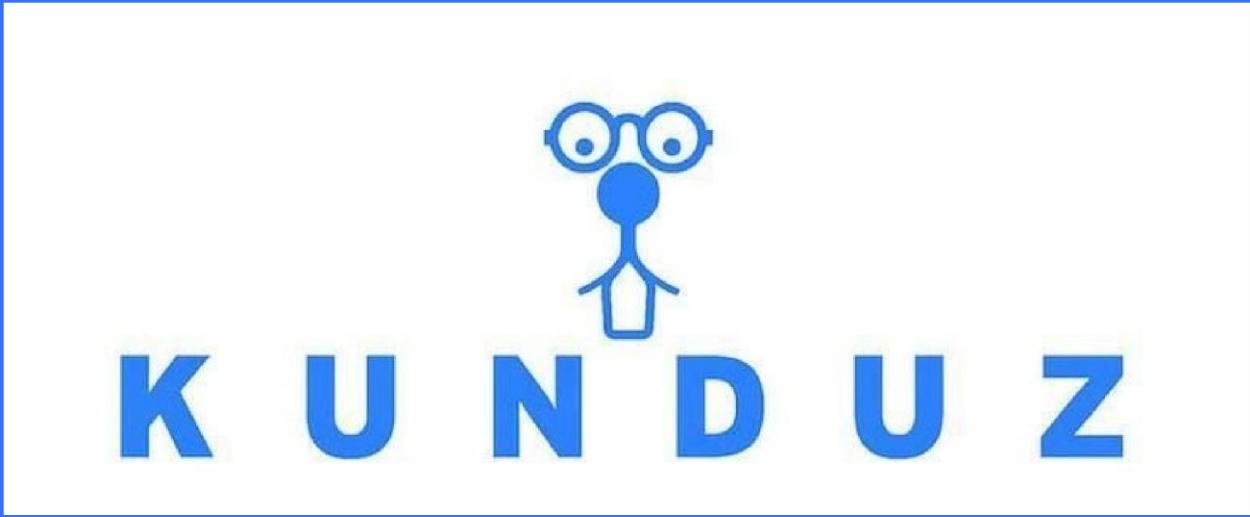


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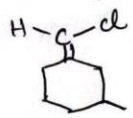
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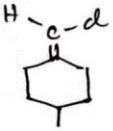
Question number

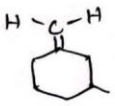
Question and Answers

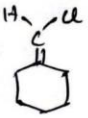
1

1. Which of the following compound will show geometrical isomerism?

(1) 

(2) 

(3) 

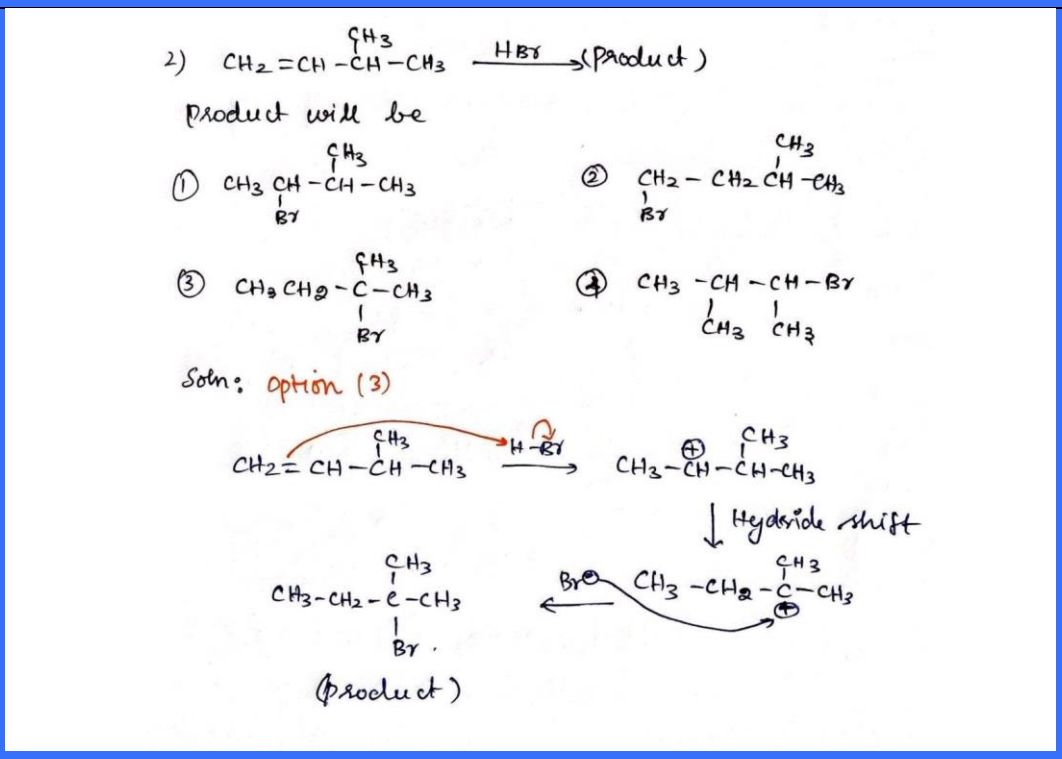
(4) 

Soln: option (1)

Compounds which have 2 different groups on doubly bonded carbon shows geometrical isomerism.

compound (1) has 2 different groups on both the doubly bonded carbon. whereas other options have same group on the doubly bonded carbon and so they do not show geometrical isomerism.

2

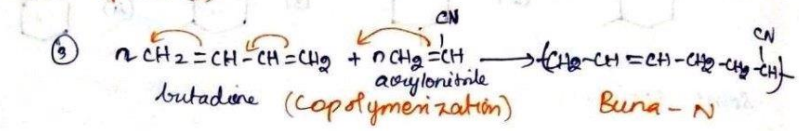

2) $CH_2=CH-\overset{CH_3}{\underset{|}{C}}H-CH_3 \xrightarrow{HBr}$ (Product)
Product will be
(1) $CH_3-\underset{Br}{\underset{|}{CH}}-\overset{CH_3}{\underset{|}{C}}H-CH_3$
(2) $\underset{Br}{\underset{|}{CH_2}}-CH_2-\overset{CH_3}{\underset{|}{C}}H-CH_3$
(3) $CH_3CH_2-\overset{CH_3}{\underset{Br}{\underset{|}{C}}}-CH_3$
(4) $CH_3-\underset{CH_3}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-Br$
Soln: option (3)
$CH_2=CH-\overset{CH_3}{\underset{|}{C}}H-CH_3$
H-Br
$CH_3-\overset{\oplus}{C}H-\overset{CH_3}{\underset{|}{C}}H-CH_3$
Hydride shift
$CH_3-CH_2-\overset{CH_3}{\underset{Br}{\underset{|}{C}}}-CH_3$
$Br^{\ominus}$
$CH_3-CH_2-\overset{CH_3}{\underset{\oplus}{\underset{|}{C}}}-CH_3$
(Product)

3

3) Which is not a condensation polymer?

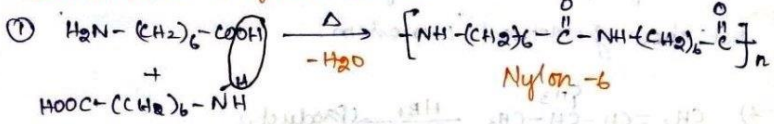
(1) Nylon - 6 (2) Nylon - 6,6 (3) Buna - N (4) Bakelite

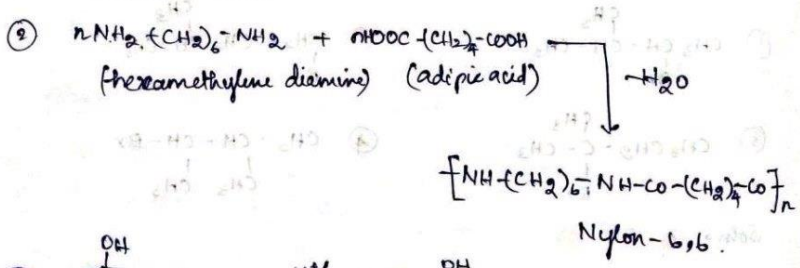
Soln: option (3)

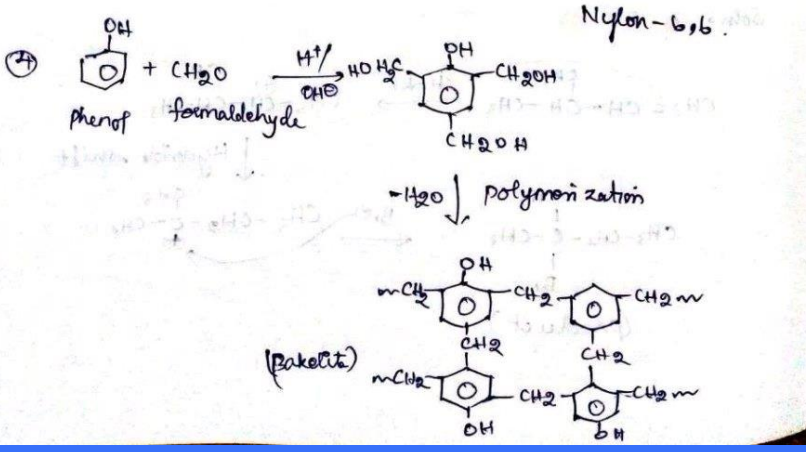


A condensation polymerization is a step-growth polymerization in which monomers / oligomers reacts with each other to form larger units releasing smaller molecules as a byproduct. eg: H_2O, CH_3OH etc

condensation polymerization:

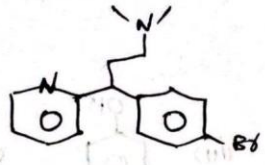






4

Q. what is the use of Brompheniramine?



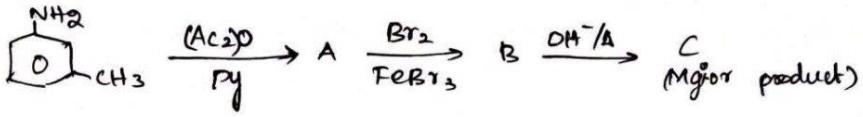
(1) antidepressant (2) Antihistamines

(3) Antiseptic (4) Analgesic

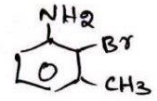
Soln: Option (2)

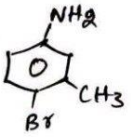
Brompheniramine (Dimetapp) is an antihistamine which is used to treat sneezing, running nose, itchy eyes etc. It belongs to propylamine class.

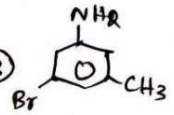
5

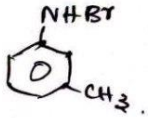
5. 

product C will be.

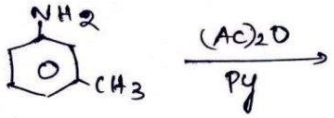
(1) 

(2) 

(3) 

(4) 

Soln: option (2)

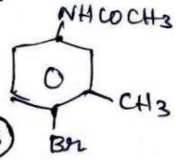


+ CH_3COOH (protection (acetylation step))

(A)

$Br_2/FeBr_3$ (Bromination)

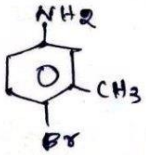
Bromination of Acetanilide yields para Brominated Product.



+ HBr

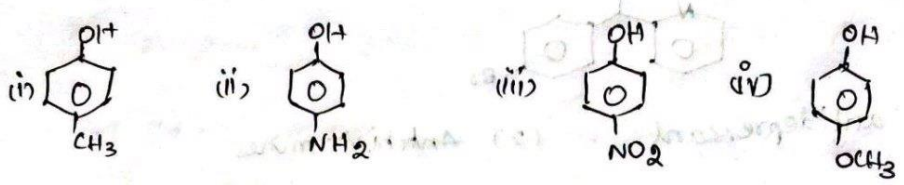
(B)

$OH^{\ominus}$, Δ (deprotection step)



6

b. Which is the correct order of Boiling point of given compounds?



(1) ii > iii > iv > i (2) ii > i > iv > iii

(3) i > iii > iv > ii 4) i > iii > ii > iv.

Soln: Option (1) [ii > iii > iv > i]

~~As~~ boiling point increases with increase in molecular weight.

Molecular weight of compound (i) - 108
(ii) - 109
(iii) - 139
(iv) - 124

Boiling point order should be iii > iv > ii > i

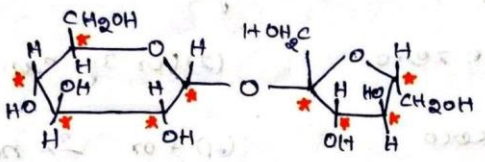
but in compound (ii) due to intermolecular H-bonding its boiling point increases.

So order will be ii > iii > iv > i

7

7. Total number of chiral carbon atoms present in sucrose is

Soln:



Ans: Sucrose has 9 chiral carbon atoms.

8

8) The minimum distance between the centre of two octahedral voids in FCC lattice terms of edge length.

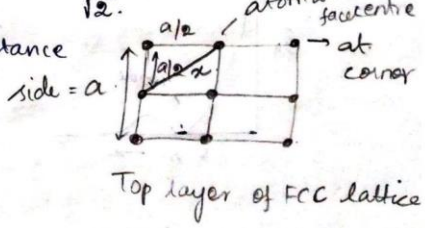
(1) a (2) $a/2$ (3) $a/\sqrt{2}$ (4) $\sqrt{2}a$

Solution: Option (3)

In FCC, octahedral voids are present at the edge centres and body centre.

Minimum distance between centres of two octahedral voids $= x = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{a}{2}\right)^2} = \sqrt{\frac{2a^2}{4}} = \frac{a}{\sqrt{2}}$.

Where x is the minimum distance



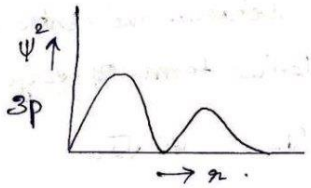
Top layer of FCC lattice

9

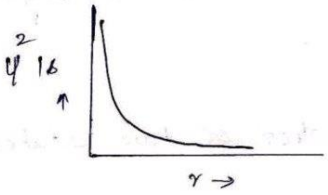
9) Which of the following statement is correct regarding probability density (except infinity)

(1) For 2p cannot be zero
(2) For 3p can be zero
(3) For 1s can be zero
(4) For 2s never be zero

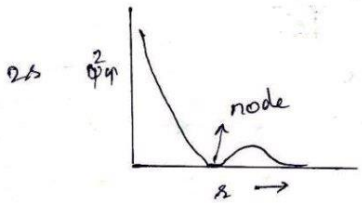
Solution: option (2)



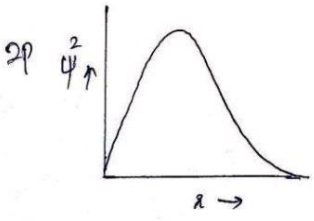
ψ^2 (probability density) can be zero for 3p orbital.
(r - distance between nucleus and electron)



The probability density is greatest at r=0 and decreases steadily with increasing distance. It cannot be zero.



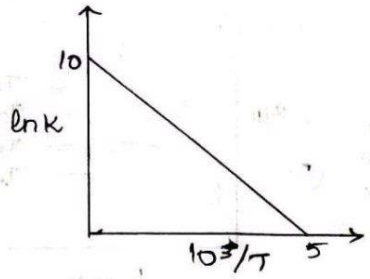
The probality density is maximum near the nucleus and decreases sharply to zero and then start increasing again and after reaching a maximum falls abruptly



ψ^2 can be zero at r = 0 for 2p orbital.

10

10 Using following graph find activation energy in KJ.



(1) R (2) 1/R (3) 2R (4) 2/R.

Solution: option (3)

$K = Ae^{-Ea/RT}$ (Arrhenius equation)

$\ln K = \ln A - \frac{Ea}{RT}$ ÷ and multiply by 10^3

$\ln k = \ln A - \left(\frac{Ea}{R \times 10^3}\right)\left(\frac{10^3}{T}\right)$

This is of the form $Y = mx + C$.

slope $m = \frac{-Ea}{R \times 10^3}$ —①

from the graph, slope $= \frac{-10}{5}$ —②

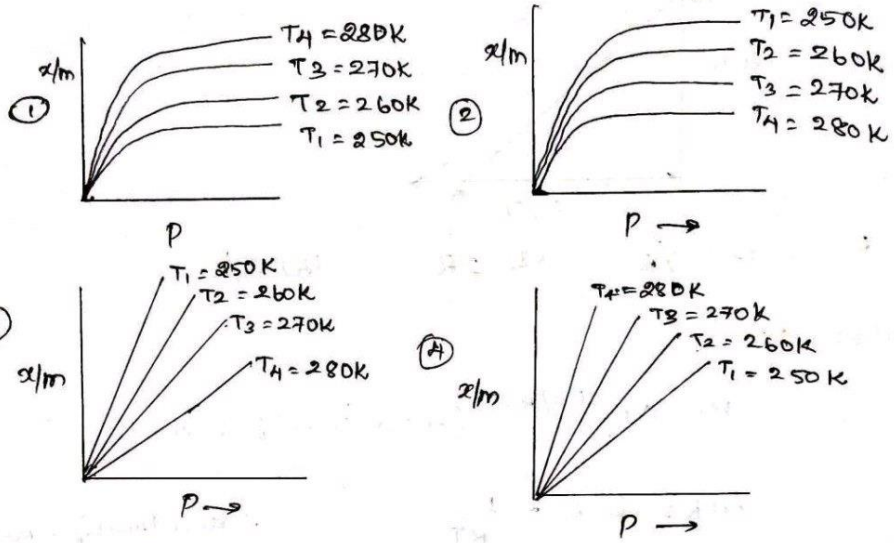
$\frac{-Ea}{R \times 10^3} = \frac{-10}{5} 2$

$Ea = 2R \times 10^3 J$

$Ea = 2R\ KJ.$

11

11. Which of the following graph between $\left(\frac{x}{m}\right)$ vs P is correct?



Soln: option (2)

From freundlich adsorption isotherm,

$$\frac{x}{m} \propto P$$

where x/m is the extent of adsorption.

On increasing the temperature, adsorption decreases.

Hence plot (2) is the correct graph between x/m Vs P at varying Temperature.

12

12) A diatomic gas expands adiabatically so that final density is 32 times the initial density. Final pressure becomes N times of initial pressure. The value of N is.

(1) 128 (2) 1/32 (3) 32 (4) -1/128

Soln: Option (1)

Given: $d_2 = 32 d_1$ d_2 - final density, d_1 - Initial density.

we know $d_2 = \frac{m}{V_2}$

$d_1 = \frac{m}{V_1}$

$$\frac{d_2}{d_1} = 32 = \frac{m/V_2}{m/V_1} = \frac{V_1}{V_2}$$

For a diatomic gas, degree of freedom = 7/5.

$$P_1 V_1^{\gamma} = P_2 V_2^{\gamma} = \text{constant}$$

$$\frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^{\gamma} = (32)^{\gamma} = (32)^{7/5}$$

$$\frac{P_2}{P_1} = (2^5)^{7/5} = 2^7$$

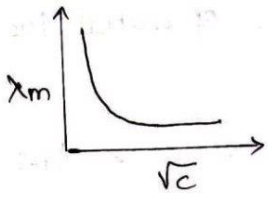
$$\frac{P_2}{P_1} = 128$$

$$P_2 = 128 P_1$$

Final pressure P_2 is 128 times the intial pressure P_1

13

13. following graph is observed for which of the electrolytic solution.



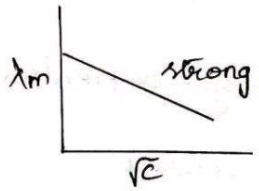
(1) CH_3COOH (2) HCl (3) KNO_3 (4) NaCl.

Soln: option (1)

Given is the graphical representation of λ_M with respect to $\sqrt{c}$ for a weak electrolyte.

Of the given options CH_3COOH is the weak electrolyte.

Note: Variation of λ_m Vs $\sqrt{c}$ for strong electrolyte is represented as



14

(14) The reaction formed by reaction of ammonia with excess of chlorine are:

(1) $NH_4Cl + Hcl$ (2) $NCl_3 + N_2$ (3) $NCl_3 + Hcl$ (4) $NH_4Cl + N_2$

Soln: option (3)

$$NH_3 + 3Cl_2 \xrightarrow{\text{(excess)}} NCl_3 + 3HCl.$$

Note:

If NH_3 is taken in excess, then

$$8NH_3 + 3Cl_2 \xrightarrow{\text{(excess)}} 6NH_4Cl + N_2.$$

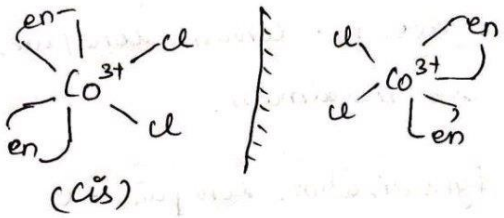
15

15) A = cis $[Co(en)_2Cl_2]^{\oplus}$ & B = trans $[Co(en)_2Cl_2]^{+}$. Which of the above complexes is optically active?

(1) only A (2) only B (3) Both (4) None.

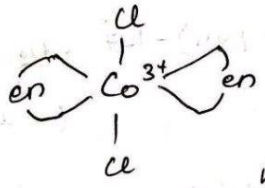
Soln: option (1) - only A.

A compound to be optically active it should not posses any plane of symmetry.



(cis)

optically ~~a~~active (no internal plane).



(trans) - optically inactive due to presence of plane of symmetry which divides molecule into 2 equal halves.

16

16. Correct arrangement of following species in the increasing order of their size is: $N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}, Al^{3+}$.

(1) $Al^{3+}, Mg^{2+}, Na^+, F^-, O^{2-}, N^{3-}$ (2) $N^{3-}, O^{2-}, F^-, Na^+, Mg^{2+}, Al^{3+}$

(3) $Al^{3+}, Mg^{2+}, Na^+, N^{3-}, O^{2-}, F^-$ (4) $Na^+, Mg^{2+}, Al^{3+}, F^-, O^{2-}, N^{3-}$

Soln: Option (1)

All the given species are isoelectronic to each other Isoelectronic - have same no. of electrons. All the given species have 10 electrons. More is the effective Nuclear charge, lesser is the ionic size.

Order of Ionic size: $Al^{3+} < Mg^{2+} < Na^+ < F^- < O^{2-} < N^{3-}$

17

17. Which of the following has maximum bond angle (consider C, N, O, S as central atom)

(1) H_2O (2) H_2S (3) NH_3 (4) CH_4

Soln: Option (4)

More the repulsion, lesser the bond angle.

Repulsion order: lp-lp > lp-bp > bp-bp

If the molecule does not contain lone pair, then its bond angle will be maximum.

CH_4 - sp^3 hybridization. lone pair = 0

CH_4 has the maximum bond angle - 109° 28'

H_2O - 104°30' ; NH_3 - (1 lone pair) - 107° , H_2S - 92°

(H_2O: 2 lone pair; H_2S: 2 lone pair)

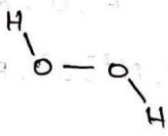
18

18. In pure form H_2O_2 is found as

(1) Linear, Blue colour (2) Linear, colourless.

(3) planar, Blue colour (4) Non planar, Blue colour.

Soln: option (4)

→ Structure of H_2O_2  (Open book shape)

Non-planar.

H_2O_2 is a weak acid. It appears colourless in a dilute solution but looks like blue in colour in large quantity. It is slightly more viscous than water.

19

19. Pure Boron and silicon can be obtained by.

(1) Electrolytic refining (2) Vapour phase refining

(3) Zone refining (4) Mond's process.

Soln: option (3)

Germanium, Si, Boron, Gallium, Indium can be obtained in pure state by zone refining process. Zone refining is a very useful method to get metals (semi conductors) with high purity such as Si, Ge etc. It is also referred to as zone melting, floating zone praess, & traveling melting zone.

20

20) 0.02M $K_2Cr_2O_7$ is treated with 0.288 gm of Ferrous oxalate. How much volume (in mL) of $K_2Cr_2O_7$ is required?

Soln: milliequivalent of $K_2Cr_2O_7$ = milli eq. of FeC_2O_4.

millieq of $K_2Cr_2O_7$ = V_{mL} of $K_2Cr_2O_7$ × Molarity × valence

$$V_{mL} \times 0.02 \times 6 = \frac{0.288}{144} \times 3 \times 1000 mL.$$

$$V_{mL} \times 0.02 \times 6 = 2 \times 6.$$

$$V_{mL} = 100 mL.$$

Ans = 100 mL

21

21) For the reaction $2A(g) \rightarrow A_2(g)$ following data is obtained at 298K, $\Delta U = -20KJ$, $\Delta S = -30J$ then find ΔG (in KJ)

Soln:

$$\Delta H = \Delta U + \Delta n_g RT.$$

given: $T = 298K$

$\Delta U = -20KJ = -20 \times 10^3 J.$

$\Delta S = -30J.$

$\Delta n_g = 1-2 = -1$

$$\Delta H = -20 \times 10^3 + (-1) \times 8.314 \times 298$$

$$= -22477.57 J$$

$$\Delta G = \Delta H - T\Delta S.$$

$$= -22477.57 - (298)(-30)$$

$$= -13537.57 J.$$

$$= -13.5 KJ.$$

$\Delta G = -13.5$ KJ

22

22) For the reaction $x+y \rightleftharpoons 2z$.

initially 1 mol of x, 1.5 mole of y and 0.5 mol of z are taken, then at equilibrium 1 mole of z is obtained. If $K_{eq} = \frac{x}{15}$ then find the value of x.

Soln:

	X	$+$ Y	$\rightleftharpoons$	$2Z$.
Initially	1	1.5		0.5
time = t (at equilibrium)	1-a	1.5-a		0.5+2a.

given at equilibrium Z = 1 mole.

$\Rightarrow 0.5+2a = 1$

$$\boxed{a = 0.25 \text{ mol}}$$

$$K_{eq} = \frac{[Z]^2}{[X][Y]} = \frac{(1)^2}{(1-0.25)(1.5-0.25)}$$

$$K_{eq} = 1.0667.$$

given $K_{eq} = \frac{x}{15}$

$$\Rightarrow K_{eq} = \frac{x}{15} = 1.0667$$

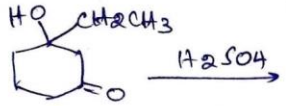
$$x = 15 \times 1.0667$$

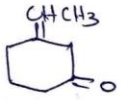
$$= 16.$$

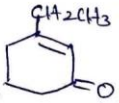
Ans: $\boxed{x = 16}$

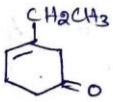
23

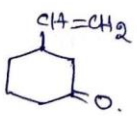
23) The major product of the following reaction is



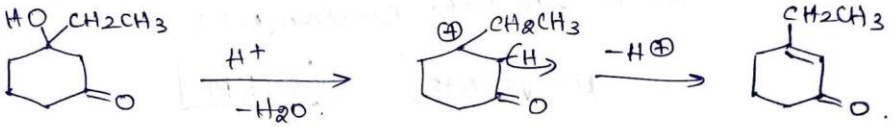
(1) 

(2) 

(3) 

(4) 

Soln: Option (2)



24

24) The one that is not suitable for the removal of permanent hardness of water is :

① Treatment with sodium carbonate ② Ion-exchange method.

③ Calgon's method ④ Clark's method.

Sol: option (4)

Temperory hardness is due to the presence of bicarbonates of calcium and magnesium. It can be removed on boiling and clark's method.

$$Ca(HCO_3)_2 \xrightarrow{\text{boiling}} CaCO_3\downarrow + H_2O + CO_2.$$

(insoluble)

Permanent hardness is due to the presence of chlorides and sulphides of Calcium and Magnesium. It can be removed by treating with Calgon (calgon's method), Ion exchange method, and treatment with sodium carbonate.

Clark's method is used to remove temporary hardness by using lime water ($Ca(OH)_2$)

25

25) Considering that $\Delta_o > P$, the magnetic moment (in BM) of $[Ru(H_2O)_6]^{2+}$ would be .....

Soln: Ru - $4d^6 5s^2$

$Ru^{2+} - 4d^6 \Rightarrow t_{2g}^{2,2,2}\ e_g^{0,0}$. since $\Delta_o > P$.

(pairing takes place)

No. of unpaired electron, $n = 0$

$\mu = \sqrt{n(n+2)} = \boxed{0 \cdot BM}$

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