TENDER HEART HIGH SCHOOL, SEC-33B, CHD

CLASS - X SUBJECT - CHEMISTRY

CHAPTER - 5 TEACHER - MOHINISHA THAKUR

Good morning to all the students!

Students this lesson is for class-X for the subject of chemistry, Topic - 'Relative Atomic Mass' which is covered in chapter-5 'Mole concept and Stoichiometry' starting on page no -76 of your text book titled - 'consise chemistry' by 'Selina Publication' and is being submitted to you on 10th April, 2023.

All students may now please open page no. -76 of your notebook in front of you.

If all students are ready then let us start with this chapter. All students may now please listen carefully.

Relative Atomic Mass :-

Relative atomic mass or Atomic weight of an element is the number of times one atom of the element is heavier than 1/12 times of the mass of an atom of carbon-12. Atomic mass is expressed in atomic mass unit (a m u)

(P.T.O)

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Relative Molecular Mass:-

The relative molecular mass is obtained by adding together the relative atomic masses of all the atoms present in a molecule.

Example:- Let us find the molecular mass of

(i) $(NH_4)_2Cr_2O_7$ [N=14, H=1, Cr=52, O=16]

$14\times2 + 1\times8 + 52\times2 + 16\times7 = 252$

(ii) CH_3COONa [C=12, H=1, O=16, Na=23]

$12 + 1\times3 + 12 + 16 + 16 + 23 = 82$

Gram Atomic Mass:-

The atomic mass of an element when expressed in grams is called gram atomic mass.

The atomic mass of sodium is 23 amu, i.e. its gram atomic mass is 23g

1gm atom of sodium = 23g of sodium

Gram Molecular Mass:-

The molecular mass of a substance expressed in grams is called gram molecular mass.

MOLE:-

If I say one dozen banana. you know that means 12 bananas. A gross means a collection of 144 objects, in the same way one mole means 6.02×10^{23} particles.

(P.T.O)

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Atoms are very tiny particles therefore we use mole for them. We generally use mole for atoms and molecules. 6.022×10^{23} is called as Avogadro's number.

IMPORTANT RELATIONS

1 mole oxygen atoms $= 6.022 \times 10^{23}$ atoms [O]
1 mole oxygen molecules $= 6.022 \times 10^{23}$ molecules [O_2]
1 mole water $= 6.022 \times 10^{23}$ H_2O molecules
1 mole Ammonia $= 6.022 \times 10^{23}$ NH_3 molecules
[So mole can be used for atoms and molecules]
One mole atom $= 6.022 \times 10^{23}$ atoms = Gram Atomic mass

∴ 1 mole oxygen atoms $= 6.02 \times 10^{23}$ oxygen atoms = 16 g
1 mole nitrogen atoms $= 6.02 \times 10^{23}$ nitrogen atoms = 14 g

One mole molecules $= 6.02 \times 10^{23}$ molecules = Gram Molecular mass (G.M.M)

∴ 1 mole oxygen molecules $= 6.02 \times 10^{23}$ molecules of oxygen = 32 g ($16 \times 2 = O_2$)
1 mole water molecules $= 6.02 \times 10^{23}$ H_2O molecules
$= 1 \times 2 + 16 = 18$ g
2 moles of water $= 2 \times 6.02 \times 10^{23}$ molecules of H_2O
$= 2 \times 18 = 36$ g

If the substance is a gas then —
1 mole = 22.4 litre at S.T.P
So,
1 mole $= 6.02 \times 10^{23}$ molecules = G.M.M = 22.4 L at S.T.P (P.T.O)

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1 mole oxygen molecules (O_2) = 6.02×10^{23} molecules
= 32g = 22.4 L of volume at S.T.P
We can also say 22.4 L of O_2 gas = 1 mole = 32g
2 moles of O_2 = 32 x 2 = 64g = 2 x 22.4 = 44.8 L at S.T.P

Now we will start with numericals.

1) Find the number of molecules in 16g of oxygen gas.

- Oxygen gas contains O_2 molecules and mass of O_2 = 16 x 2 = 32g (G.M.M) [G.M.M = 1 mole = 6×10^{23} molecules]

∴ 32g = 6×10^{23} molecules
1g = $\frac{6 \times 10^{23}}{32}$ molecule [Using unitary method]
∴ 16g = $\frac{6 \times 10^{23}}{32} \times 16 = 3 \times 10^{23}$ molecules

Let us solve problems from Ex-5B

Q5:- Find the: [H=1, O=16, Cl = 35.5, Ca = 40, C=12, S=32]

a) Number of molecules in 73g of HCl
G.M.M or Molar mass of HCl = 1 + 35.5 = 36.5g
G.M.M = 36.5g of HCl = 1 mole = 6.02×10^{23} molecules
36.5g = 6×10^{23} molecules
∴ 1g = $\frac{6 \times 10^{23}}{36.5}$ molecules
∴ 73g = $\frac{6 \times 10^{23}}{36.5} \times 73^{2} = 12 \times 10^{23}$ molecules.

b) Weight of 0.5 mole of O_2
1 mole O_2 = Molar mass = 16 x 2 = 32g

(P.T.O)

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$\therefore$ 0.5 mole of $O_2 = 32 \times 0.5 = 16g$

c) number of molecules in 1.8 g of H_2O
Gr.M.M of $H_2O = 1 \times 2 + 16 = 18g$ = 1 mole = 6.02×10^{23} molecule
$18g = 6.02 \times 10^{23}$ molecules
$\therefore 1.8g = \frac{6.02 \times 10^{23}}{18} \times 1.8 = 6.02 \times 10^{22}$ molecules

d) number of moles in 10g of $CaCO_3$
Gr.M.M of $CaCO_3 = 40 + 12 + 16 \times 3 = 100g$
$100g$ $CaCO_3$ = 1 mole
$\therefore 10g\ CaCO_3 = \frac{1}{100} \times 10 = 0.1$ mole

e) Weight of 0.2 mole of H_2 gas
Gr.M.M of $H_2 = 1 \times 2 = 2g$ = 1 mole
$\therefore 0.2$ mole $= 2 \times 0.2 = 0.4g$

f) number of molecules in 3.2 g of SO_2
Gr.M.M of $SO_2 = 32 + 16 \times 2 = 64g$ = 1 mole
$64g$ = 1 mole = 6.02×10^{23} molecules
$\therefore 3.2g = \frac{6.02 \times 10^{23}}{64} \times 3.2 = 3.01 \times 10^{22}$ molecules

Q8:- Calculate the number of:
a) Particles in 0.1 mole of any substance
1 mole = 6.02×10^{23} particles
$\therefore$ 0.1 mole = 6.02×10^{23} particles
b) Hydrogen atoms in 0.1 mole of H_2SO_4
One molecule of H_2SO_4 contains 2 atoms of hydrogen
Then 0.1 mole = 6.02×10^{22} molecules will contain
$= 2 \times 6.02 \times 10^{22} = 12.04 \times 10^{22}$ hydrogen atoms

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c) Molecules in One kg of $CaCl_2$
G.M.M of $CaCl_2$ = $40 + 35.5 \times 2 = 111g$
$111g = 1 \text{ mole} = 6.02 \times 10^{23}$ molecules
$\therefore$ 1Kg or 1000g $= \frac{6.02 \times 10^{23}}{111} \times 1000 = 5.4 \times 10^{24}$ molecules

Q9 b) How many grams of HCl are present in 0.1 mole; G.M.M of HCl = $1 + 35.5 = 36.5g = 1$ mole
$\therefore$ 0.1 mole $= 36.5 \times 0.1 = 3.65g$

Q10:- a) At STP 5.6 L of a gas = 12g
(GMM) Relative mol. mass of gas = ?
We know that G.M.M = 22.4 litres at STP
So, if 5.6L = 12g
$\therefore$ 22.4L $= \frac{12}{5.6} \times 22.4 = 48g$

$\therefore$ Molecular mass of the gas is 48g

b) Volume occupied by 2 moles of SO at STP
We know that 1 mole = 22.4 L, at STP
$\therefore$ 2 moles $= 2 \times 22.4 = 44.8$ L, at STP

Q11:- a) Calculate the number of moles of CO_2 which contains 800g of O_2
G.M.M of $CO_2 = 12 + 16 \times 2 = 44g = 1$ mole
1 mole of CO_2 contains 32g of O_2 or we can write 32g of O_2 is present in = 1 mole CO_2
$\therefore$ 8g of O_2 is present in $= \frac{1}{32} \times 8 = \frac{1}{4} = 0.25$ moles of CO_2

b) Methane in 0.80g of methane (CH_4)
G.M.M of $CH_4 = 12 + 4 = 16g = 1$ mole
$\therefore$ 0.80g $= \frac{1}{16} \times 0.80 = 0.05$ moles.

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Q12:- Calculate the mass of:

a) an atom of oxygen

1 mole atoms $= 6 \times 10^{23}$ atoms = Atomic mass of oxygen

6×10^{23} atoms = 16g, $\therefore$ 1 atom $= \frac{16}{6 \times 10^{23}} = 2.66 \times 10^{-23}$ g

b) an atom of hydrogen

1 mole atoms $= 6 \times 10^{23}$ atoms = Atomic mass of hydrogen

6×10^{23} atoms = 1g, $\therefore$ 1 atom $= \frac{1}{6 \times 10^{23}} = 1.6 \times 10^{-24}$ g

c) a molecule of NH_3

G.M.M of $NH_3 = 14 + 3 = 17$g

6×10^{23} molecules = 17

1 molecule $= \frac{17}{6 \times 10^{23}} = 2.8 \times 10^{-23}$ g

d) 10^{22} atoms of carbon

1 mole atoms $= 6 \times 10^{23}$ atoms = 12g

$\therefore 10^{22}$ atoms $= \frac{12}{6 \times 10^{23}} \times 10^{22} = 0.2$g

e) molecule of oxygen

1 mole $= 6 \times 10^{23}$ molecules $= 16 \times 2 = 32$g

$\therefore$ 1 molecule $= \frac{32}{6 \times 10^{23}} = 5.3 \times 10^{-23}$ g

f) 0.25 gram atom of calcium

1g atom of calcium = 40g

0.25g atom of calcium $= 40 \times 0.25 = 10$g

(P.T.O.)

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Students, now I will give you three a very short questions. You will get a three minutes break to write the answers.

The Questions are:-

Q1:- What is the Relative molecular mass of CH_3COONa?
Q2:- If substance is a gas then. - 1 mole = _____.
Q3:- 1 mole of atom = _____.

I hope you all have written the answers by now. Let us check the answers now.

Ans1:- 82 u
Ans2:- 22.4 litre at S.T.P
Ans3:- 6.022×10^{23} atoms.

Students, Now I am ending the lesson for today by giving 'Instructions' and 'Homework'.

INSTRUCTIONS:-

You all are required to read the lesson again and revise or practice the numericals which we have done today.

HOMEWORK:-

Do Q- 13, 14, 15, 16, 17, 18, 19, 20, 21 22, 23, 24, 25, 26, 27 from Exercise 5(B) given on page no 84