# JEE Main September 2020

## Question Paper With Text Solution

## 6 September| Shift-1

# CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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# JEE MAIN SEP 2020 | 6 Sep. SHIFT-1

**1.** Which of the following compounds shows geometrical isomerism?

(1) 2-methylpent-1-ene (2) 2-methylpent-2-ene

(3) 4-methylpent-1-ene (4) 4-methylpent-2-ene

Ans (4)

S. $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH = CH - CH_3$

Can show G.I. because both doubly bonded carbon have two different groups.

**2.** Consider the Assertion and Reason given below.

**Assertion (A) :** Ethene polymerized in the presence Ziegler Natta Catalyst at hight temperature and pressure is used to make buckets and dustbins.

**Reason (R) :** Hight density polymers are closely packed and are chemically inert.

Choose the correct answer from the following :

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

(2) (A) and (R) both are wrong.

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

(4) (A) is correct but (R) is wrong.

Ans (3)

S. High density polythene: It is formed when addition polymerisation of ethene takes place in a hydrocarbon solvent in the presence of a catalyst such as triethylaluminium and titanium tetrachloride (Ziegler-Natta catalyst) at a temperature of 333 K to 343 K and under a pressure of 6-7 atmospheres.

High density polythene (HDP) thus produced, consists of linear molecules and has a high density due to close packing. It is also chemically inert and more tougher and harder. It is used for manufacturing buckets, dustbins, bottles, pipes, etc.

**3.** The presence of soluble fluoride ion upto 1 ppm concentration in drinking water, is :

(1) harmful to bones (2) harmful to skin (3) harmful for teeth (4) safe for teeth

Ans (4)

S. Soluble fluoride is often added to drinking water to make concentration upto 1 ppm because $F^-$ ions make the enamel on teeth much harder. But above 2 ppm cause brown mottling of teeth. Cause harmful effect on bones and teeth.

**4.** The variation of equilibrium constant with temperature is given below :

| Temperature | Equilibrium Constant |
|---|---|
| $T_1 = 25\ ^oC$ | $K_1 = 10$ |
| $T_2 = 100\ ^oC$ | $K_2 = 100$ |

The values of $\Delta H^o$, $\Delta G^o$ at $T_1$ and $\Delta G^o$ at $T_2$ (in kJ $mol^{-1}$) respectively, are close to [use R = 8.314 J $K^{-1}$ $mol^{-1}$]

(1) 0.64, –5.71 and –14.29 (2) 0.64, –7.14 and –5.71

(3) 28.4, –5.71 and –14.29 (4) 28.4, –7.14 and –5.71

Ans (3)

S. $T_1 = 298$ K $T_2 = 373$ K

$k_1 = 10$ $k_2 = 100$

$$\log\left(\frac{k_2}{k_1}\right) = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$\log\left(\frac{100}{10}\right) = \frac{\Delta H}{2.303 \times 8.314}\left[\frac{1}{298} - \frac{1}{373}\right]$$

$$\log 10 = \frac{\Delta H}{2.303 \times 8.314}\left[\frac{75}{298 \times 373}\right]$$

$$\Delta H = \frac{2.303 \times 8.314 \times 298 \times 373}{75} = 28.4KJ$$

At $T_1 = 25^oC = 298$ K, $K_1 = 10$

$\Delta G = -2.303\ RT_1 \log K_1$

$= -2.303 \times 8.314 \times 298 \times \log(10)$

$= -2.303 \times 8.314 \times 298 \times 1$

$= -5.7$ KJ

At $T_2 = 100^oC = 373$ K $\qquad K_2 = 100$

$\Delta G = -2.303\, RT_2 \log K_2$

$= -2.303 \times 8.314 \times 373 \times \log(10)^2$

$= -2.303 \times 8.314 \times 373 \times 2 \times 1$

$= -14283.7$ J

$= -14.29$ KJ

**5.** For the reaction

$$Fe_2N(s) + \frac{3}{2}H_2(g) \rightleftharpoons 2\,Fe(s) + NH_3(g)$$

(1) $K_C = K_P(RT)^{3/2}$ (2) $K_C = K_P(RT)^{1/2}$ (3) $K_C = K_P(RT)^{-1/2}$ (4) $K_C = K_P(RT)$

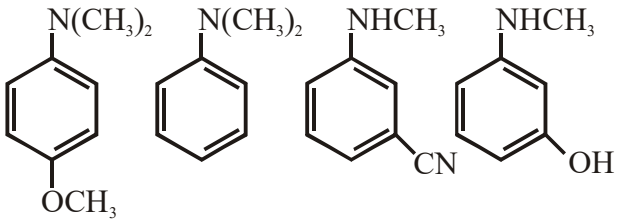
Ans (2)

S. $K_p = K_c(RT)^{\Delta ng}$ as $\Delta n_g = 1 - 3/2 = -1/2$.

$K_p = K_c(RT)^{-1/2}$

$K_c = K_p(RT)^{1/2}$

**6.** The increasing order of $pK_b$ values of the following compounds is :




I II III IV

(1) II < I < III < IV (2) II < IV < III < I (3) I < II < III < IV (4) I < II < IV < III

Ans (4)

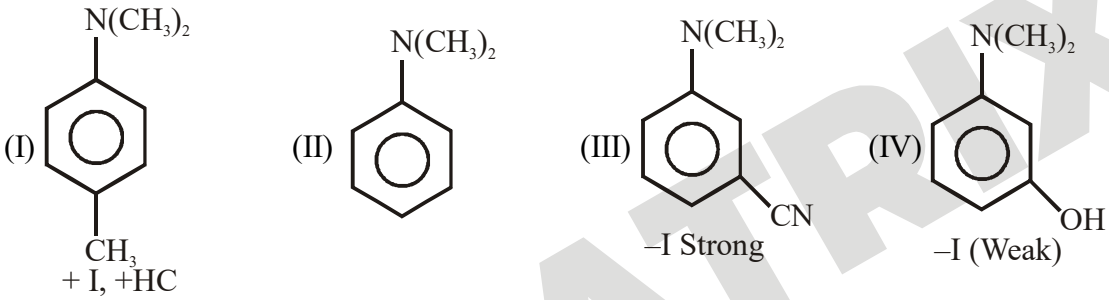
S. $pK_b \propto \frac{1}{\text{Basic strength}\,(K_b)}$

$K_b \propto$ +I, +M effect ($e^-$ density)

$K_b \propto \frac{1}{-I, -M \text{ effect}}$

$K_b = 1 > 2 > 4 > 3$

$pK_b = 1 < 2 < 4 < 3$




**7.** The lanthanoid that does NOT show +4 oxidation state is :

(1) Ce (2) Tb (3) Dy (4) Eu

Ans (4)

S. $Eu(z = 63) = 4F^7 6s^2$

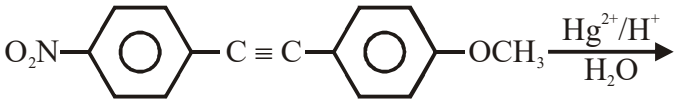
$Dy(z = 66) = 4F^{10} 6s^2$

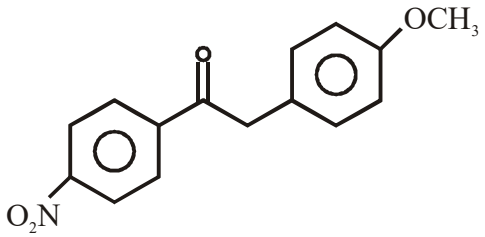
$Tb(z = 65) = 4F^9 6s^2$

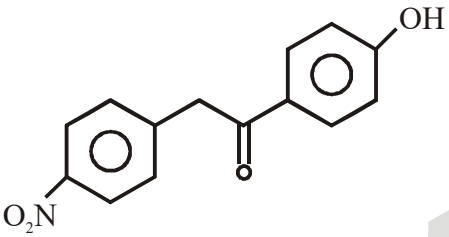
$Ce(58) = 4F^1 5d^1 6s^2$

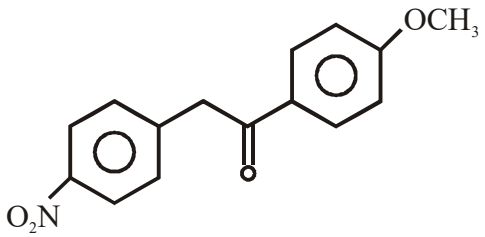
Dy, Tb and Ce show +4 oxidation state while Eu do not show +4 oxidation state. Due to half filled f–subshell.

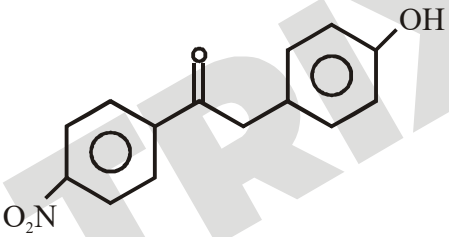
**8.** The major product obtained from the following reaction is :




(1) 

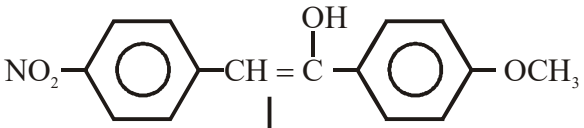

(2) 


(3) 

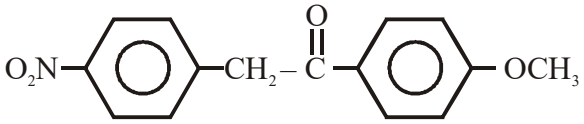

(4) 


Ans (3)

S. 


Tautomerisation




(Final product)

**9.** Among the sulphates of alkaline earth metals, the solubilities of $BeSO_4$ and $MgSO_4$ in water, respectively, are :

(1) high and high (2) poor and high (3) poor and poor (4) high and poor

Ans (1)

S. $BeSO_4$
$MgSO_4$
$CaSO_4$
$SrSO_4$
$BaSO_4$
↓ On moving down Solubility decreases

So, $BeSO_4$ and $MgSO_4$ have high solubility in water.

**10.** The set that contains atomic numbers of only transition elements, is :

(1) 9, 17, 34, 38 (2) 21, 25, 42, 72 (3) 37, 42, 50 ,64 (4) 21, 32, 53, 64

Ans (2)

S. A transition element is defined as the one which has incompletely filled d orbitals in its ground state or in any one of the oxidation state.

Zn(z = 30), Cd(z = 48), Hg(z = 80) are not transition element.

**11.** The species that has a spin-only magnetic moment of 5.9 BM, is :

($T_d$ = tetrahedral)

(1) $[Ni(CN)_4]^{2-}$ (square planar) (2) $[MnBr_4]^{2-}$ ($T_d$)

(3) $Ni(CO)_4$ ($T_d$) (4) $[NiCl_4]^{2-}$ ($T_d$)

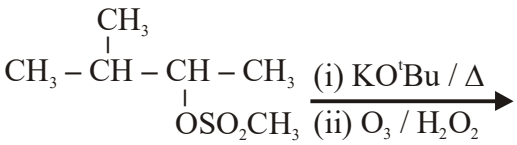
Ans (2)

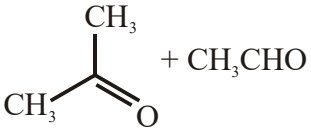
| S. | **Configuration** | **Number of upaired electrons (n)** |
|---|---|---|
| (1) $Ni(CO)_4$ | $3d^{10}$ | 0 |
| (2) $[Ni(CN)_4]^{2-}$ | $3d^8$ | 0 |
| (3) $[NiCl_4]^{2-}$ | $3d^8$ | 2 |
| (4) $[MnBr_4]^{2-}$ | $3d^5$ | 5 |

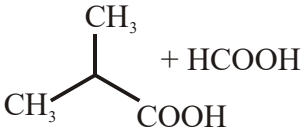
Spin only magnetic moment = $\sqrt{n(n+2)}$ BM

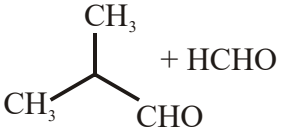
$= \sqrt{5(5+2)}$ BM = 5.9 BM

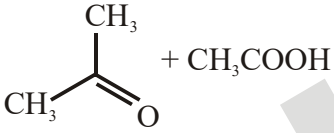
**12.** The major products of the following reaction are :



(1) 

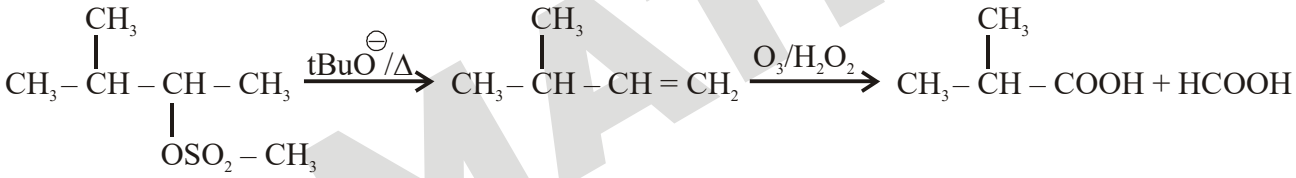
(2) 

(3) 

(4) 

Ans (2)

S. Due to bulky base at high temperature first reaction is $E_2$ and produce Hoffman alkene which further show oxidative ozonolysis.



Given in option (C). So answer goes to 3

**13.** A solution of two components containing $n_1$ moles of the 1st component and $n_2$ moles of the 2nd component is prepared. $M_1$ and $M_2$ are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in g $mL^{-1}$, $C_2$ is the molarity and $x_2$ is the mole fraction of the 2nd component, then $C_2$ can be expressed as :

(1) $C_2 = \dfrac{d\,x_2}{M_2 + x_2(M_2 - M_1)}$

(2) $C_2 = \dfrac{d\,x_1}{M_2 + x_2(M_2 - M_1)}$

(3) $C_2 = \dfrac{1000\,d\,x_2}{M_1 + x_2(M_2 - M_1)}$

(4) $C_2 = \dfrac{1000\,x_2}{M_1 + x_2(M_2 - M_1)}$

Ans (3)

S. $C_2 = \dfrac{n_2}{V_{sol}} \times 10^3$

$W_{sol} = W_1 + W_2$

$= n_1M_1 + n_2M_2$

$$V_{sol} = \frac{W_{sol}}{d} = \frac{n_1M_1 + n_2M_2}{d}$$

$$C_2 = \frac{n_2 d \times 10^3}{n_1M_1 + n_2M_2}$$

Both numerator and denominator divide by $(n_1 + n_2)$.

$$C_2 = \frac{x_2 d \times 10^3}{x_1M_1 + x_2M_2} = \frac{x_2 d \times 10^3}{(1 - x_2)M_1 + x_2M_2}$$

$$C_2 = \frac{1000\, d\, x_2}{M_1 + x_2(M_2 - M_1)}$$

**14.** The correct statement with respect to dinitrogen is :

(1) it can combine with dioxygen at 25 ºC.

(2) $N_2$ is paramagnetic in nature.

(3) it can be used as an inert diluent for reactive chemicals.

(4) liquid dinitrogen is not used in cryosurgery.

Ans (3)

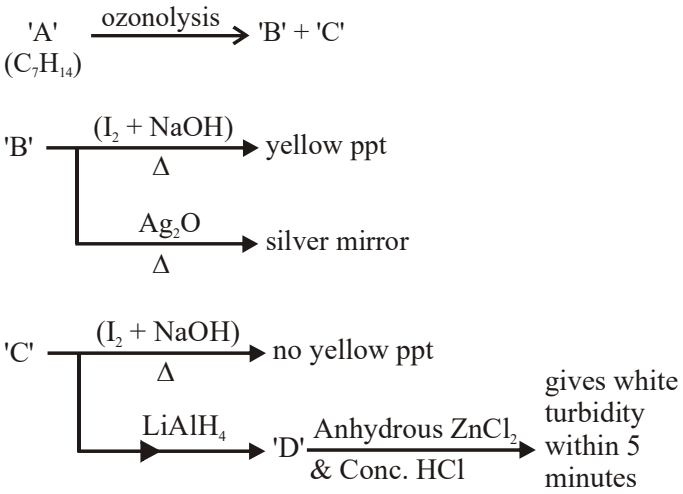
S. (1) it can not combine with dioxygen at 25ºC.

(2) $N_2$ is diamagnetic in nature.

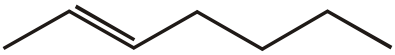
(3) it can be used as an inert diluent for reactive chemicals.

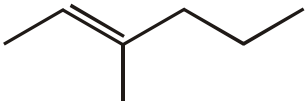
(4) liquid dinitrogen is used in cryosurgery.

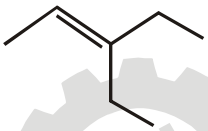
**15.** Consider the following reactions :




'A' is :

(1) 

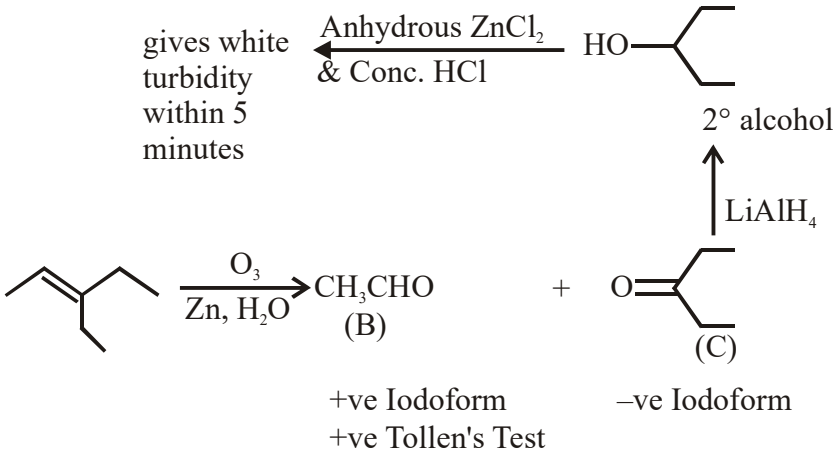
(2) 

(3) 

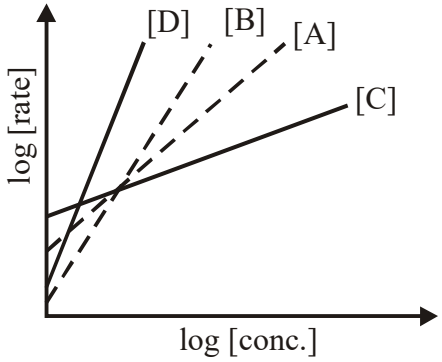
(4) 

Ans (3)

S.



**16.** Consider the following reactions A → P1 ; B → P2 ; C → P3 ; D → P4, The order of the above reactions are a, b, c and d, respectively. The following graph is obtained when log [rate] vs. log[conc.] are plotted :




Among the following, the correct sequence for the order of the reactions is :

(1) a > b > c > d (2) d > b > a > c (3) c > a > b > d (4) d > a > b > c

Ans (2)

S. Rate = K[Conc]$^{order}$

log[Rate] = log K + order log[conc]

so slope of graph is order of reaction.

greater the slope greater is order of reaction

so order of reaction ⇒ "d > b > a > c"

**17.** Kraft temperature is the temperature :

(1) above which the formation of micelles takes place.

(2) above which the aqueous solution of detergents starts boiling.

(3) below which the formation of micelles takes place.

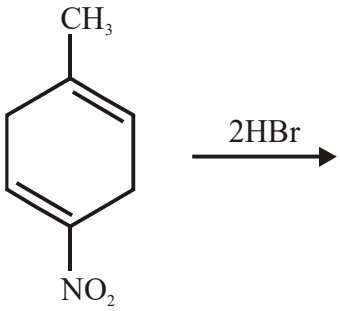
(4) below which the aqueous solution of detergents starts freezing.

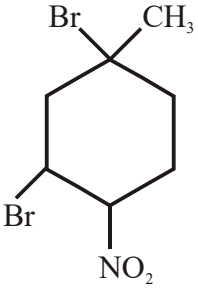
Ans (1)

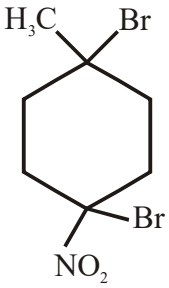
S. (i) Micelles formation take place only above a particular temperature called as kraft temperature ($T_k$)

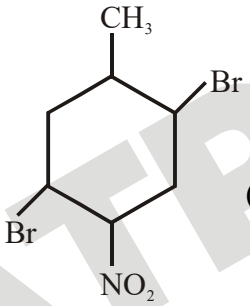
(ii) Concentration above which micelle formation become appreciable is critical micells concentration.

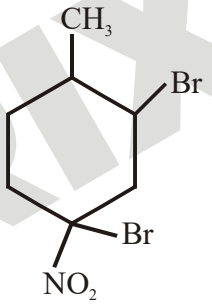
**18.** The major product the following reaction is :



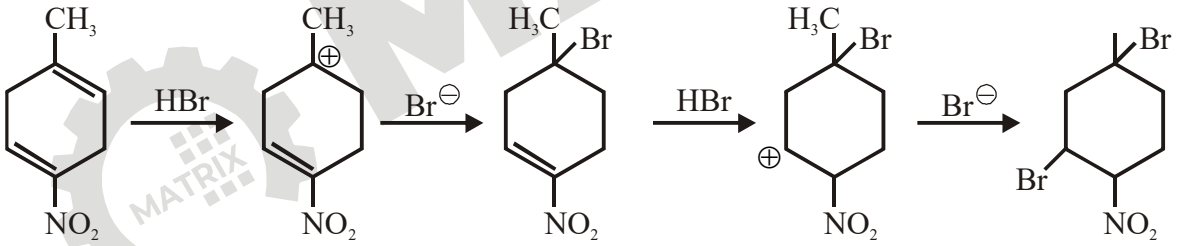

(1) 


(2) 


(3) 


(4) 


Ans (1)

S. 


**19.** The INCORRECT statement is :

(1) german silver is an alloy of zinc, copper and nickel.

(2) brass is an alloy of copper and nickel.

(3) cast iron is used to manufacture wrought iron.

(4) bronze is an alloy of copper and tin.

Ans (2)

S.

| S.No. | Alloy | Composition |
|---|---|---|
| 1. | Bronze | Cu (75 – 90%) + Sn (10 – 25%) |
| 2. | Brass | Cu (60 – 80%) + Zn (20 – 40%) |
| 3. | German Silver | Cu (50 – 62%) + Zn (17 – 19%) + Ni (21 – 30%) |

Cast iron is used to manufacture wrought iron.

**20.** Arrange the following solutions in the decreasing order of pOH :

(A) 0.01 M HCl

(B) 0.01 M NaOH

(C) 0.01 M $CH_3COONa$

(D) 0.01 M NaCl

(1) (B) > (C) > (D) > (A)

(2) (B) > (D) > (C) > (A)

(3) (A) > (C) > (D) > (B)

(4) (A) > (D) > (C) > (B)

Ans (4)

S. pH of 0.01 M HCl = 2

pH of 0.01 M NaOH = 12

pH of 0.01 M $CH_3COONa$ > 7

pH of 0.01 M NaCl = 7

So the order of pH : B > C > D > A

So the order of pOH : A > D > C > B.

**21.** The elevation of boiling point of 0.10 m aqueous $CrCl_3.xNH_3$ solution is two times that of 0.05 m aqueous $CaCl_2$ solution. The value of x is _____.

[Assume 100% ionisation of the complex and $CaCl_2$, coordination number of Cr as 6, and that all $NH_3$ molecules are present inside the coordination sphere]

Ans (5)

S. $CaCl_2 \longrightarrow Ca^{2+} + 2Cl^-$

$i_{CaCl_2} = 3$

$\Delta T_{b[complex]} = \Delta T_{b[CaCl_2]}$

$i_{[complex]} \times k_b \times m_{[complex]} = i_{CaCl_2} \times k_b \times m_{CaCl_2}$

$i_{[complex]} \times k_b \times 0.10 = 3 \times k_b \times 0.05$

$\Rightarrow i_{[complex]} = 3$

Hence the complex must be producing three ions in the solution, so its formula = $[Cr(NH_3)_5Cl]Cl_2$

so x = 5

**22.** A spherical balloon of radius 3 cm containing helium gas has a pressure of $48 \times 10^{-3}$ bar. At the same temperature, the pressure, of a spherical balloon of radius 12 cm containing the same amount of gas will be _____ $\times 10^{-6}$ bar.

Ans (750)

S. If volume of 3 cm balloon is = V

then volume of 12 cm radius balloon = 64V

So pressure will become 1/64 times = $1/64 \times 48 \times 10^{-3}$ bar = $750 \times 10^{-3}$ bar

**23.** Potassium chlorate is prepared by the electrolysis KCl in basic solution $6\,OH^- + Cl^- \rightarrow ClO_3^- + 3\,H_2O + 6e^-$ If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10 g of $KClO_3$ using a current of 2 A is _____.

(Given : F = 96,500 C $mol^{-1}$; molar mass of $KClO_3$ = 122 g $mol^{-1}$)

Ans (11)

S. $W = \frac{Eit}{96500}$

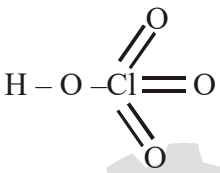
$\{2 \times t \times 60 \times 60 / 96500\} \times 0.60 \times 122 \times (1/6) = 10$

So t = 10.98 hours

**24.** The number of Cl = O bonds in perchloric acid is, "_____."

Ans (3)

S. Perchloric acid $\Rightarrow HClO_4$



Total Cl = O bonds = 3

**25.** In an estimation of bromine by Carius method, 1.6 g of an organic compound gave 1.88 g of AgBr. The mass percentage of bromine in the compound is _____.

(Atomic mass, Ag = 108, Br = 80 g $mol^{-1}$)

Ans (50)

S. If molar mass of compound is M

1.6/M = 1.88/188 = 0.01

so M = 160 gram/mole

Now % of bromine = 80/160 × 100 % = 50%