

1. Calculate relative rate of effusion of O_2 to CH_4 through a container containing O_2 and CH_4 in 3 : 2 mass ratio.

- ☒ A. $\frac{3\sqrt{2}}{4}$
- ☒ B. $\frac{3}{4\sqrt{2}}$
- ☒ C. $\frac{3}{2\sqrt{2}}$
- ☒ D. None of these

We know
 $r \propto n$

$$r \propto \sqrt{\frac{1}{M}}$$

The ratio of given mass of O_2 and CH_4 is 3 : 2

$$\text{Number of moles (n)} = \frac{\text{Weight}}{\text{Molecular mass}}$$

So,

$$\begin{aligned} \frac{r_{O_2}}{r_{CH_4}} &= \frac{n_{O_2}}{n_{CH_4}} \times \sqrt{\frac{M_{CH_4}}{M_{O_2}}} \\ &= \frac{3}{2} \times \frac{16}{32} \times \sqrt{\frac{16}{32}} \\ &= \frac{3}{4\sqrt{2}} \end{aligned}$$

2. What is the final temperature of 0.10 mole monoatomic ideal gas that performs 75 cal of work adiabatically if the initial temperature is 227°C ?
(use $R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$)

- ☒ A. 250 K
☐ B. 300 K
☐ C. 350 K
☐ D. 750 K

We know $\Delta U = n C_v dT$

$$= n \frac{f}{2} R dT \quad (\because f = \text{Degree of freedom})$$

$$\Delta U = w$$

$$\Rightarrow -75 = 0.1 \times \frac{3}{2} \times 2[T_2 - 500]$$

$$\Rightarrow T_2 = 250 \text{ K}$$

3. The compressibility factor for nitrogen at 330 K and 800 atm is 1.90 and at 570 K and 200 atm is 1.10. A certain mass of N_2 occupies a volume of 1 dm^3 at 330 K and 800 atm. Calculate volume occupied by same quantity of N_2 gas at 570 K and 200 atm:

- ☐ A. 1 L
☐ B. 2 L
☐ C. 3 L
☒ D. 4 L

$$Z = \frac{PV}{nRT}$$

$$\Rightarrow 1.90 = \frac{1 \times 800}{n \times R \times 330}$$

$$\Rightarrow n = \frac{1 \times 800}{1.90 \times R \times 330}$$

$$Z = 1.10 = \frac{V \times 200}{n \times R \times 570}$$

$$\Rightarrow 1.10 = \frac{V \times 200 \times 1.90 \times R \times 330}{800 \times R \times 570}$$

$$\Rightarrow V = 4 \text{ L}$$

4. At a certain temperature the equilibrium constant K_c is 0.25 for the reaction
 $A_2(g) + B_2(g) \rightleftharpoons C_2(g) + D_2(g)$
 If we take 1 mole of each of the four gases in a 10 litre container, what would be equilibrium concentration of $A_2(g)$?

☐ A. 0.331 M

☐ B. 0.033 M

☒ C. 0.133 M

☐ D. 1.33 M

$$Q_c = \frac{1 \times 1}{1 \times 1} = 1$$

$$\therefore Q_c > K_c$$

So reaction will proceed in backward direction.

	$A_2(g) +$	$B_2(g) \rightleftharpoons$	$C_2(g) +$	$D_2(g)$
Conc. eqm	$\frac{1+x}{10}$		$\frac{1+x}{10}$	
	$\frac{1-x}{10}$		$\frac{1-x}{10}$	

$$0.25 = \frac{\left(\frac{1-x}{10}\right)^2}{\left(\frac{1+x}{10}\right)^2}$$

$$\Rightarrow x = 0.333$$

$$[A_2(g)] = \frac{1+x}{10} = \frac{1.333}{10} = 0.133$$

5. For an electron placed in the third orbit of the hydrogen atom, calculate the number of revolutions per second made by it around the nucleus.

☐ A. 4.2×10^{14}

☐ B. 4.2×10^{12}

☐ C. 2.4×10^{12}

☒ D. 2.4×10^{14}

Radius of 3rd orbit = $3^2 \times 0.529 \times 10^{-8} \text{ cm} = 4.761 \times 10^{-8} \text{ cm}$

We know that,

$$mvr = \frac{nh}{2\pi}$$

$$\Rightarrow v = \frac{nh}{2\pi mr}$$

$$\Rightarrow v = \frac{3 \times 6.626 \times 10^{-27}}{2 \times 3.14 \times (9.1 \times 10^{-28}) \times (4.761 \times 10^{-8})}$$

$$\Rightarrow v = 7.3 \times 10^7 \text{ cm/sec}$$

$$\text{Number of revolutions per second} = \frac{v}{2\pi r}$$

$$\Rightarrow \frac{7.3 \times 10^7}{2 \times 3.14 \times 4.761 \times 10^{-8}}$$

$$\Rightarrow 2.4 \times 10^{14}$$

6. Find the number of electrons present in a pure sample of $(NH_4)_2SO_4$ containing 8 moles of O -atoms?

☐ A. 6.43×10^{25}

☒ B. 8.43×10^{25}

☐ C. 5.34×10^{25}

☐ D. 8.34×10^{25}

From the formula unit of $(NH_4)_2SO_4$, 4 moles of O -atoms are present in 1 mole of $(NH_4)_2SO_4$.

Therefore, 8 moles of O -atoms will be present in

$$\Rightarrow \frac{8}{4} \text{ moles of } (NH_4)_2SO_4$$

Again, the total number of electrons in one formula unit of $(NH_4)_2SO_4$

$$\Rightarrow 7 \times 2 + 8 \times 1 + 16 + 8 \times 4 = 70$$

So, the total number of electrons in one mole of $(NH_4)_2SO_4$

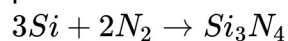
$$\Rightarrow 70 \times 6.022 \times 10^{23}$$

Therefore, the total number of electrons in $\frac{8}{4}$ moles of $(NH_4)_2SO_4$

$$\Rightarrow 70 \times 6.022 \times 10^{23} \times 2$$

$$\Rightarrow 8.43 \times 10^{25}$$

7. 21.44 moles of Si react with 17.62 moles of N_2 . How many moles of Si_3N_4 will be produced?

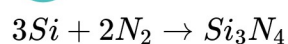


☐ A. 13.87 mol

☐ B. 5.42 mol

☐ C. 10.53 mol

☒ D. 7.15 mol



Finding the limiting reagent:

$$\text{For } Si = \frac{\text{given moles}}{\text{stoichiometric coefficient}} = \frac{21.44}{3} = 7.15$$

$$\text{For } N_2 = \frac{17.62}{2} = 8.81$$

So, Si is the limiting reagent.

3 mol of Si produces 1 mole of Si_3N_4 .

$$21.44 \text{ moles will produce } = \frac{1}{3} \times 21.44 = 7.15 \text{ mol of } Si_3N_4$$

8. 0.52 g of a dibasic acid required 100 mL of 0.2 N $NaOH$ for complete neutralization.

The equivalent weight of acid is:

- ☒ A. 26
- ☐ B. 52
- ☐ C. 104
- ☐ D. 156

Using ,

Equivalents of Acid = Equivalents of $NaOH$

$$\frac{\text{Weight}}{\text{Equivalent weight}} = N \times V \text{ of } (NaOH)$$

$$\Rightarrow \frac{0.52}{\text{Equivalent weight}} = \frac{100 \times 0.2}{1000}$$

$$\Rightarrow \text{Equivalent weight of acid} = 26$$

Hence (a) is the correct answer.

9. In an isobaric process, the ratio of heat supplied to the system (dq) and work done by the system (dw) for a diatomic gas is:

- ☒ A. 1 : 1
☒ B. 7 : 2
☐ C. 7 : 5
☐ D. 5 : 7

At constant pressure, (isobaric process) heat supplied is given as:

$$q_p = nC_p dT$$

$$C_p \text{ for a diatomic gas} = \frac{7}{2}R$$

$$\text{So, } q_p = \frac{7}{2}nR dT$$

Work done by system is given as:

$$dw = nR dT$$

$$\text{Hence, the ratio is: } \Rightarrow \frac{dq}{dw} = \frac{(7/2)nR dT}{nR dT} = \frac{7}{2}$$

10. What is the change in internal energy when a gas contracts from 377 mL to 177 mL under a constant pressure of 2 atm, while at the same time being cooled by removing 124 J heat?

[Take: 1 L atm = 100 J]

- ☐ A. -24 J
- ☒ B. -84 J
- ☐ C. -14 J
- ☐ D. -64 J

From the first law of thermodynamics,

$$\Delta U = Q + W$$

$$Q = -124 \text{ J (given)}$$

$$W = -P_{ext} (v_2 - v_1)$$

$$\Rightarrow W = -2(177 - 377) = 400 \text{ atm mL}$$

$$\Rightarrow W = 0.4 \text{ atm L}$$

$$\text{Since, } 1 \text{ atm L} = 100 \text{ J}$$

$$\Rightarrow 0.4 \text{ atm L} = 40 \text{ J}$$

Substituting the values of Q and W , we get,

$$\Delta U = -124 + 40 = -84 \text{ J}$$

11. Ratio of radii of orbits in two different orbits of H -atom is 4 : 9, then possible ratio of energy for these two orbits is:

☐ A. 2 : 3

☐ B. 3 : 2

☐ C. 2 : 9

☒ D. 9 : 4

r_n = radius of n^{th} orbit

E_n = Energy of n^{th} orbit

We know,

$$\frac{r_{n_1}}{r_{n_2}} = \frac{0.529 \left(\frac{n_1^2}{1} \right) \text{Å}}{0.529 \times \left(\frac{n_2^2}{1} \right) \text{Å}} \Rightarrow \frac{4}{9} = \frac{n_1^2}{n_2^2} \dots (1)$$

Now,

$$\frac{E_{n_1}}{E_{n_2}} = \frac{-13.6 \times \left(\frac{1}{n_1^2} \right) \text{eV}}{-13.6 \times \left(\frac{1}{n_2^2} \right) \text{eV}} = \frac{n_2^2}{n_1^2} = \frac{9}{4} = 9 : 4$$

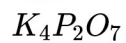
12. What will be the average oxidation state of P in $K_4P_2O_7$?

☐ A. +4

☒ B. +5

☐ C. +2

☐ D. -3



charge on $K = +1$

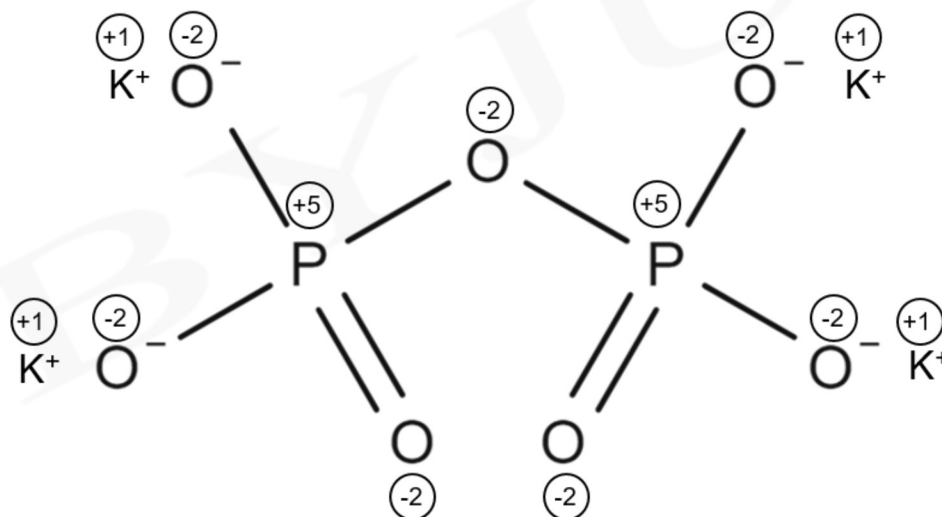
charge on $O = -2$

Let x be oxidation state of P

$$\Rightarrow 2x + 4 - 2 \times 7 = 0$$

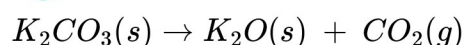
$$\Rightarrow 2x = 10$$

$$\Rightarrow x = +5$$



13. 27.6 g of K_2CO_3 is thermally decomposed to give K_2O and CO_2 g. Calculate the volume of CO_2 formed at STP. (Molar mass of $K_2CO_3 = 138 \text{ g mol}^{-1}$)

- ☐ A. 11.20 L
- ☒ B. 4.48 L
- ☐ C. 3.20 L
- ☐ D. 5.56 L



Applying the principle of atom conservation (POAC) to C,

Moles of C in K_2CO_3 = moles of carbon in CO_2

$$1 \times \text{Number of mol of } K_2CO_3 = 1 \times \text{number of moles of } CO_2$$

Hence, the number of moles of CO_2 produced will be equal to the number of moles of K_2CO_3 decomposed.

Now we have,

$$\text{Moles of } K_2CO_3 = \frac{\text{Given weight}}{\text{Molar mass}}$$

$$\Rightarrow \text{Moles of } K_2CO_3 = \frac{27.6}{138} = 0.2$$

$$\text{Moles of } K_2CO_3 = \text{Moles of } CO_2 = 0.2 \text{ mol}$$

We know that the volume of 1 mol of gas at STP is 22.4 L and

$$\text{Volume of } CO_2 = \text{number of mol of } CO_2 \times 22.4 = 0.2 \times 22.4 = 4.48 \text{ L}$$

Therefore, the volume of $CO_2 = 4.48 \text{ L}$

14. The geometry of electron pairs around I in IF_5 is:

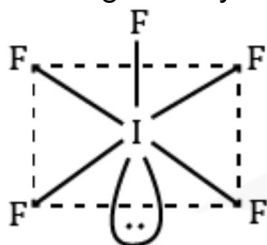
- ☒ A. Octahedral
- ☐ B. Trigonal bipyramidal
- ☐ C. Square pyramidal
- ☐ D. Pentagonal planar

Geometry of IF_5 :

$$\text{Steric number of } IF_5 = \frac{1}{2}(7 + 5) = 6$$

So, the number of bond pairs and lone pairs are 5 and 1 respectively. The hybridisation is sp^3d^2 .

\therefore The geometry looks like



\therefore the geometry is octahedral and the shape of molecule is

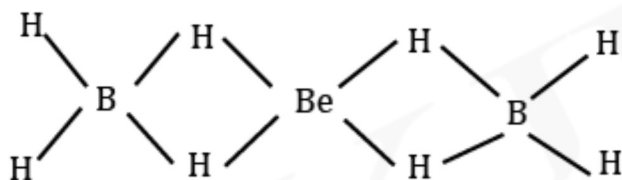
distorted square pyramidal.

15. Find the total number of $2c - 2e$ and $3c - 2e$ bonds in $Be(BH_4)_2$ respectively.

- ☐ A. 6, 4
- ☐ B. 4, 6
- ☒ C. 4, 4
- ☐ D. 4, 8

In $Be(BH_4)_2$, $3c - 2e$ bond means in the structure, 2 electrons are shared between 3 atoms.

In the structure $B - H - Be$ bond is $3c - 2e$ bond which are four in total. Similarly, terminal $H - B - H$ are $2c - 2e$ bonds which are also four.



16. The angular momentum of an electron in a certain orbit of Li^{+2} ion is $3.16 \times 10^{-34} \text{ kg m}^2\text{sec}^{-1}$. What will be the potential energy of electron in that orbit?

Given : $h = 6.62 \times 10^{-34} \text{ J sec}$

$$\pi = 3.14$$

$$3.16 \times 3.14 \approx 9.93$$

☒ A. -13.6 eV

☒ B. -27.2 eV

☒ C. $+13.6 \text{ eV}$

☒ D. -53.4 eV

$$\text{Angular momentum} = \frac{nh}{2\pi} = 3.15 \times 10^{-34} \text{ kg m}^2\text{sec}^{-1}$$

$$\Rightarrow n = 3$$

$$\text{Total energy of electron} = -13.6 \left(\frac{Z^2}{n^2} \right)$$

$$= -13.6 \left(\frac{3^2}{3^2} \right) = -13.6 \text{ eV}$$

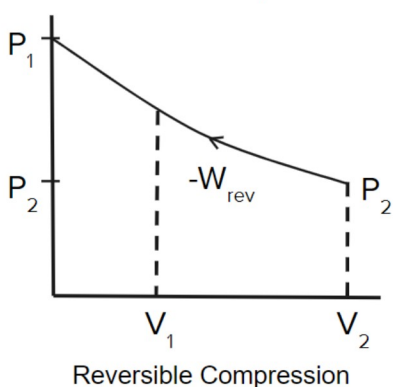
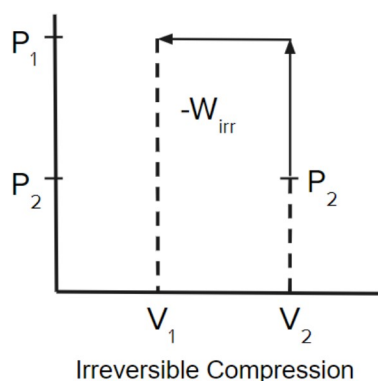
$$\text{P.E.} = 2 \times (\text{Total energy}) = -27.2 \text{ eV}$$

17. An ideal gas is expanded from p_1, V_1, T_1 to p_2, V_2, T_2 under different conditions. The incorrect statement among the following is:

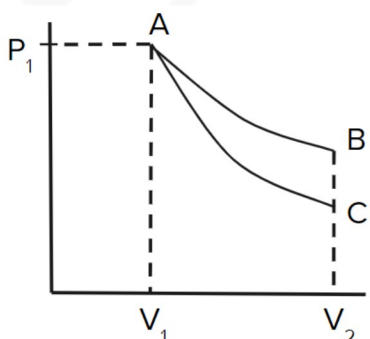
- ☒ A. The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions
- ☐ B. The change in internal energy of the gas is (i) zero, if it is expanded reversibly with $T_1 = T_2$ and (ii) positive, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$
- ☒ C. Temperature of any system in thermal equilibrium is an example of intensive property
- ☒ D. For an isothermal free expansion of an ideal gas into vacuum, $\Delta U = 0, q = 0, w = 0$

(a)

Maximum work is done on the system when compression occur irreversibly and minimum work is done in reversible compression.



AB is isothermal and AC is adiabatic path. Work done is area under the curve. Hence, less work is obtained in adiabatic process than in isothermal.



(b) The change in internal energy of the gas is (i) zero, if it is expanded reversibly with $T_1 = T_2$ and (ii) negative, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$. Hence, (b) is incorrect.

(c) An intensive property is a physical quantity whose value does not depend on the amount of the substance for which it is measured. For example, the temperature of a system in thermal equilibrium is the same as the temperature of any part of it.

Hence, (c) is correct.

(d)

For isothermal process, $\Delta T = 0$

For an ideal gas, the internal energy U depends only on temperature, not on pressure or volume.

So, $\Delta U = 0$

On the basis of mathematical form of first law

$$\Delta U = q + w$$

$$\Rightarrow q = -w = -p\Delta V$$

For an isothermal free expansion of an ideal gas into vacuum.

$$p = 0$$

$$\therefore q = -w = 0$$

So, the correct value is

$$\Delta U = 0, q = 0, w = 0$$

18. Uncertainty in position and momentum are equal. Uncertainty in velocity is at least:

☐ A. $\sqrt{\frac{h}{\pi}}$

☐ B. $\sqrt{\frac{h}{2\pi}}$

☒ C. $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$

☐ D. None of these

By Heisenberg's uncertainty principle, we know that,

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$

Where, Δx = Uncertainty in position

Δp = Uncertainty in momentum

h = Planck's constant

According to the question,

$$\Delta x = \Delta p$$

We know that,

$$\Delta p = m\Delta v$$

where, p = momentum of the particle

v = velocity with which particle is moving

Equation (i) can be written as:

$$\Delta x \cdot m\Delta v \geq \frac{h}{4\pi}$$

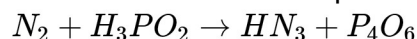
$$\Delta x = \Delta p$$

$$m\Delta v \cdot m\Delta v \geq \frac{h}{4\pi}$$

$$\Rightarrow \Delta v^2 \geq \frac{h}{m^2 4\pi}$$

$$\Rightarrow \Delta v \geq \frac{1}{2m}\sqrt{\frac{h}{\pi}}$$

19. Redox reaction involves transfer of electrons between 2 chemical species. An unbalanced and incomplete example is shown below:



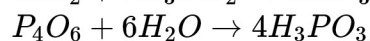
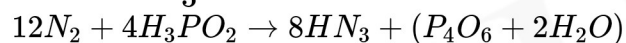
If the above reaction were unidirectional towards right, what fraction of P_4O_6 would be left unreacted if reaction were started with stoichiometric amount of reactants.

☐ A. $\frac{1}{2}$

☐ B. $\frac{3}{4}$

☐ C. $\frac{1}{3}$

☒ D. $\frac{2}{3}$



6 moles H_2O react with 1 mole P_4O_6

2 moles H_2O react with $\frac{1 \times 2}{6} = \frac{1}{3}$ mole P_4O_6

\therefore fraction of P_4O_6 left unreacted = $\frac{2}{3}$

20. For the equilibrium



$K_p = 9 \text{ atm}^2$ at 37°C . A 5 L vessel contains 0.1 mole of $LiCl \cdot NH_3$. How many moles of NH_3 should be added to the flask at this temperature to derive the backward reaction for completion?

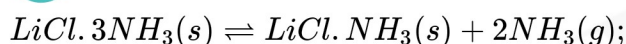
Use : $R = 0.082 \text{ atm L mol}^{-1} \text{ K}^{-1}$

☐ A. 0.2

☐ B. 0.59

☐ C. 0.69

☒ D. 0.79



$[K_p = 9 \text{ atm}^2]$

Therefore,

	$LiCl \cdot NH_3(s)$	+	$2NH_3(g)$	\rightleftharpoons	$LiCl \cdot 3NH_3(s);$
Initial moles:	0.1		α		0
Final moles at eqm.:	0		$(\alpha - 0.2)$		0.1
$\left[K_p' = \frac{1}{9}(\text{atm})^{-2} \right]$					

Let, initial moles of NH_3 is α for completion of reaction.

$$\text{At equilibrium, } K_p' = \frac{1}{(P'_{NH_3})^2} \text{ or } \frac{1}{9} = \frac{1}{(P'_{NH_3})^2}$$

$$\therefore P'_{NH_3} = 3 \text{ atm}$$

$$\therefore PV = nRT \Rightarrow 3 \times 5 = n \times 0.0820 \times 310$$

$$\therefore n = 0.59 \text{ i.e., } (\alpha - 0.2) = 0.59$$

\therefore
Initial moles of $NH_3 = 0.79$

21. Find the work done in J when one mole of an ideal gas in 10 litre container at 1 atm is allowed to enter into an evacuated bulb of capacity 100 litre

Accepted Answers

0 0.0 0.00

Solution:

Work done is given as:

$$w = -P_{ext} \Delta V$$

But since gas enters the vacuum bulb and pressure in vacuum is zero. And expansion against vacuum ($P_{ext} = 0$) called as free expansion so, work done is zero.

22. A substance on analysis gave the following percentage composition: $Na = 43.4\%$, $C = 11.3\%$ and $O = 45.3\%$. Calculate the empirical weight (Atomic weight in amu of $Na = 23$, $C = 12$, $O = 16$).

Accepted Answers

106

Solution:

Element	Percentage composition	Atomic ratio	Least ratio
Sodium	43.4	$\frac{43.4}{23} = 1.89$	$\frac{1.89}{0.94} = 2$
Carbon	11.3	$\frac{11.3}{12} = 0.94$	$\frac{0.94}{0.94} = 1$
Oxygen	45.3	$\frac{45.3}{16} = 2.83$	$\frac{2.83}{0.94} = 3$

Hence, the empirical formula is Na_2CO_3 and the empirical weight is 106.

23. A certain volume of nitrogen gas at 0.8 atm takes 25 seconds to diffuse through a pin hole whereas the same volume of an unknown compound of xenon and flourine at 1.6 atm takes 37 second to diffuse through the same hole. The molecule formed can be expressed as XeF_n . Find the value of n .
 (Given: Molecular mass of Xe = 131 u)

Accepted Answers

6 6.0 6.00

Solution:

$$\frac{r_{N_2}}{r_{XeF_n}} = \frac{P_{N_2}}{P_{XeF_n}} \sqrt{\frac{M_{XeF_n}}{M_{N_2}}}$$

$$\frac{r_{N_2}}{r_{XeF_n}} = \frac{t_{N_2}}{\text{Volume of } XeF_n} = \frac{t_{XeF_n}}{t_{N_2}} = \frac{37}{25}$$

$$\therefore \frac{37}{25} = \frac{0.8}{1.6} \sqrt{\frac{M_{XeF_n}}{28}}$$

$$M_{XeF_n} = \left(\frac{37}{25}\right)^2 \times \left(\frac{1.6}{0.8}\right)^2 \times 28$$

$$= 245.3$$

$$M_{Xe} + nM_F = 245.3$$

$$131 + n \times 19 = 245.3$$

$$n = 6.02 \approx 6$$

$$\therefore \text{Molecular formula} = XeF_6$$

24. The ionisation energy of hydrogen atom is 13.6 eV. What will be the ionisation energy of Li^{2+} ion?

Accepted Answers

122 122.0 122.00

Solution:

Given,

The ionisation energy of hydrogen atom = 13.6 eV

We know,

Ionisation energy = $13.6Z^2$ eV

[Since ionisation energy is defined for ground state only]

Thus,

Ionisation energy (I.E) $\propto Z^2$

$$\therefore \frac{I.E_H}{I.E_{Li^{2+}}} = \frac{Z_H^2}{Z_{Li^{2+}}^2}$$

$$\Rightarrow I.E_{Li^{2+}} = (I.E)_H \frac{Z_{Li^{2+}}^2}{Z_H^2}$$

Therefore, the ionisation energy of Li^{2+} ion

$$\Rightarrow 13.6 \times \frac{3^2}{1^2} \text{ eV} = 122.4 \text{ eV}$$

25. Find the temperature (in K) at which 3 mol of SO_2 will occupy a volume of 10 L at a pressure of 15 atm.

[$a = 6.71 \text{ atm L}^2 \text{ mol}^{-2}$; $b = 0.0564 \text{ L mol}^{-1}$]

Accepted Answers

624 624.0 624.00

Solution:

van der Waal equation is:

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

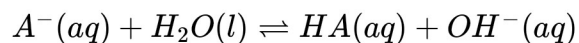
Given: $P = 15 \text{ atm}$

$V = 10 \text{ L}$, $n = 3$, $a = 6.71 \text{ atm litre}^2 \text{ mol}^{-2}$

$$\Rightarrow \left(15 + \frac{6.71 \times 9}{100}\right)(10 - 3 \times 0.0564) = 3 \times 0.082 \times T$$

$$\Rightarrow T = 624 \text{ K}$$

26. The percentage degree of hydrolysis in the equilibrium at salt concentration 0.0001 M is :



(Given $K_a = 1.0 \times 10^{-6}$)

Accepted Answers

1 1.0 1.00

Solution:

Given,

$$C = 10^{-4}\text{ M}$$

$$K_a = 10^{-6}$$

The relationship between hydrolysis constant and dissociation constant is given as:

$$K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{10^{-6}} = 10^{-8}$$

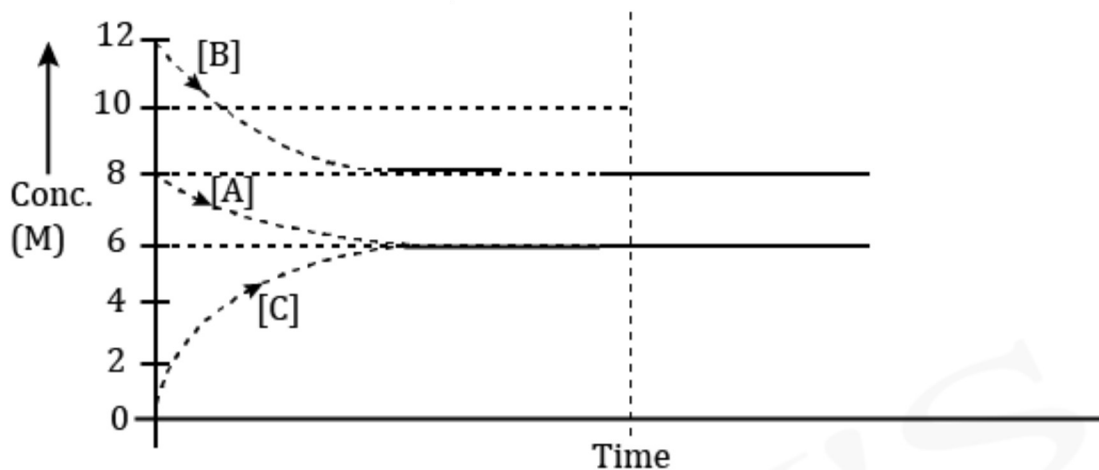
The expression for degree of hydrolysis is:

$$h = \sqrt{\frac{K_h}{C}}$$

$$\Rightarrow h = \sqrt{\frac{10^{-8}}{10^{-4}}} = \sqrt{10^{-4}} = 10^{-2}$$

$$\text{Percentage of degree of hydrolysis} = 10^{-2} \times 100 \% = 1 \%$$

27. The gaseous reaction: $A(g) + nB(g) \rightleftharpoons mC(g)$ is represented by following curves. What is the value of $n + m$?



Accepted Answers

5 5.0 5.00

Solution:

From the graph,

Increase in concentration of C is thrice the decrease in concentration of A.

Decrease in concentration of B is twice the decrease in concentration of A.

\Rightarrow 1 mole of A reacts with two moles B to give three moles of C.

So $n = 2$, $m = 3$ and $n + m = 2 + 3 = 5$

28. If two moles of $KMnO_4$ oxidises 3 moles of M^{x+} to MO_3^- in neutral medium.
Find the value of x .

Accepted Answers

3 3.0 3.00

Solution:

In neutral medium permanganate (MnO_4^-) reduces to MnO_2 . So the oxidation state of Mn changes +7 to +4. So n-factor is 3.

Two mole of permanganate reacts with 3 moles of M^{x+} .

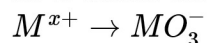
Let the n -factor of M^{x+} be x

Applying equivalence,

$$2 \times 3 = 3 \times x$$

$$\Rightarrow x = 2$$

so n-factor for M^{x+} is 2.



So the oxidation state of M in MO_3^- is +5

Hence, the value of x is $5 - 2 = 3$

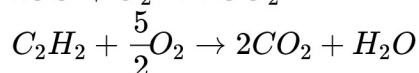
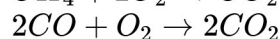
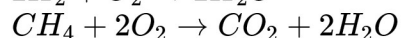
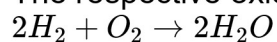
29. What volume of air in m^3 is needed for the combustion of 1 m^3 of a gas having the following composition in percentage volume: 2% of C_2H_2 , 8% of CO , 35% of CH_4 , 50% of H_2 and 5% of non-combustible gas. The air contains 20.8% (by volume) of oxygen.

Accepted Answers

5 5.0 5.00

Solution:

The respective oxidation reactions are,



From the given percentage of gases,

Here volume of $C_2H_2 = 0.02 m^3$

volume of O_2 required = $0.05 m^3$

volume of $CO = 0.08 m^3$

volume of O_2 required = $0.04 m^3$

volume of $CH_4 = 0.35 m^3$

volume of O_2 required = $0.7 m^3$

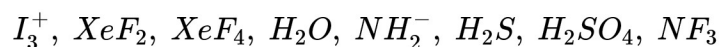
Volume of $H_2 = 0.50 m^3$

volume of O_2 required = $0.25 m^3$

Hence the total required volume of oxygen for the combustion of given gas mixture = $1.04 m^3$

Hence, volume of air required = $\frac{1.04 \times 100}{20.8} = 5 m^3$

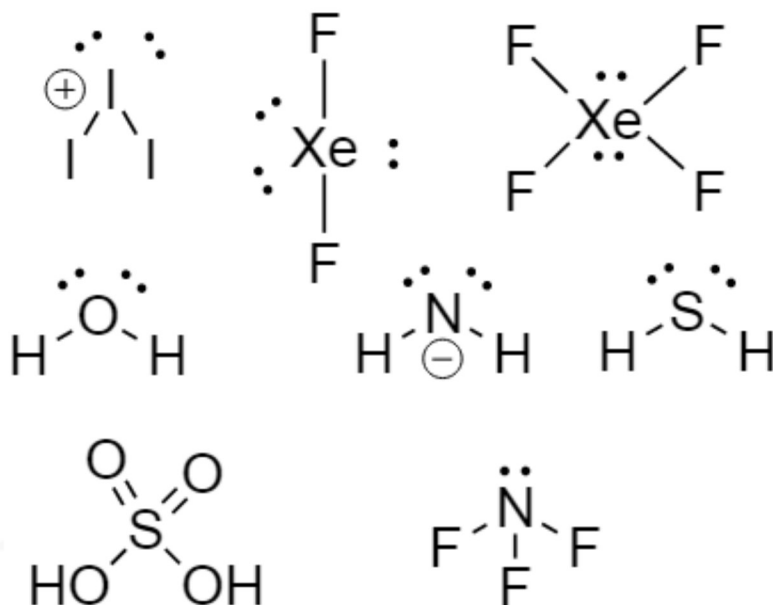
30. Find the number of molecules among the following having two lone pair of electrons on central atom.



Accepted Answers

5 5.0 5.00

Solution:



There are 5 molecules which have two lone pairs on the central atom.
The compounds are I_3^+ , XeF_4 , H_2O , NH_2^- , H_2S