# ©゙doubtnut 

India's Number 1 Education App

## CHEMISTRY

## BOOKS - EVERGREEN CHEMISTRY (ENGLISH)

## PART B (STIOCHIOMETRY) PRECENTAGE COMPOSITION -

## EMPIRICAL \& MOLECULAR FORMULA CHEMICAL EQUATION

## CALCULATIONS

## Percentage Composition E Problems Based

1. Calculate the percentage by weight of the following : a] Potassium in potassium dichromate $[\mathrm{K}=39, \mathrm{Cr}=52, \mathrm{O}=16$ ] (b) Phosphorus in calcium phosphate $\left[\mathrm{Ca}_{3}\left(\mathrm{PO}_{4}\right)_{2}\right][\mathrm{Ca}=40, \mathrm{P}=31, \mathrm{O}=16]$
2. Calculate the mass of nitrogen supplied to the soil by 5 kg of urea. $\left.\left[\mathrm{CO}\left(\mathrm{NH}_{2}\right)_{2}\right] \mathrm{N}=14, \mathrm{C}=12, \mathrm{O}=16, \mathrm{H}=1\right]$

## - View Text Solution

3. Calculate the percentage of water of crystallisation in washing soda
$\mathrm{Na}_{2} \mathrm{CO}_{3} \cdot 10 \mathrm{H}_{2} \mathrm{O}[\mathrm{Na}=23, \mathrm{C}=12, \mathrm{O}=16, \mathrm{H}=1]$.

## D View Text Solution

4. Calculate the percentage of pure iron in 10 kg . of iron [III] oxide [ $\mathrm{Fe}_{2} \mathrm{O}_{3}$ ] of $80 \%$ purity. [ $\left.\mathrm{Fe}=56, \mathrm{O}=16\right]$.

## D View Text Solution

5. Calculate the number molecules of water of crystallisation in copper sulphate crystals, if 10 g . of hydrous copper sulphate crystals gives 6.4 g .
of anhydrous $\mathrm{CuSO}_{4}$ on heating. [ $\left.\mathrm{Cu}=64, \mathrm{~S}=32, \mathrm{O}=16\right]$

## - View Text Solution

## Empirical Molecular Formula F Problems Based

1. A compound of carbon, hydrogen and oxygen is found to contain $40 \%$ of carbon, $6.7 \%$ of hydrogen and $53.3 \%$ of oxygen. Calculate its empirical formula. If its vapours density is 30 , calculate the molecular formula. [ $\mathrm{C}=$ $12, \mathrm{H}=1, \mathrm{O}=16]$.

## - View Text Solution

2. A chemical reaction showed that 10.47 g . of the compound contained
6.21 g . of metal ' X ' and the rest of a non-metal ' Y '. Calculate the empirical formula of the compound formed between ' X ' and ' Y ' [At. wt. of $\mathrm{X}=207, \mathrm{Y}=$ 35.5]
3. A compound has the following percentage composition : $\mathrm{Na}=18.60 \%$, S $=25.80 \%, \mathrm{H}=4.03 \%$ and $\mathrm{O}=51.58 \%$. Calculate the molecular formula of the crystalline salt assuming that all the hydrogen in the compound is in combination with the oxygen as water of crystallisation. Molecular weight of the compound is 248 . $[\mathrm{Na}=23, \mathrm{~S}=32, \mathrm{H}=1, \mathrm{O}=16]$

## - View Text Solution

4. Empirical formula of a compound is $X Y_{2}$. If its empirical formula weight is equal to its vapour density. Calculate the molecular formula of the compound.

## - View Text Solution

5. State the empirical formula of each compound whose molecular formula is - $\mathrm{C}_{5} \mathrm{H}_{10}$
6. State the empirical formula of each compound whose molecular formula is - $\mathrm{H}_{2} \mathrm{CO}_{2}$

## - View Text Solution

7. Calculate the empirical formula of a compound whose molecule formula is $C_{8} H_{6} O_{4}$ and empirical formula weight is 83 . [ $\mathrm{C}=12, \mathrm{H}=1, \mathrm{O}=$ 16]

## - View Text Solution

## Chemical Equations G Problems Based

1. Calculate the weight of potassium nitrite formed by decomposition of
15.15 g of potassium nitrate. $[\mathrm{K}=39, \mathrm{~N}=14, \mathrm{O}=16]$.
2. Copper on reacting with conc. $\mathrm{H}_{2} \mathrm{SO}_{4}$ produces copper [III] sulphate. If 1.28 g . of copper is to be converted to copper sulphate. Find (i) the weight of the copper sulphate formed and ii] the weight of the acid required. [Cu $=64, S=32, O=16]$.

## - View Text Solution

3. From the equation $\mathrm{CaCO}_{3}+2 \mathrm{HCl} \rightarrow \mathrm{CaCl}_{2}+\mathrm{H}_{2} \mathrm{O}+\mathrm{CO}_{2}$. Calculate the weight of $\mathrm{CaCl}_{2}$ obtained from 10 g . of $\mathrm{CaCO}_{3}$ and the volume at s.t.p. of $\mathrm{CO}_{2}$ obtained at a same time. [ $\mathrm{Ca}=40, \mathrm{C}=12, \mathrm{O}=16, \mathrm{Cl}$ = 35.5]

## - View Text Solution

4. Combustion of butane takes place as follows : $2 \mathrm{C}_{4} \mathrm{H}_{10}+13 \mathrm{O}_{2} \rightarrow 8 \mathrm{CO}_{2}+10 \mathrm{H}_{2} \mathrm{O}$. Calculate a] the number of moles of
oxygen needed for complete combustion of 58 g of butane, b] the volume of carbon dioxide formed at s.t.p. at the same time. [ $H=1, C=12]$.

## - View Text Solution

5. Thermal decomposition of calcium nitrate takes place as follows : $2 \mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2} \rightarrow 2 \mathrm{CaO}+4 \mathrm{NO}_{2}+\mathrm{O}_{2}$. If the relative molecular mass of calcium nitrate is 164 . a] Calculate the volume of nitrogen dioxide obtained at s.t.p. and b] the weight of calcium oxide obtained when 164 g of calcium nitrate is heated to constant weight. [ $C a=40, ~ O=16, N=14]$.

## - View Text Solution

6. 2.12 g of an impure mixture containing anhydrous sodium sulphate is dissolved in water. An excess of barium chloride solution is added when
1.74 g . of barium sulphate is obtained as a dry precipitate. Calculate the percentage purity of the impure sample. $[\mathrm{Na}=23, \mathrm{~S}=32, \mathrm{O}=16, \mathrm{Ba}=137]$.

## A Lussac S Law Problem

1.4000 cc . of $\mathrm{O}_{2}$ burnt with 300 cc . of ethane. Calculate the vol. of unused $\mathrm{O}_{2}$ and $\mathrm{CO}_{2}$ formed.

## - View Text Solution

## B Mole Concept Avgadro S Number Problem

1. Calculations based on -

The number of moles ii] The mass iii] The volume iv] The number of molecules v] The gram molecular weight.

1. If 30 lits. of $O_{2}$ contains 'X' no. of molecules, state the no. of molecules in 10 lits. of $\mathrm{H}_{2} 60$ lits. of $\mathrm{Cl}_{2}$ and 5 lits. of $\mathrm{NH}_{3}$. All gases collected under the same conditions of temp. \& press.

## - View Text Solution

## E Percentage Composition

1. Calculate the percentage of boron $[B]$ in borax
$N a_{2} B_{4} O_{7} \cdot 10 H_{2} O[H=1, B=11, O=16, N a=32]$

## - View Text Solution

## F Empirical Formula Molecular Formula Problem

1. A compound has the following \% composition : $\mathrm{C}=40 \%, \mathrm{H}=6.7 \%, \mathrm{O}=$ $53.3 \%$, the vapour density of the compound is 30 , calculate its molecular
formula $[C=12, H=1, O=16]$.

## - View Text Solution

## G Chemical Equations Problem

1. Copper reacts with dilute nitric acid to give copper nitrate, water and nitric oxide. Calculate
i] the mass of copper needed to react with 126 g . of $\mathrm{HNO}_{3}$
ii] vol. of nitric oxide obtained at the same time $[\mathrm{Cu}=64, \mathrm{H}=1, \mathrm{O}=16, \mathrm{~N}=$ 14].

## - View Text Solution

## Additional Problems Percentage Composition

1. Calculate the percentage by weight of : a] C in carbon dioxide, b] Na in sodium carbonate, c$] \mathrm{Al}$ in aluminium nitride. $[\mathrm{C}=12, \mathrm{O}=16, \mathrm{H}=1, \mathrm{NA}=23$,

## - View Text Solution

2. Calculate the percentage of iron in $K_{3} F e(C N)_{6}$. $[\mathrm{K}=39, \mathrm{Fe}=56, \mathrm{C}=12$, $N=14]$

## - View Text Solution

3. Calculate which of the following - calcium nitrate or ammonium sulphate has a higher \% of nitrogen. [ $C a=40, O=16, S=32, N=14]$

## - View Text Solution

4. Calculate the percentage of pure aluminium in 10 kg . of aluminium oxide $\left[\mathrm{Al}_{2} \mathrm{O}_{3}\right]$ of $90 \%$ purity.
5. State which of the following are better fertilizers - Potassium phosphate $\left[\mathrm{K}_{3} \mathrm{PO}_{4}\right]$ or potassium nitrate $\left[\mathrm{NKO}_{3}\right]$

## - View Text Solution

6. State which of the following are better fertilizers - Urea $\left[\mathrm{NH}_{2} \mathrm{CONH}_{2}\right]$ or ammonium phosphate $\left[\left(\mathrm{NH}_{4}\right)_{3} \mathrm{PO}_{4}\right][\mathrm{K}=39, \mathrm{P}=31, \mathrm{O}=16, \mathrm{~N}=14, \mathrm{H}=$ 1]

## - View Text Solution

7. Calculate the percentage of carbon in a $55 \%$ pure sample of carbon carbonate. $[\mathrm{Ca}=40, \mathrm{C}=12, \mathrm{O}=16]$

## - View Text Solution

8. Calculate the percentage of water of crystalisation in hydrated copper sulphate $\left[\mathrm{CuSO}_{4} \cdot 5 \mathrm{H}_{2} \mathrm{O}\right] .[\mathrm{Cu}=63.5, \mathrm{~S}=32, \mathrm{O}=16, \mathrm{H}=1]$

## - View Text Solution

9. Hydrated calcium sulphate $\left[\mathrm{CaSO}_{4} \cdot x \mathrm{H}_{2} \mathrm{O}\right]$ contains $21 \%$ of water of crystallisation. Calculate the number of molecules of water of crystalisation i.e. ' X ' in the hydrated compound. [Ca = 40, S = 32, O = 16, H = 1]

## D View Text Solution

## Additional Problems Emipirical Molecular Formula

1. A compound gave the following data : $\mathrm{C}=57.82 \%, \mathrm{O}=38.58 \%$ and the rest hydrogen. Its vapour density is 83 . Find its empirical and molecular formula. [ $\mathrm{C}=12, \mathrm{O}=16, \mathrm{H}=1]$
2. Four g of a metallic chloride contains 1.89 g of the metal ' X '. Calculate the empirical formula of the metallic chloride. [At. Wt. of ' X ' $=64, \mathrm{Cl}=35.5$ ]

## - View Text Solution

3. Calculate the molecular formula of a compound whose empirical formula is $\mathrm{CH}_{2} \mathrm{O}$ and vapour density is 30 .

## - View Text Solution

4. A compound has the following percentage composition. $\mathrm{Al}=0.2675 \mathrm{~g}$., $\mathrm{P}=0.3505 \mathrm{~g} ., \mathrm{O}=0.682 \mathrm{~g}$. If the molecular weight of the compound is 122 and its original weight which on analysis gave the above results 1.30 g .

Calculate the molecular formula of the compound. [AI $=27, \mathrm{P}=31, \mathrm{O}=16$ ]
5. Two organic compounds ' $X$ ' and ' $Y$ ' containing carbon and hydrogen only have vapour densities 13 and 39 respectively. State the molecular formula of ' $X$ ' and ' $Y$ '. [ $C=12, H=1]$

## - View Text Solution

6. A compound has the following $\%$ composition. $\mathrm{Zn}=22.65 \%, \mathrm{~S}=11.15 \%$, O $=61.32 \%$ and $\mathrm{H}=4.88 \%$. Its relative molecular mass is 287 g . Calculate its molecular formula assuming that all the hydrogen in the compound is present in combination with oxygen as water of crystallization. [ $\mathrm{Zn}=65, \mathrm{~S}$ $=32, \mathrm{O}=16, \mathrm{H}=1$ ]

## - View Text Solution

7. A hydrogen contains $82.8 \%$ of carbon. Find its molecular formula if its vapour density is 29. [ $\mathrm{H}=1, \mathrm{C}=12]$
8. An organic compound on analysis gave $\mathrm{H}=6.48 \%$ and $\mathrm{O}=51.42 \%$. Determine its empirical formula if the compound contains 12 atoms of carbon. $[\mathrm{C}=12, \mathrm{H}=1, \mathrm{O}=16]$

## - View Text Solution

9. A hydrated salt contains $\mathrm{Cu}=25.50 \%, \mathrm{~S}=12.90 \% \mathrm{O}=25.60 \%$ and the remaining \% is water of crystallization. Calculate the empirical formula of the salt. $[\mathrm{Cu}=64, \mathrm{~S}=32, \mathrm{O}=16, \mathrm{H}=1]$

## D View Text Solution

10. A gaseous hydrocarbon weighs 0.70 g and contains 0.60 g . of carbon.

Find the molecular formula of the compound if its molecular weight is 70 .
$[\mathrm{C}=12, \mathrm{H}=1$ ]

## - View Text Solution

11. A salt has the following $\%$ composition :- $\mathrm{Al}=10.50 \%, \mathrm{~K}=15.1 \%, \mathrm{~S}=$ $24.8 \%$ and the remaining oxygen. Calculate the empirical formula of the salt. $[\mathrm{Al}=27, \mathrm{~K}=39, \mathrm{~S}=32, \mathrm{O}=16]$

## - View Text Solution

## Additional Problems Chemical Equations

1. What mass of silver chloride will be obtained by adding an excess of hydrochloric acid to a solution of 0.34 g of silver nitrate. [Cl = 35.5, $\mathrm{Ag}=$ $108, \mathrm{~N}=14, \mathrm{O}=16, \mathrm{H}=1]$

## - View Text Solution

2. What volume of oxyegen at s.t.p. will be obtained by the action of heat on 20 g . of $\mathrm{KClO}_{3}$. $[\mathrm{K}=39, \mathrm{Cl}=35.5, \mathrm{O}=16]$
3. From the equation : $3 \mathrm{Cu}+8 \mathrm{HNO}_{3} \rightarrow 3 \mathrm{Cu}\left(\mathrm{NO}_{3}\right)_{2}+4 \mathrm{H}_{2} \mathrm{O}+2 \mathrm{NO}$.

## Calculate

 the mass of copper needed to react with 63 of nitric acid.
## - View Text Solution

4. From the equation : $3 \mathrm{Cu}+8 \mathrm{HNO}_{3} \rightarrow 3 \mathrm{Cu}\left(\mathrm{NO}_{3}\right)_{2}+4 \mathrm{H}_{2} \mathrm{O}+2 \mathrm{NO}$.

Calculate the volume of nitric oxide collected at the same time. $[\mathrm{Cu}=64, \mathrm{H}=1, \mathrm{O}=$ $16, \mathrm{~N}=14]$

## - View Text Solution

5. Zinc blende [ZnS] is roasted in air. Calculate :
the number of moles of sulphur dioxide liberated by 776 g of ZnS
6. Zinc blende [ZnS] is roasted in air. Calculate :

The weight of ZnS required to produce 22.4 lits of $S O_{2}$ at s.t.p. [ $\mathrm{S}=32, \mathrm{Zn}$ $=65, O=16]$

## D View Text Solution

7. Ammonia reacts with sulphuric acid to give the fertilizer ammonium sulphate. Calculate the volume of ammonia [at s.t.p.] used to form 59 g of ammonium sulphate.
$[\mathrm{N}=14, \mathrm{H}=1, \mathrm{~S}=32, \mathrm{O}=16]$.

## - View Text Solution

8. Heat on lead nitrate gives yellow lead [II] oxide, nitrogen dioxide \& oxygen. Calculate the total volume of $\mathrm{NO}_{2} \& \mathrm{O}_{2}$ produced on heating 8.5 of lead nitrate. $[\mathrm{Pb}=207, \mathrm{~N}=14, \mathrm{O}=16]$.

## - View Text Solution

9. $2 \mathrm{KClO}_{3} \xrightarrow{\Delta} 2 \mathrm{KCl}+3 \mathrm{O}_{2}, \mathrm{C}=\mathrm{O}_{2} \xrightarrow{\Delta} \mathrm{CO}_{2}$. Calculate the amount of $\mathrm{KCIO}_{3}$ which on thermal decomposition gives 'X' vol. of $\mathrm{O}_{2}$, which is the volume required for combustion of 24 g . of carbon. $[\mathrm{K}=39, \mathrm{Cl}=35.5$, $\mathrm{O}=16, \mathrm{C}=12]$.

## - View Text Solution

10. Calculate the weight of ammonia gas.

Required for reacting with sulphuric acid to give 78 g . of fertilizer ammonium sulphate.

## - View Text Solution

11. Calculate the weight of ammonia gas.

Obtained when 32.6 g . of ammonium chloride reacts with calcium hydroxide during the laboratory preparation of ammonia.
$\left[2 \mathrm{NH}_{4} \mathrm{Cl}+\mathrm{Ca}(\mathrm{OH})_{2} \rightarrow \mathrm{CaCl}_{2}+2 \mathrm{H}_{2} \mathrm{O}+2 \mathrm{NH}_{3}\right][\mathrm{N}=14, \mathrm{H}=1,0=16$, $\mathrm{S}=32, \mathrm{Cl}=35.5]$.

## - View Text Solution

12. Sodium carbonate reacts with dil. $\mathrm{H}_{2} \mathrm{SO}_{4}$ to give the respective salt, water and carbon dioxide. Calculate the mass of pure salt formed when 300 g. of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ of $80 \%$ purity reacts with dil. $H_{2} \mathrm{SO}_{4}[\mathrm{Na}=23, C=12,0=16, H=1, S=32]$.

## - View Text Solution

13. Sulphur burns in oxygen to give sulphur dioxide. If 16 g . of sulphur burns in X cc. of oxygen, calculate the amount of potassium nitrate which must be heated to produce $X$ cc. of oxygen. . $[S=32, K=39, N=14, O=16]$.

## - View Text Solution

14. Sample of impure magnesium is reacked with dilute sulphuric acid to give the respective salt and hydrogen. If 1 g . of the impure sample gave
298.6 cc. of hydrogen at st.p. Calculate the \% purity of the sample. [ $\mathrm{Mg}=$ $24, \mathrm{H}=1]$.

## - View Text Solution

## Questions A Gay Lussac S Law Problem Based

1. $\left[C_{4} H_{10}\right][40 \%]$ is burnt. Calculate the total volume of carbon dioxide formed. Combustion reactions of the mixture are represented as $\mathrm{C}_{3} \mathrm{H}_{8}+5 \mathrm{O}_{2(\mathrm{~g})}+3 \mathrm{CO}_{2(g)}+4 \mathrm{H}_{2} \mathrm{O}_{(\mathrm{g})}, 2 \mathrm{C}_{4} \mathrm{H}_{10(\mathrm{~g})}+13 \mathrm{O}_{2} \rightarrow 8 \mathrm{CO}_{2(g)}$

## D View Text Solution

2. 67.2 litres of H , combines with 44.8 litres of $N_{2}$ to form $\mathrm{NH}_{3}: \mathrm{N}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g}) \rightarrow 2 \mathrm{NH}_{3}(\mathrm{~g})$. Calculate the vol. of $\mathrm{NH}_{3}$ produced. What is the substance, if any, that remains in the resultant mixture.
3. What volume of oxygen is required to burn completely $90 m d^{3}$ of butane under similar conditions of temperature \& pressure. $2 \mathrm{C}_{4} \mathrm{H}_{10}+13 \mathrm{O}_{2} \rightarrow 8 \mathrm{CO}_{2}+10 \mathrm{H}_{2} \mathrm{O}$

## - View Text Solution

4. What volume of ethyne gas at s.t.p is required to produce $8.4 d m^{3}$ of carbon dioxide at s.t.p. $2 \mathrm{CH}_{2}+5 \mathrm{O}_{2} \rightarrow 4 \mathrm{CO}_{2}+2 \mathrm{H}_{2} \mathrm{O}$ [H = 1, C=12, O=16]

## - View Text Solution

5. If 6 litres of hydrogen and 4 litres of chlorine are mixed and exploded \& if water is added to the gases formed, find the volume of the residual gas.

## - View Text Solution

6. The equation $4 \mathrm{NH}_{3}+5 \mathrm{O}_{2} \rightarrow 4 \mathrm{NO}+6 \mathrm{H}_{2} \mathrm{O}$, represents the catalytic oxidation of ammonia. If $100 \mathrm{~cm}^{3}$ of ammonia is used, calculate the volume of oxygen required to oxidize the ammonia completely.

## - View Text Solution

7. Propane burns in air according to the following equation: $\mathrm{C}_{3} \mathrm{H}_{8}+5 \mathrm{O}_{2}+3 \mathrm{CO}_{2}+4 \mathrm{H}_{2} \mathrm{O}$. What volume of propane is consumed on using $1000 \mathrm{~cm}^{3}$ of air, considering only $20 \%$ of air contains oxygen.

## - View Text Solution

8. Ethane burns in $\mathrm{O}_{2}$ to form $\mathrm{CO}_{2}$ \& $\mathrm{H}_{2} \mathrm{O}: 2 \mathrm{C}_{2} \mathrm{H}_{6}+7 \mathrm{O}_{2} \rightarrow 4 \mathrm{CO}_{2}+6 \mathrm{H}_{2} \mathrm{O}$. If 1250 cc . of oxygen is burnt with 300 cc . of ethane - Calculate the: i] volume of $\mathrm{CO}_{2}$ formed ii] volume of unused $O_{2}$ [600cc., 200cc.]

## Questions B Mole Concept Avogadro S Number

1. $2 \mathrm{KMnO}_{4} \rightarrow \mathrm{KMnO}_{4}+\mathrm{MnO}_{2}+\mathrm{O}_{2}$ Given that the molecular mass of $\mathrm{KMnO}_{4}$ is 158, what volume of oxygen [measured at room temp.] would be obtained by the complete decomposition of 15.8 g . of potassium permanganate. [Molar volume at room temperature is 24 litres.]

## - View Text Solution

2. The volumes of gases $A, B, C \& D$ are in the ratio, 1:2:2:4 under the same conditions of temp. \& press.
i] Which sample contains maximum no. of molecules. If the temp. \& pressure of gas $A$ are kept constant, what will happen to the volume of $A$ when the no. of molecules is doubled. [D, Doubles]
ii] If the volume of 'A' is $5.6 \mathrm{dm}^{3}$ at s.t.p., calculate the no. of molecules in the actual vol. of 'D' at s.t.p. [Avog.no.is $6 \times 10^{23}$ ]. Using your answer, state the mass of ' $D$ ' if the gas is $N_{2} O$ '. [ $\left.\mathrm{N}=14, \mathrm{O}=16\right]\left[6 \times 10^{23}, 44 \mathrm{~g}\right.$. $]$
3. Calculate the no. of moles \& the no. of molecules present in 1.4 g . of éthylene gas $\left[\mathrm{C}_{2} \mathrm{H}_{4}\right]$. What is the vol. occupied by the same amount of $C_{2} H_{4}$. State the vapour density of $C_{2} H_{4}$. [Avog. No. $=6 \times 10^{23}, \mathrm{C}=12, \mathrm{H}=$ 1]

## - View Text Solution

4. The equation for the burning of octane is: $2 \mathrm{C}_{8} \mathrm{H}_{18}+25 \mathrm{O}_{2} \rightarrow 16 \mathrm{CO}_{2}+18 \mathrm{H}_{2} \mathrm{O}$
i] How many moles of carbon dioxide are produced when one mole of octane burns.
ii) What volume, at s.t.p. is occupied by the number of moles determined in 1. i].
iii] If the relative molecular mass of carbon dioxide is 44 , what is the mass of carbon dioxide produced by burning two moles of octane.

## - View Text Solution

5. Define the term - Mole. A gas cylinder contains $24 \times 10^{24}$ molecules of nitrogen gas. If Avogardro's number is $6 \times 10^{23}$ and the relative atomic mass of nitrogen is 14 , calculate :
(i) Mass of nitrogen gas in the cylinder. (ii) Volume of nitrogen at STP in $d m^{3}$

## D View Text Solution

6. Gas ' $X$ ' occupies a volume of $100 \mathrm{~cm}^{3}$ at S.T.P. and weighs 0.5 g . Find its relative molecular mass.

## - View Text Solution

7. Dil. HCl is reacted with 4.5 moles of calcium carbonate. Calculate (i) The mass of 4.5 moles of $\mathrm{CaCO}_{3}$. (ii) The volume of $\mathrm{CO}_{2}$ liberated at step. (iii) The mass of $\mathrm{CaCl}_{2}$ formed. (iv) The number of moles of the acid HCl used in the reaction [relative molecular mass of $\mathrm{CaCO}_{3}$ is 100 and of $\mathrm{CaCl}_{2}$ is
8. Calculate the mass of -i] $10^{22}$ atoms of sulphur. li] 0.1 mole of carbon dioxide. [ $\mathrm{S}=32, \mathrm{C}=12$ and $\mathrm{O}=16 \&$ Avogadro's number $=6 \times 10^{23}$ ]

## - View Text Solution

9. Calculate the volume of 320 g of $S O_{2}$ at stp. [ $\mathrm{S}=32$ and $\mathrm{O}=16$ ]

## - View Text Solution

10. The mass of $5.6 \mathrm{dm}^{3}$ of a gas at stp is 12.0 g . Calculate the relative molecular mass of the gas.

## - View Text Solution

11. The vapour density of a gas is 8 . What would be the volume occupied by 24.0 g of the gas at STP.

## - View Text Solution

12. Calculate the volume occupied by 0.01 mole of $\mathrm{CO}_{2}$ at STP.

## - View Text Solution

13. State Avogadro's Law. A cylinder contains 68 g . of ammonia gas at s.t.p. i] What is the volume occupied by this gas. ii] How many moles \& how many molecules of ammonia are present in the cylinder. $[\mathrm{N}=14, \mathrm{H}=1]$

## - View Text Solution

14. Calculate the mass of Calcium that will contain the same number of atoms as are present in 3.2 gm of sulphur. [ $\mathrm{S}=32, \mathrm{Ca}=40$ ]
15. Select the correct answer from A, B C \& D : The ratio between the number of molecules in 2 g of hydrogen and 32 g of oxygen is: [ $H=1, O=$ 16]
A. 1:2
B. 1: 0.01
C. 1:1
D. $0.01: 1$

## Answer: C

## - View Text Solution

16. A gas of mass 32 gms has a volume of 20 litres at S.T.P. Calcuate the gram mol. Weight of the gas.
17. A gas cylinder contains $12 \times 10^{24}$ molecules of oxygen gas. Calculate : i] the mass of $O_{2}$ present in the cylinder. (ii) the volume of $O_{2}$ at S.T.P. present the cylinder. $[\mathrm{O}=16]$ Avog. No. is $6 \times 10^{23}$

## - View Text Solution

18. Calculate the number of gram atoms in 4.6 grams of sodium $[\mathrm{Na}=23]$

## D View Text Solution

19. The mass of 11.2 litres of a certain gas at s.t.p. is 24 g . Find the gram molecular mass of the gas.

## - View Text Solution

20. Calculate : i$]$ The number of moles in 12 g . of oxygen gas. [ $\mathrm{O}=16$ ]
(ii) The weight of $10^{22}$ atoms of carbon. [ $C=12$, Avogadro's No.
$\left.=6 \times 10^{23}\right]$

## - View Text Solution

## Questions C Mole Concept Avogadro S Law Problem Based

1. The gas law which relates the volume of a gas to the number of molecules of the gas is
A. Avogadro's Law
B. Gay - Lussac's Law
C. Boyle's Law
D. Charles Law

## Answer: A

2. A gas cylinder can hold 1 kg . of $H_{2}$ at room temp. \& press. : i] Find the number of moles of hydrogen present. ii] What weight of $\mathrm{CO}_{2}$ can the cylinder hold under similar conditions of temp. \& press. iii] If the number of molecules of hydrogen in the cylidnder is $X$, calculate the number of $\mathrm{CO}_{2}$ molecules in the cylinder under the same conditions of temp. \& press. iv] State the law that helped you to arrive at the above result.

## - View Text Solution

3. If 150 cc . of gas A contains X molecules, how many molecules of gas $B$ will be present in 75 cc . of B . The gases $\mathrm{A} \& \mathrm{~B}$ are under the same conditions of temperature \& pressure.

Name the law on which the problem is based.

## - View Text Solution

1. Find the relative molecular mass of a gas, 0.546 g of which occupies $360 \mathrm{~cm}^{3}$ at $87^{\circ} \mathrm{C}$ and 380 mm Hg pressure. [1 litre of hydrogen at s.t.p. weighs 0.09 g ]

## - View Text Solution

2. $2 \mathrm{KMnO}_{4} \rightarrow \mathrm{~K}_{2} \mathrm{MnO}_{4}+\mathrm{MnO}_{2}+\mathrm{O}_{2} \quad\left[\mathrm{~K}_{2} \mathrm{MnO}_{4}+\mathrm{MnO}_{2}\right.$ is the solid residue]

Potassium permanganate was heated in a test tube. After collecting one litre of oxygen at room temp., it was found that the test tube has undergone a loss in mass of 1.32 g . If one litre of $\mathrm{H}_{2}$ under the same conditions of temp. \& pressure has a mass of 0.0825 g . Calculate the relative molecular mass of oxygen.

## - View Text Solution

3. A gas cylinder of capacity of $20 \mathrm{dm}^{3}$ is filled with gas X the mass of which is 10 g . When the same cylinder is filled with hydrogen gas at the
same temperature and pressure the mass of the hydrogen is 2 g ., hence the relative molecular mass of the gas is :
A. 5
B. 10
C. 15
D. 20

## Answer: A

## - View Text Solution

4. The vapour density of carbon dioxide $[C=12, O=16]$ is :
A. A : 32
B. B: 16
C. C : 44
D. D : 22

## - View Text Solution

## Questions E Percentage Composition

1. Find the total percentage of oxygen in magnesium nitrate crystals :
$M g\left(\mathrm{NO}_{3}\right)_{2} \cdot 6 \mathrm{H}_{2} \mathrm{O} \cdot[\mathrm{O}=16, \mathrm{~N}=14, \mathrm{H}=1, \mathrm{Mg}=24]$

## - View Text Solution

2. What is the mass of nitrogen in 1000 kg of urea $\left[\mathrm{CO}\left(\mathrm{NH}_{2}\right)_{2} .[\mathrm{C}=12]\right.$

Answer to nearest kg.]

## - View Text Solution

3. Calculate the \% boron [B] in borax $\mathrm{Na}_{2} \mathrm{~B}_{4} \mathrm{O}_{7} \cdot 10 \mathrm{H}_{2} \mathrm{O}$. [H $=1, \mathrm{~B}=11, \mathrm{O}=$
$16, \mathrm{Na}=32]$.

## - View Text Solution

4. If a crop of wheat removes 20 kg of nitrogen per hectare of soil, what mass in kg. of the fertilizer calcium nitrate would be required to replace the nitrogen in 10 hectare field. $[\mathrm{N}=14, \mathrm{O}=16, \mathrm{Ca}=40]$.

## - View Text Solution

5. Calculate the percentage of phosphorus in the fertilizer superphosphate $\mathrm{Ca}\left(\mathrm{H}_{2} \mathrm{PO}_{4}\right)_{2}$. [correct to 1 dp ].

## - View Text Solution

6. Calculate the percentage of platinum in ammonium chloroplatinate $\left(\mathrm{NH}_{4}\right) \mathrm{PtCl}_{6}$
[Give your answer correct to the nearest whole number]. [ $\mathrm{N}=14, \mathrm{H}=1, \mathrm{Cl}=$ 35.5, Pt $=195$ ] [ 44\%]
7. Calculate the percentage of nitrogen in aluminium nitride. [Al $=27, N=$ 14]

## - View Text Solution

8. Calculate the percentage of sodium in sodium aluminium fluoride
[ $\mathrm{Na}_{3} \mathrm{AlF}_{6}$ ] correct to the nearest whole number. [ $\mathrm{F}=19, \mathrm{Na}=23, \mathrm{Al}=27$ ]

## - View Text Solution

9. Determine the percentage of oxygen in ammonium nitrate [ $O=16$ ]

## - View Text Solution

10. If the relative molecular mass of ammonium nitrate is 80 , calculate the percentage of nitrogen and oxygen in ammonium nitrate. [ $\mathrm{N}=14, \mathrm{H}=1, \mathrm{O}$

## - View Text Solution

11. Find the total percentage of magnesium in magnesium nitrate crystals, $\mathrm{Mg}\left(\mathrm{NO}_{3}\right)_{2} \cdot 6 \mathrm{H}_{2} \mathrm{O} \cdot[\mathrm{Mg}=24, \mathrm{~N}=14, \mathrm{O}=16$ and $\mathrm{H}=1]$

## - View Text Solution

12. Calculate the percentage of water of crystallisation in $\mathrm{CuSO}_{4} \cdot 5 \mathrm{H}_{2} \mathrm{O}$
$[H=1, O=16, S=32, C u=64]$

## D View Text Solution

## Questions F Empirical Formula And Molecular Formula

1. What is the empirical formula of octane. [ $\mathrm{C}_{8} \mathrm{H}_{18}$ ]
2. A compound contains - Carbon $14.4 \%$, hydrogen $1.2 \%$ and chlorine 84.5\%. Determine the empirical formula of this compound. Work is its molecular formula. [ $\mathrm{C}=12, \mathrm{H}=1, \mathrm{Cl}=35.5]$

## - View Text Solution

3. A gaseous compound of nitrogen and hydrogen contains $12.5 \%$ hydrogen by mass. Find the molecular formula of the compound it its relative molecular mass is $37 .[\mathrm{N}=14, \mathrm{H}=1]$

## - View Text Solution

4. An organic compound has vapour density 94 . It contains $\mathrm{C}=12.67 \%, \mathrm{H}=$ $2.13 \%$, and $\mathrm{Br}=85.11 \%$. Find the molecular formula of the organic compound. [ $\mathrm{C}=12, \mathrm{H}=1, \mathrm{Br}=80$ ]
5. A compound having empirical formula $X_{2} Y$ is made of two elements X \& $Y$. Find its molecular formula if the atomic weight of $X$ is 10 \& that of $Y$ is $5 \&$ the compound has a vapour density 25 .

## - View Text Solution

6. If the empirical formula of a compound is CH and it has a vapour density of 13 , find the molecular formula of the compound. [ $C=12, H=1]$

## - View Text Solution

7. A gaseous hydrocarbon contains $82.76 \%$ of carbon. Given that its vaopur density is 29 , find its molecular formula. [ $C=12, H=1$ ]

## - View Text Solution

8. A compound of X and Y has the empirical formula $X Y_{2}$. Its vapour density is equal to its empirical formula weight. Determine its molecular formula.

## - View Text Solution

9. The percentage compositions of a gas is : Nitrogen $82.35 \%$, Hydrogen 17.64\%. Find the empirical formula of the gas. [ $\mathrm{N}=14, \mathrm{H}=1$ ]

## - View Text Solution

10. Molecular formula of a compound is $\mathrm{C}_{6} \mathrm{H}_{18} \mathrm{O}_{3}$. Find its empirical formula.

## - View Text Solution

11. Find the empirical \& molecular formula of an organic compound from the data given : $\mathrm{C}=75.92 \% \mathrm{H}=6.32 \%$ \& $\mathrm{N}=17.76 \%$. The vapour density of the compound is 39.5. [ $\mathrm{C}=12, \mathrm{H}=1, \mathrm{~N}=14]$

## - View Text Solution

## Questions G Chemical Equations

1. Washing soda has the formula $\mathrm{Na}_{2} \mathrm{CO}_{3} \cdot 10 \mathrm{H}_{2} \mathrm{O}$. What mass of anhydrous sodium carbonate is left when all the water of crystallization is expelled by heating 57.2 g of washing soda.

## - View Text Solution

2. $\mathrm{Na}_{2} \mathrm{SO}_{4}+\mathrm{Pb}\left(\mathrm{NO}_{3}\right)_{2} \rightarrow \mathrm{PbSO}_{4}+2 \mathrm{NaNO}_{3}$. When excess lead nitrate solution was added to a solution of sodium sulphate. 15.15 g of lead sulphate were precipitated. What mass of sodium sulphate was
present in the original solution. $[\mathrm{H}=1, \mathrm{C}=12, \mathrm{O}=16, \mathrm{Na}=23, \mathrm{~S}=32, \mathrm{~Pb}=$ 207]

## - View Text Solution

3. From the equation : $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{Cr}_{2} \mathrm{O}_{7} \rightarrow \mathrm{Cr}_{2} \mathrm{O}_{3}+4 \mathrm{H}_{2} \mathrm{O}+\mathrm{N}_{2}$ Calculate
(i) the vol. of nitrogen at STP, evolved when 63 g . Of ammonium dichromate is heated.
(ii) the mass of $\mathrm{Cr}_{2} \mathrm{O}_{3}$ formed at the same time. [ $\mathrm{N}=14, \mathrm{H}=1, \mathrm{Cr}=52, \mathrm{O}=$ 16].

## - View Text Solution

4. 10 g . of a mixture of $\mathrm{NaCl} \&$ anhydrous $N a_{2} \mathrm{SO}_{4}$ is dissolved in water. An excess of $B a C l_{2}$ soln. is added \& 6.99 g . of $B a S O_{4}$ is precipitated according to equation : $\mathrm{Na}_{2} \mathrm{SO}_{4}+\mathrm{BaCl}_{2} \downarrow+2 \mathrm{NaCl}$. Calculate the percentage of $\mathrm{Na}_{2} \mathrm{SO}_{4}$ in the original mixture. [ $\mathrm{O}=16, \mathrm{Na}=23, \mathrm{~S}=32$, Ba = 137]

## - View Text Solution

5. The reaction of potassium permanganate with acidified iron [II] sulphate is given below $2 \mathrm{KMnO}_{4}+10 \mathrm{FeSO}_{4}+8 \mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow \mathrm{~K}_{2} \mathrm{SO}_{4}+2 \mathrm{MnSO}_{4}+5 \mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}+$

If 15.8 g . of potassium permanganate was used in the reaction, calculate the mass of iron [II] sulphate used in the above reaction. $[K=39, M n=55$, $S=32, O=16]$

## - View Text Solution

6. The equations given below relate to the manufacture of sodim carbonate [Mol. Wt. of $\mathrm{Na}_{2} \mathrm{CO}_{3}=106$ ]

$$
\begin{equation*}
\mathrm{NaCl}=\mathrm{NH}_{3}+\mathrm{CO}_{2}+\mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{NaHCO}_{3}+\mathrm{NH}_{4} \mathrm{Cl} \tag{i}
\end{equation*}
$$

$2 \mathrm{NaHCO}_{3} \rightarrow \mathrm{Na}_{2} \mathrm{CO}_{3}+\mathrm{H}_{2} \mathrm{O}+\mathrm{CO}_{2}$
Questions a and (b) are based on the production of 21.2 g of sodium carbonate.
(a) What mass of sodium hydrogen carbonate must be heated to give 21.2 g. of sodium carbonate [Molecular weight of $\mathrm{NaHCO}_{3}=84$ ].
(b) To produce the mass of sodium hydrogen carbonate calculated in (a), what volume of carbon dioxide, measured at s.t.p., would be required.

## - View Text Solution

7. The relative molecular mass [mol. wt.] of copper oxide is 80 . What vo. of $\mathrm{NH}_{3}$ [ measured at s.t.p.] is required to completely reduce 120 g . of CuO . $\left[3 \mathrm{CuO}+2 \mathrm{NH}_{3} \rightarrow 3 \mathrm{Cu}+3 \mathrm{H}_{2} \mathrm{O}+\mathrm{N}_{2}\right]$.

## D View Text Solution

8. A sample of ammonium nitrate when heated yields 8.96 litres of steam (measured at stp).
$\mathrm{NH}_{4} \mathrm{NO}_{3} \rightarrow \mathrm{~N}_{2} \mathrm{O}+2 \mathrm{H}_{2} \mathrm{O}$ (i) what volume of dinitrogen oxide is produce at the same time as 8.96 litres of steam. (ii) What mass of ammonium nitrate should be heated to produce 8.96 litres of steam [Relative molecular mass of $\mathrm{NH}_{4} \mathrm{NO}_{3}$ is 80 ]

## - View Text Solution

9. From the equation : $\mathrm{C}+2 \mathrm{H}_{2} \mathrm{SO}_{4} \rightarrow \mathrm{CO}_{2}+2 \mathrm{H}_{2} \mathrm{O}+2 \mathrm{SO}_{2}$. Calculate :

The volume of $\mathrm{SO}_{2}$ measured at s.t.p., liberated at the same time.

## - View Text Solution

10. Commercial NaOH weighing 30 g . Has some NaCl in it. The mixture on dissolving in water \& treatment with excess $\mathrm{AgNO}_{3}$ soln. formed a precipitate weighing 14.3 g . What is the percentage of NaCl in the commercial sample of NaOH .
$\mathrm{NaCl}+\mathrm{AgNO}_{3} \rightarrow \mathrm{AgCl}+\mathrm{NaNO}_{3}$. [Relative molecular mass of $\mathrm{NaCl}=$ $58, \mathrm{AgCl}=143]$

## - View Text Solution

11. Calculate the volume of oxygen required for the complete combustion of 8.8 g or propane. $\left[C_{3} H_{8}\right]$ [C 12, $\mathrm{O}=16, \mathrm{H}=1$, Molar Volume $=22.4 d \mathrm{~m}^{3}$ at stp]

## - View Text Solution

12. $\mathrm{P}+5 \mathrm{HNO}_{3}$ [conc.] $\rightarrow \mathrm{H}_{3} \mathrm{PO}_{4}+\mathrm{H}_{2} \mathrm{O}+5 \mathrm{NO}_{2}$. If 9.3 g of phosphorus was used in the reaction, Calculate : (i) Number of moles of phosphorus taken. (ii) The mass of phosphorus acid formed. (iii) The volume of $\mathrm{NO}_{2}$ produced at stp. [ $\mathrm{H}=1, \mathrm{~N}=14, \mathrm{P}=31, \mathrm{O}=16$ ]

## - View Text Solution

13. $2 \mathrm{KClO}_{3} \xrightarrow{\mathrm{MnO}_{2}} 2 \mathrm{KCl}+3 \mathrm{O}_{2}$
(i) Calculate the mass of $\mathrm{KClO}_{3}$ required to produce 6.72 litre of $\mathrm{O}_{2}$ at stp. $[\mathrm{K}=39 . \mathrm{Cl}=35.5, \mathrm{O}=16]$.
(ii) Calculate the no. of moles of $O_{2}$ in the above volume \& also the no. of molecules.

## - View Text Solution

14. From the equation : $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{Cr}_{2} \mathrm{O}_{7} \xrightarrow{\text { heat }} \mathrm{N}_{2}(\mathrm{~g})+4 \mathrm{H}_{2} \mathrm{O}(\mathrm{g})+\mathrm{Cr}_{2} \mathrm{O}_{3}$.

Calculate : (i) the quantity in moles of $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ if 63 gm . of $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{Cr}_{2} \mathrm{O}_{7}$ is heated. (ii) the quantity in moles of $\mathrm{N}_{2}$ formed. (iii) the volume in litres or $d m^{3}$ of $N_{2}$ evolved at s.t.p. (iv) the mass in grams of $\mathrm{Cr}_{2} \mathrm{O}_{3}$ formed at the same time. [ $\left.\mathrm{H}=1, \mathrm{Cr}=52, \mathrm{~N}=14\right]$

## - View Text Solution

15. How much calcium oxide is formed when 82 g . of calcium nitrate is heated. Also find the volume of nitrogen dioxide evolved : $2 \mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2} \rightarrow 2 \mathrm{CaO}+4 \mathrm{NO}_{2}+\mathrm{O}_{2}[\mathrm{Ca}=40, \mathrm{~N}=14 \mathrm{O}=16]$

## - View Text Solution

16. Aluminium carbide reacts with water according to the equation :

$$
\mathrm{Al}_{4} \mathrm{C}_{3}+12 \mathrm{H}_{2} \mathrm{O} \rightarrow 4 \mathrm{Al}(\mathrm{OH})_{3}+3 \mathrm{CH}_{4} .
$$

(i) State what mass of aluminium hydroxide is formed from 12 g . of aluminium carbide.
(ii) State the volume of methane at s.t.p. obtained from 12 g . of aluminium carbide.
[relative molecular weight of $\mathrm{Al}_{4} \mathrm{C}_{3}=144, \mathrm{Al}(\mathrm{OH})_{3}=78$ ]

## - View Text Solution

17. Copper [II] sulphate soln. reacts with sodium hydroxide soln. to form copper hydroxide according to the equation :
$2 \mathrm{NaOH}+\mathrm{CuSO}_{4} \rightarrow \mathrm{Na}_{2} \mathrm{SO}_{4}+\mathrm{Cu}(\mathrm{OH})_{2} \downarrow$
What mass of copper hydroxide is precipitated using 200 gm of sodium hydroxide. $[\mathrm{H}=1, \mathrm{O}=16, \mathrm{Na}=23, \mathrm{~S}=32, \mathrm{Cu}=64]$

## - View Text Solution

