CHEMISTRY
JEE-MAIN (August-Attempt)
26 August (Shift-2) Paper
Solution

SECTION - A

Q.1 The number of non-ionisable hydrogen atoms present in the final product obtained from the hydrolysis PCl_5 is :

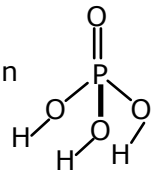
(1) 2 (2) 0 (3) 3 (4) 1

Sol. 2

$$PCl_5 + H_2O \rightarrow POCl_3 + 2HCl$$

$$\downarrow +3HO$$

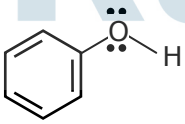
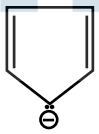
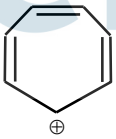
$$H_3PO_4 + 3HCl$$

In  +HCl

all hydrogens are ionisable

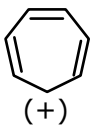
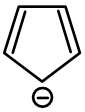
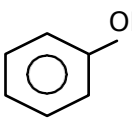
$\therefore$ Ans is zero.

Q.2 Which one of the following compounds is not aromatic?

(1)  (2)  (3)  (4) 

Sol. 4

 : Non aromatic

 ;  ;  All are aromatic

(+) ⊖ OH

Q.3 The sol given below with negatively charged colloidal particles is :

(1) $Al_2O_{(3)}xH_2O$ in water (2) KI added to $AgNO_3$ solution

(3) $AgNO_3$ added to KI solution (4) $FeCl_3$ added to hot water

Sol. 3

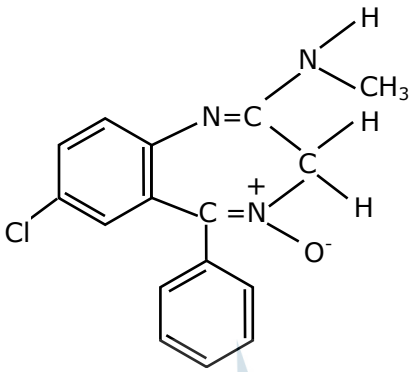
KI added to Ag NO_3

KI + Ag NO_3 $\longrightarrow$ AgI + KNO_3

AgI/I^- $\longrightarrow$ negative sol

Direct from NCERT Examples

Q.4



Chlordiazepoxide

The class of drug to which chlordiazepoxide with above structure belongs is :

(1) Tranquilizer (2) Antibiotic (3) Antacid (4) Analgesic

Sol. 1

The drug named chlordiate poxide is example of tranquilizer.

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

Assertion (A) : Photochemical smog causes cracking of rubber.

Reason (R) : Presence of ozone, nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate in photochemical smog makes it oxidizing.

Choose the most appropriate answer from the options given below:

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

(2) (A) is true but (R) is false.

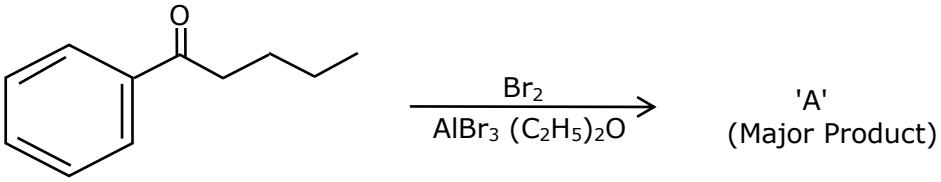
(3) (A) is false but (R) is true.

(4) Both (A) and (R) are true but (R) is not the true explanation of (A).

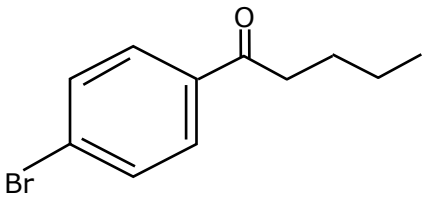
Sol. 4

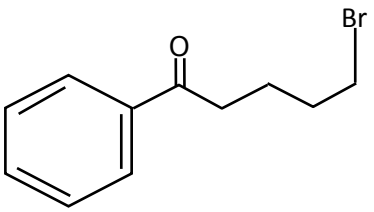
Photochemical smog causes cracking of rubber, the common component of photochemical smog areozone, nitric oxide, acrolein, formaldehyde and peroxyacetyle nitrate (PAN).

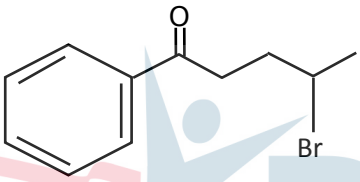
Rankers

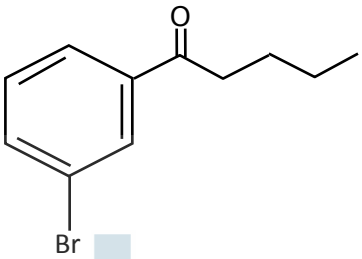
Q.6 

Consider the given reaction, the Product A is :

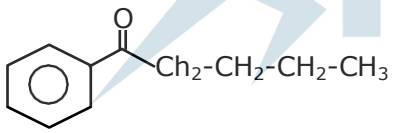
(1) 

(2) 

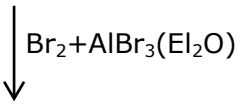
(3) 

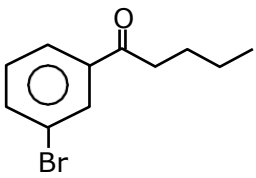
(4) 

Sol. 4



(m-directing)





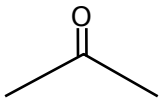
Q.7 Chalcogen group elements are :
(1) Se, Tb and Pu. (2) Se, Te and Po. (3) O, Ti and Po. (4) S, Te and Pm.

Sol. 2

Group 16/oxygen family is known as Chalcogens. And the members are O, S, Se, Te, Po

Rankers

Q.8 Match List –I with List – II

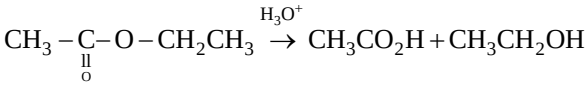
List – I (Chemical Reaction)	**List – II** (Reagent used)
(a) $CH_3COOCH_2CH_3 \rightarrow CH_3CH_2OH$	(i) CH_3MgBr/H_3O^+(1 equivalent)
(b) $CH_3COOH_3 \rightarrow CH_3CHO$	(ii) H_2SO_4/H_2O
(c) $CH_3C \equiv N \rightarrow CH_3CHO$	(iii) DIBAL-H/H_2O
(d) $CH_3C{=}N \rightarrow CH_3$ 	(iv) $SnCl_2$,HCl/H_2O

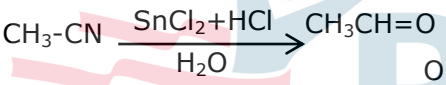
Choose the most appropirate

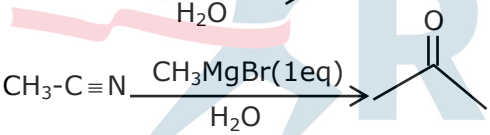
(1) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv) (2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

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

Sol. 2







Q.9 Indicate the complex/complex ion which did not show any geometrical isomerism:

(1) $[Co(NH_3)_4Cl_2]^+$ (2) $[Co(NH_3)_3(NO_2)_3]$

(3) $[CoCl_2(en)_2]$ (4) $[Co(CN)_5(NC)]^{3-}$

Sol. 4

(1) $[CoCl_2(en)_2]$ show
Cis-trans isomerism

(2) $[Co(CN)_5(NC)]^{-3}$ can'tShow G.I.

(3) $[Co(NH_3)_3(NO_2)_3]$

Show fac & mer isomerism

(4) $[Co(NH_3)_4Cl_2]^{\oplus}$ show cis & trans isomerism

Q.10 Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A) : Sucrose is a disaccharide and non-reducing sugar.

Reason (R) : Sucrose involves glycosidic linkage between C_1 of β-glucose and C_2 of α-fructose.

Choose the most appropriate answer from the option given below :
(1) Both (A) and (R) are true and (R) is the true explanation of (A).
(2) Both (A) and (R) are true but (R) is not the true explanation of (A).
(3) (A) is false but (R) is true.
(4) (A) is true but (R) is false.

Sol. 4

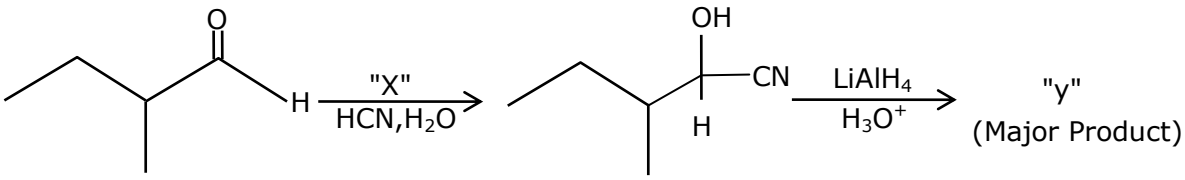
Surcrose is example of disaccharide & non reducing sugar

Assertion : correct

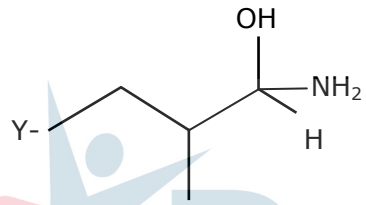
Sucrose involves glycosidic linkage between C_1 of α-D-glucose C_2 of β-D-fructose

Reason : Incorrect

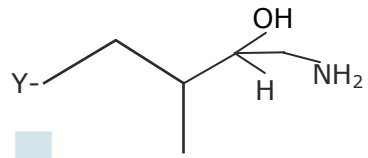
Q.11



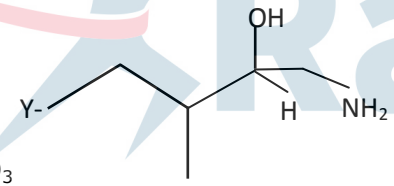
Consider the given reaction, Identify 'X' and 'Y' :



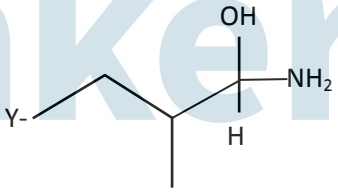
(1) X-NaOH



(2) X-NaOH

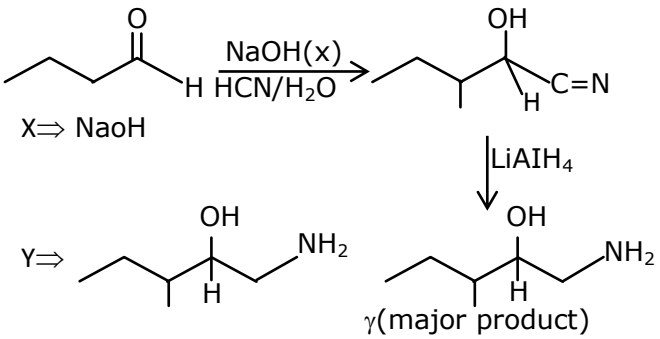


(3) X-HNO_3



(4) X-HNO_3

Sol. 2



Q.12 Givne below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Heavy water is use for the study of reaction mechanism.

Reason (R) : The rate of reaction for the cleavage of O-H bond is slower than of O-D bond.

Rankers

Choose the most appropriate answer from the options given below :
(1) (A) is true but (R) is false.
(2) Both (A) and (R) are true but (R) is not the true explanation of (A).
(3) (A) is false but (R) is true.
(4) Both (A) and (R) are true and (R) is the true explanation of (A).

Sol. 1

D_2O in used for the study of reaction mechanism. Rate of reaction for the cleavage of O–H bond > O-D bond.

Q.13 The interaction energy of London forces between two particles is proportional to r^x, where r is the distance between the particles. The value of x is:
(1) 3 (2) -3 (3) 6 (4) -6

Sol. 4

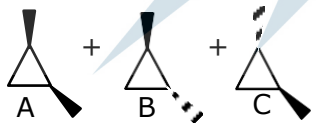
For london dispersion forces.

$$E \propto \frac{1}{r^6}$$

Hence x = –6

Q.14 The number of stereoisomers possible for 1,2-dimethyl cyclopropane is :
(1) One (2) Four (3) Two (4) Three

Sol. 4



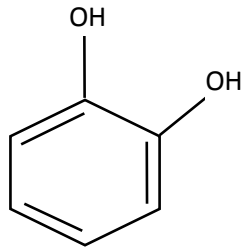
Q.15 Given below are two statements :
Statement I : Sphalerite is a sulphide ore of zinc and copper glance is a sulphide ore of copper.
Statement II : It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using 'depressants' in a froth flotation method.
(1) Statement I is false but Statement Ii is true.
(2) Both Statement I and Statement II are true.
(3) Statement I is true but Statement II is false.
(4) Both Statement I and Statement II are false.

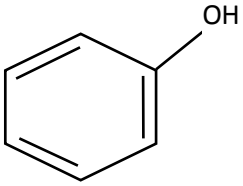
Sol. 2

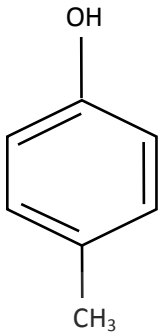
Sphalerite-ZnS, copper glance - Cu_2S two sulphide ores can be separated by adjusting proportions of oil to water or by using ' Depressants '

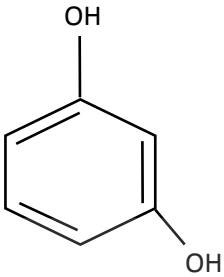
Rankers

Q.16 Which one of the following phenols does not give colour when condensed with phthalic anhydride in presence of conc. H_2SO_4?

(1) 

(2) 

(3) 

(4) 

Sol. 3

Only p-methyl, phenol does not give any colour with phthalic anhydroxide with cons. H_2SO_4.

Q.17 Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Barium carbonate is insoluble in water and is highly stable.

Reason (R) : The thermal stability of the carbonates increase with increasing cationic size.

Choose the most appropirate

(1) Both (A) and (R) are true but (R) is not the true explanation of (A).

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

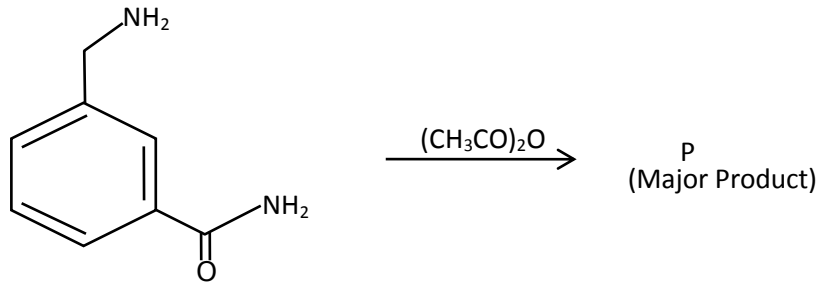
(3) (A) is true but (R) is false.

(4) (A) is false but (R) is true.

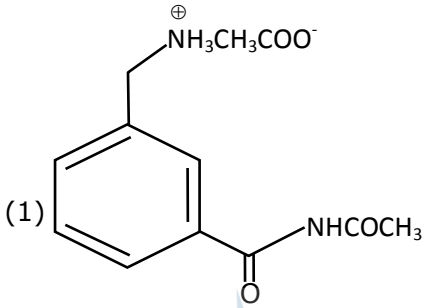
Sol. 2

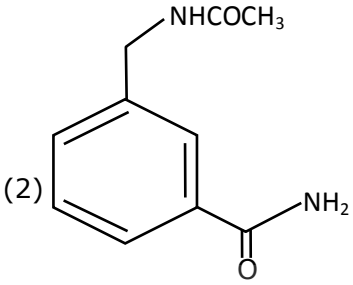
In IIA group on moving down the group size of cation increases and show thermal stability of carbonate increases.

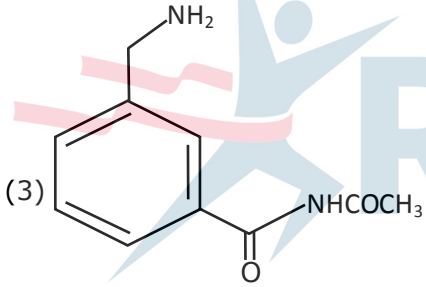
Rankers

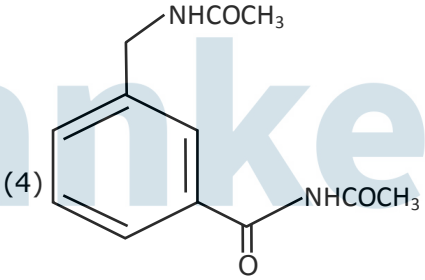


Q.18 The Major Product in the above reaction is :

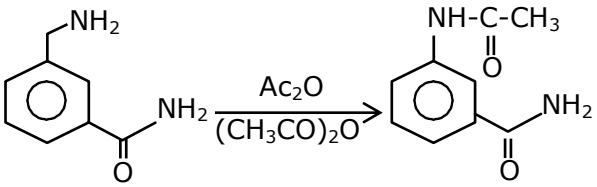
(1) 

(2) 

(3) 

(4) 

Sol. 2



Q.19 Arrange the following Cobalt complexes in the order of increasing Crystal Field Stabilization Energy (CFSE) value.

Complexes : $\underset{A}{\left[CoF_6\right]^{3-}}, \underset{B}{\left[Co(H_2O)_6\right]^{2+}}, \underset{C}{\left[Co(NH_3)_6\right]^{3+}}$ *and* $\underset{D}{\left[Co(en)_3\right]^{3+}}$.

Choose the correct option.

(1) A<B<C<D (2) B<C<D<A (3) B<A<C<D (4) C<D<B<A

Rankers

Sol. **3**

(i) CFSE $\propto$ charge or oxidation no. of central metalion.

(ii) CFSE $\propto$ strength of ligand en > NH_3 > H_2O > F^-

$\therefore$ order of CFSE

$$[\overset{III}{Co}(en_3)]^{+3} > \overset{III}{Co}(NH_3)]^{+3} > [\overset{II}{Co}(H_2O)_6]^{+2}$$

20. The bond order and magnetic behaviour of O_2^- ion are, respectively :

(1) 1 and paramagnetic. (2) 2 and diamagnetic.

(3) 1.5 and diamagnetic. (4) 1.5 and paramagnetic.

Sol. **4**

$$O_2^- = (\sigma_{1s})^2(\sigma^*_{1s})^2(\sigma_{2s})^2(\sigma^*_{2s})^2(\sigma_{2p_x})^2$$

$$\left(\pi^2_{2p_x} = \pi^2_{2P_y}\right)\left(\pi^{*2}_{2Px} = \pi^{*1}_{2Py}\right)$$

Bond order $= \frac{10-7}{2} = 1.5$

and paramagnetic

Section B

Q.1 For the galvanic cell,

$Zn(s) + Cu^{2+}(0.02\ M) \rightarrow Zn^{2+}(0.04\ M) + Cu(s)$.

$E_{cell}^{=}$ _____ $\times\ 10^{-2}V$. (Nearest integer)

$$\left[Use: E^0_{Cu/Cu^{2+}} = -0.34V.E^0_{Zn/Zn^{2+}} = +0.76V.\frac{2.303RT}{F} = 0.059V\right]$$

Sol. **109**

$$Zn(s) + Cu^{+2}_{0.02} \rightarrow Zn^{+2}_{0.04} + Cu(s)$$

According to Nernet equation

$$F_{cell} = E^0_{Cell} - \frac{0.059}{n}\log\frac{\left[Zn^{+2}\right]\left[Cu^{+}\right]}{\left[Zn\right]\left[Cu^{+2}\right]}$$

[Cu] = [Zn] = 1 (Pure solid)

n=2 (Change of e^-)

Zn is oxidized (anode)

Cu is reduced (Cathode)

$E^0_{Cell} = E^0_{Cathode} - E^0_{anod}$

$^{E0}_{Cell}$ = 0.76 – (-0.34)
E^0_{Cell} =1.10
Put value

$$E_{cell} = 1.10 - \frac{0.059}{2}\log\left(\frac{0.04}{0.02}\right)$$

E_{cell} = 1.0911
E_{cell} = 109.11×10^{-2}
E_{cell} = 110 V

Q.2 83 g of ethylene glycol dissolved in 625 g of water. The freezing point of the solution is _____K. (Nearest integer)
[Use : Modal Freezing point depression constant of water = (1)86 K kg mol^{-1}
Freezing point of water = 273 K
Atomic masses : C : 12 u, O : 16.0 u, H : 1 u]

Sol. 269

W_{C2H6O2} = 83 gm

$$n_{C2H6O2} = \frac{83}{62} mole$$

W_{H2O} = 625 gm $\Rightarrow$ 0.625 Kg
ΔTy = Kgm

$$= \times\frac{n_B}{W_A(kg)}$$

$$\Delta Ty = 1.86\times\frac{83}{62\times0.625}$$

ΔTy= 3.984
$(Ty)_{sol} = (T^0_A)_y - \Delta Ty$
$(Ty)_{sol}$ = 273 – 3.984
$(Ty)_{sol}$ = 269.016
Freezing point of solution $\Rightarrow$ 269 K

Q.3 The reaction rate for the reaction

$$\left[PtCl_4\right]^{2-} + H_2O \rightleftharpoons \left[Pt(H_2O)Cl_3\right] + Cl\sqrt{b^2-4ac}$$

was measured as a function of concentrations of different species. It was observed that

$$\frac{-d\left[[PtCl_4]^{2-}\right]}{dt} = 4.8\times10^{-5}\left[\left[PtCl_4\right]^{-2}\right] - 24\times10^{-3}\left[[Pt(H_2O)Cl_3]^{-}\right]\left[Cl^{-}\right]$$

Where square brackets are used denote molar concentrations. The equilibrium constant

K_c = _____. (Nearest integet)

Sol. 50

$$\left[Pt\,cl_4\right]^{2-} + H_2O \rightleftharpoons \left[pt(H_2O)cl_3\right]^{-} + cl^{-}$$

By rate law of revere reaction

Rate = kg $[Pt\ Cl_4]^{-2}$ – $Kb[Pt(H_2O)H_2O)Cl^-_3][Cl^-]$

Compare with given date

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$$\frac{-d\left[Ptcl_4^{-2}\right]}{dt} = 4.8\times10^{-5}\left[PtCl_4^{-2}\right] - 2.4\times10^{-3}\left[Pt(H_2O)Cl_3^-\right]\left[Cl^-\right]$$

Ky=4.8×10^{-5} Kb = 2.4×10^{-3}

$K_C = \frac{Ky}{Kb} = \frac{4.8\times10^{-5}}{2.4\times10^{-3}}$

$K_C = 2\times10^{-2}$

$K_C = 0.02$

$K_C = 0$

Q.4 100 ml. of Na_3PO_4 solution contains 3.45 g of sodium. The molarity of the solution is _____$\times10^{-2}$ mol $L^{-(1)}$ (Nearest integet)
[Atomic Masses – Na : 23.0 u, O : 16.0 u, P : 31.0 u]

Sol. 50

$V_{Na_3Po_4} = 100\,ml \Rightarrow 0.l\,L$

W_{Na} = 3.45 gm

$h_{Na} = \frac{3.45}{23}mole$

$h_{Na} = 3\times h_{Na_3Po_4}$

$h_{Na_3Po_4} = \frac{3.45}{23\times3}mole$

$\left[Na_3Po_4\right] = \frac{3.45}{23\times3\times0.1}$

$[Na_3Po_4] = 0.5$

$[Na_3Po_4] = 50\times10^{-2}$

Q.5 A chloro compound "A"
(i) forms aldehydes on ozonolysis followed by the hydrolysis
(ii) When vaporized completely 1.53 g of A, gives 448 ml. of vapour at STP.
The number of carbon atoms in a molecule of compound A is _____

Sol. 3

A(s) $\longrightarrow$ A (↑)

1.53 gm 448ml

STP :- P = 1 atm

T = 273 K

We ideal gas equation

$PV = \frac{w}{M}RT$

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$M = \frac{WRT}{PV}$

$M = \frac{1.53 \times 0.0821 \times 273}{1 \times 0.448}$

M = 76.54

The compound must contains 1 Cl and it will be alkene

CH_2=Ch-Ch_2-Cl

No. of Carbon atom = 3

Q.6 For water Δ_{vap} H=41 kJ mol^{-1} at 373 K and 1 bar pressure. Assuming that water vapour is an ideal gas that occupies a much larger volume than liquid water, the internal energy change during evaporation of water is _____kJ $mol^{-(1)}$

Sol. 38

$$H_2O(\ell) \rightarrow H_2O(g) : \Delta H = 41 \frac{kJ}{mol}$$

$$\Rightarrow \text{From the relation} : \Delta H = \Delta U + \Delta n_g RT$$

$$\Rightarrow 41 \frac{kJ}{mol} = \Delta U + (1) \times \frac{8.3}{1000} \times 373$$

$$\Rightarrow DU = 41 - 3.0959$$

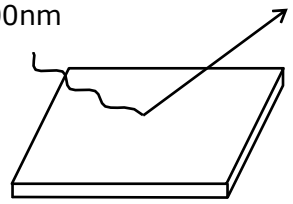
= 38 kJ/mol

Q.7 A metal surface is exposed to 500 nm radiation. The threshold frequency of the metal for photoelectric current is 4.3×10^{14} Hz. The velocity of ejected electron is_____$\times 10^5$ $ms^{-(1)}$ (Nearest integer)

[Use : h=6.63×10^{-34} Js, me=9.0×10^{-31} kg]

Sol. 5

λ=500nm



υ : speed of electron having max. K.E.

$\Rightarrow$ from Einstein equation : E = ϕ + K.E.max

$$\Rightarrow \frac{hc}{\lambda} = h\upsilon_0 + \frac{1}{2}mv^2$$

$$\Rightarrow \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{500 \times 10^{-9}} = 6.63 \times 10^{-34} \times 4.3 \times 10^{14} + \frac{1}{2}mv^2$$

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$$\Rightarrow \frac{6.63\times30\times10^{-20}}{5} = 6.63\times4.3\times10^{-20} + \frac{1}{2}mv^2$$

$$\Rightarrow 11.271\times10^{-20}\,\text{J} = \frac{1}{2}\times9\times10^{-31}\times\upsilon^2$$

$$\Rightarrow \upsilon = 5\times10^5\,\text{m/sec.}$$

Q.8 In the sulphur estimation, 0.471 g of an organic compound gave 1.44 g of barium sulphate. The percentage of sulphur in the compound is_____& (Nearest integer)
(Atomic Mass of Ba=137 u)

Sol. 42

Molecular mass of BaSO4 = 233 g
Θ 233 BaSO4 contain → 32 g sulphur

∴ 1.44 g BaSO4 contain $\rightarrow \frac{32}{233}$ × 1.44 g sulphur

given : 0.471 g of organic compound

% of S = $\frac{32\times1.44}{233\times0.471}\times100 = 41.98\% \approx 42\%$

OR

$\underset{W_{\propto}=0.471g}{\boxed{O.C.}} \rightarrow \underset{1.44g}{BaSO_4}$

$$\Rightarrow n_s = n_{BaSO_4} = \frac{1.44}{233}$$

$$\Rightarrow W_s = \frac{1.44}{233}\times32g$$

$$\text{therefore}\,\%S = \frac{W_s}{W_{O.C.}}\times100 = \frac{1.44\times32}{233\times0.471}\times100$$

$$= \frac{46.08}{109.743}\times100 = 41 = 41.98 = 42 = 42$$

Q.9 The equilibrium constant K_c at 298 K for reaction
A+B = C+D
is 100. Starting with an equimolar solution with concentrations of A,B C and D all equal to 1 M, the equilibrium concentration of D is_____$\times10^{-2}$M. (Nearest integer)

Sol. 182

A + B $\rightleftharpoons$ C + D : Keq = 100

1M 1M 1M 1M
First check direction of reversible reaction.

Since $Q_C = \frac{[C][D]}{[A][B]} = 1 < k_{eq.} \Rightarrow$ reaction will

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move in forward direction to attain equilibrium state.

$\Rightarrow A+B \rightleftharpoons C+D : K_{eq}=100$

to 1 1 1 1

$t_{eq.}\ 1-x\ 1-x\ 1+x\ 1+x$

$\text{Now : } K_{eq}=100=\frac{(1+x)(1+x)}{(1-x)(1-x)}$

$\Rightarrow \boxed{100=\left(\frac{1+x}{1-x}\right)^2}$

$(i)\ 10\left(\frac{1+x}{1-x}\right)$

$\Rightarrow 10-10x=1+x$

$\Rightarrow 11x=9$

$\Rightarrow \boxed{x=\frac{9}{11}}$

$(ii)\ -10=\frac{1+x}{1-x}$

$\Rightarrow -10+10x=1+x$

$\Rightarrow -9x=-11$

$\Rightarrow \boxed{x=\frac{11}{9}}$

$\rightarrow$ 'x' cannot be more than one, therefore not valid.
therefore equation concretion of (D) = 1 + x

$=1+\frac{9}{11}=\frac{20}{11}$

= 1.8181 = 181.81 × 10^{-2}
= 182 × 10^{-2}

Q.10 The overall stability constant of the complex ion $[Co(NH_3)_4]^{2+}$ is 2.1×10^{13} The overall dissociation constant is $y\times10^{-14}$ Then y is_____(Nearest integer)

Sol. **5**

Given $k_f = 2.1 \times 10^{13}$

$K_d = \frac{1}{} = 4.7\times10^{-14}k_f$

$\therefore$ y = 4.7≈5

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