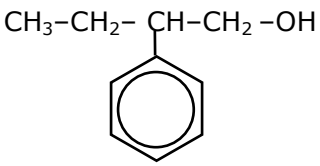
Sol. (1)

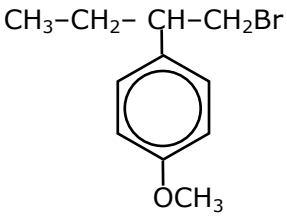
Sucrose is formed by α–D(+) . Glucose + β–D (–)Fructose.

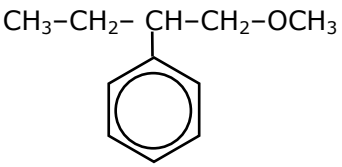
we obtain these monomers on hydrolysis.

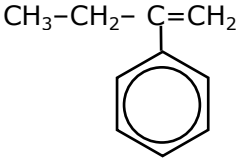
Q.17 The major product (A) formed in the reaction given below is :



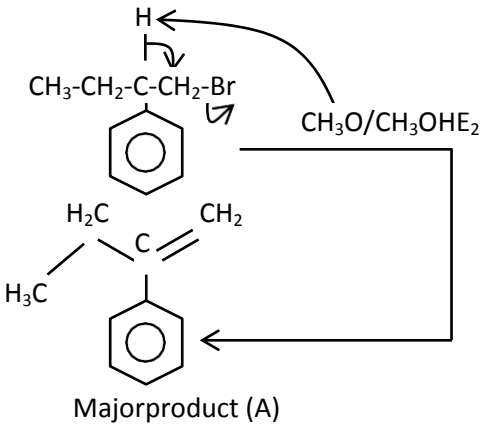
(1) 

(2) 

(3) 

(4) 

Sol. (4)



Majorproduct (A)

Q.18 Which one of the following is used to remove most of plutonium from spent nuclear fuel ?

(1) I_2O_5 (2) ClF_3 (3) O_2F_2 (4) BrO_3

Sol. (3)

O_2F_2 oxidises plutonium to PuF_6 and the reaction is used in removing plutonium as PuF_6 from spent nuclear fuel.

Q.19 Match **List- I** with **List – II:**

Lsit-I (Name of ore/mineral)		**List-II (Chemical formula)**	
(a)	Calamine	(i)	ZnS
(b)	Malachite	(ii)	$FeCO_3$
(c)	Siderite	(iii)	$ZnCO_3$
(d)	Sphalerite	(iv)	$CuCO_3.Cu(OH)_2$

Choose the most appropriate answer from the option given below

(1) (a) – (iii), (b) – (ii), (c) – (iv), (d) –(i)

(2) (a) – (iv), (b) – (iii), (c) – (i), (d) –(ii)

(3) (a) – (iii), (b) – (iv), (c) – (ii), (d) –(i)

(4) (a) – (iii), (b) – (iv), (c) – (i), (d) –(ii)

Sol. (3)

(Name of ore/mineral)

(a) Calamine $ZnCO_3$

(b) Malachite $CuCO_3.Cu(OH)_2$

(c) Siderite $FeCO_3$

(d) Sphalerite ZnS

Q.20 The addition of dilute NaOH to Cr^{3+} salt solution will give :

(1) precipitate of $\left[Cr(OH)_6\right]^{3-}$ (2) precipitate of $Cr_2O_3(H_2O)_n$

(3) a solution of $[Cr(OH)_4]^-$ (4) precipitate of $Cr(OH)_3$

Sol. (2)

$$Cr^{3+} + NaOH \xrightarrow[\text{dil.}]{} \underset{\text{precipitate}}{Cr_2O_3(H_2O)}$$

Section– B

Q.1 The first order rate constant for the decomposition of $CaCO_3$ at 700 K is 6.36×10^{-3} s^{-1} and activation energy is 209 kJ mol^{-1} . Its rate constant (in s^{-1}) at 600 K is $x \times 10^{-6}$. The value of x is _____ (Nearest inter)

[Given R =8.31 jK^{-1} mol^{-1} ; log $6.36 \times 10^{-3} = -2.19$, $10^{-4.79} = 1.62 \times 10^{-5}$]

Sol. **16**

$K_{700} = 6.36 \times 10^{-3} s^{-1}$;

$K_{600} = x \times 10^{-6} s^{-1}$

$E = 209 kj / mol$

applying;

$$\log\left(\frac{K_{T_2}}{K_{T_1}}\right) = \frac{-E_a}{2.303R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

$$\log\left(\frac{K_{700}}{K_{600}}\right) = \frac{-E_a}{2.303R}\left(\frac{1}{700} - \frac{1}{600}\right)$$

$$\log\left(\frac{6.36 \times 10^{-3}}{K_{600}}\right) = \frac{+209 \times 1000}{2.303 \times 8.31}\left(\frac{100}{700 \times 600}\right)$$

Log (6.36×10^{-3}) – $\log K_{600} = 2.6$

$\Rightarrow \log K_{600} = -2.19-2.6 = -4.79$

$\Rightarrow K_{600} = 10^{-4.79} = 1.62 \times 10^{-5}$

$= 16.2 \times 10^{-6}$

$= x \times 10^{-6}$

Q.2 The number of photons emitted by a monochromatic (single frequency) infrared range finder of power 1 mW and wavelength of 100 nm, in 0.1 second is $x \times 10^{13}$. The value of x is _____. (Nearest integer)

(h = 6.63×10^{-34} Js, C = 3.00×10^8 ms^{-1})

Sol. **50**

Energy emitted in 0.1 sec.

= 0.1 sec. $\times 10^{-3}$ J/S

= 10^{-4} J

If 'n' photons of λ = 1000 nm are emitted, then : $10^{-4} = n \times \frac{hc}{\lambda}$

$$\Rightarrow 10-4=\frac{n\times 6.63\times 10^{-34}\times 3\times 10^{8}}{1000\times 10^{-9}}$$

$\Rightarrow$ n = $5.02 \times 10^{14} - 50.2 \times 10^{13}$

$\Rightarrow$ 50 (nearest integer)

Q.3 The resistance of a conductivity cell with cell constant 1.14 cm^{-1}, containing 0.001 M KCl at 298 K is 1500 Ω. The molar conductivity of 0.001 M KCl solution at 298 K is S cm^2 mol^{-1} is _____. (Integer answer)

Sol. 760

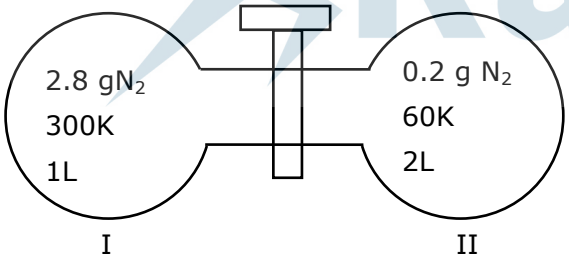
$$K=\frac{1}{R}\times \ell / \mathrm{A}=\left(\left(\frac{1}{1500}\right)\times 1.14\right) S\ cm^{-1}$$

$$\Rightarrow \wedge_m = 1000\times \frac{\left(\frac{1.14}{1500}\right)}{0.001} S\ cm^2 mol^{-1}$$

= 760 S cm^2 mol^{-1}

$\Rightarrow$ 760

Q.4 Two flasks I and II shown below are connected by a valve of negligible volume.



When the valve is opened, the final pressure of the system in bar is x x 10^{-2} .The value of x is _____(Integer answer)

[Assume - Ideal gas; 1 bar =10^5 Pa; Molar mass of N_2 = 28.0 g mol^{-1} ;

R = 8.31 J mol^{-1} K^{-1}]

Sol. 84

$\Rightarrow$ Assuming the system attains a final temperature of T (such that 300 < T < 60)

$$\Rightarrow \begin{pmatrix} Heat\ lost\ by \\ N_2\ of Container \\ I \end{pmatrix} = \begin{pmatrix} Heat\ gained\ by \\ H_2\ of\ container \\ II \end{pmatrix}$$

$$\Rightarrow n_I Cm\,(300-T) = n_{II} C_m (T-60)$$

$$\Rightarrow \left(\frac{2.8}{28}\right)(300-T) = \frac{0.2}{28}(T-60)$$

$$\Rightarrow 14(300-\mathrm{T}) = \mathrm{T}-60$$

$$\Rightarrow \Delta T_r = T_r - T_f\,' = 1.86 \times \frac{10}{9}$$

$$\Rightarrow T_r\,' = 273.15 - 1.86 \times \frac{10}{9}$$

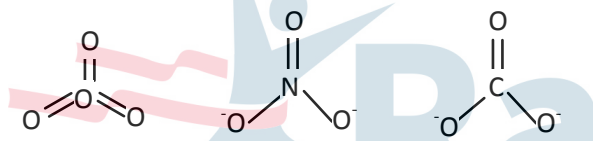
= 271.08 K

= 271 K (nearest-integer)

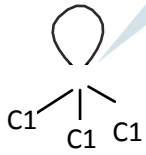
Q.5 The number of species having non-pyramidal shape among the following is_____

(A) SO_3 (2) NO_3^- (3) PCl_3 (4) CO_3^{2-}

Sol. 3



Trigonal planar Trigonal planar Trigonal planar



Pyramidal

Hence non-pyramidal species are SO_3, NO_{3-} and CO_3^{2-}.

Q.6 40 g of glucose (Molar mass = 180) is mixed with 200 mL of water. The freezing point of solution is _____ K. (Nearest integer)

[Given : K_f= 1.86 K kg mol^{-1} ; Density of water= 1.00 g cm^{-3} ; Freezing point of water =273.15 K]

Sol. 271

$\omega_{C_6H_{12}O_6}$ = 40gm

$$n_{C_6H_{12}O_6} = \frac{40}{180}\text{mole}$$

d_{H_2O} = 1gm/ml

W_{H_2O} = 200gm = 0.2kg

ΔT_f = kg m = $\frac{kg \times mole}{W_{H_2O}(kg)}$

$\Delta T_f = \frac{1.86 \times 40}{180 \times 0.2}$

ΔT_f = 2.067

$(T_f)_{Sol} = (T\text{Å})_f - \Delta T_f$

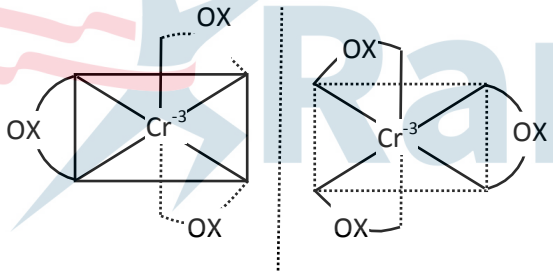
= 273.15 – 2.067

$(T_f)_{sol}$ = 271K

Q.7 The number of optical isomers possible for $\left[Cr\left(C_2O_4\right)\right]^{-3}$ is _____

Sol. 2

The number of optical isomers for $[Cr(C_2O_4)_3]^{3-}$ istwo.



Q.8 When 5.1 g of solid NH_4HS is introduced into a two litre evacuated flask at 27°C, 20% of the solid decomposes into gaseous ammonia and hydrogen suiphide. The K_P, for the reaction at 27°C is x × 10^{-2}. The value of x is _____. (Integer answer)

[Given R=0.082 L atm K^{-1} mol^{-1}J]

Sol. 6

$n_{NH_4HS} = \frac{5.1}{51}$ = 0.1mole

$NH_4HS(s) \rightleftharpoons NH_3(\uparrow) + H_2S(\uparrow)$

t = 0 0.1 – –

eq 0.1 – 0.02 0.02 002

pV = nRT

$$P = \frac{nRT}{V}$$

$$K_P = \left(P_{NH_3}\right)\left(P_{H_2S}\right)$$

$$K_P = \left(\frac{0.02 \times RT}{V}\right)\left(\frac{0.02 \times RT}{V}\right)$$

$$K_P = \left(\frac{0.02 \times 0.0821 \times 300}{2}\right)^2$$

$K_P = 6.07 \times 10^{-2}$

$x = 6$

Q.9 Data given for the following reaction is as follows :

$FeO_{(s)} + C_{(graphite)} \longrightarrow Fe_{(s)} + CO_{(g)}$

Substance	**$\Delta_f H°$ (Kj mol^{-1})**	**$\Delta S°$ (J mol^{-1} K^{-1})**
$FeO_{(s)}$	–266.3	57.49
$C_{(graphite)}$	0	5.74
$Fe_{(s)}$	0	27.28
$CO_{(g)}$	–110.5	197.6

The minimum temperature in K at Which the reaction becomes spontaneous is ____ (integer answer)

Sol. 964

$$\Delta_r H° = \sum \Delta H°_P - \sum \Delta H°_R$$

$$\Delta_r H° = (0 - 110.5) - (-266.3 + 0)$$

$\Delta_r H°$ = 155.8 kJ/mole

$$\Delta_r S° = \sum \Delta_r S°_P - \sum S°_R$$

= (27.28 + 197.6) – (57.49 + 5.74)

$\Delta_r S°$ = 161.65 J/mol-k

For spontaneous nature

$\Delta G° < 0$

$\Delta H° - T\Delta S° < 0$

$$T > \frac{\Delta H°}{\Delta S°}$$

$$T > \frac{155.8}{161.65 \times 10^{-3}}$$

$T > 963.81$

Minimum temperature = 964K

Q.10 100 g of propane is completely reacted with 1000 g of oxygen. The mole fraction of carbon dioxide in the resulting mixture is $x \times 10^{-2}$. The value of x is _____

(Nearest integer)

[Atomic weight: H = 1.008; C = 12.00; 0 = 16.00]

Sol. 19

$$n_{C_3H_8} = \frac{100}{44} \text{ mole}$$

$$n_{O_2} = \frac{1000}{32} \text{ mole}$$

O_2 is L.R.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$