

**Grade 10 – Term 2 – Lesson 7 – Quantification of elements and compound**

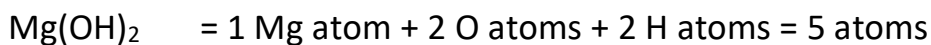
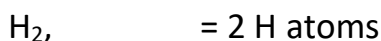
- 1) Mass of a  $^{12}\text{C}$  isotope =  $1.993 \times 10^{-23}\text{g}$
- 2) Atomic mass unit =  $\frac{1}{12}$ <sup>th</sup> of mass of  $^{12}\text{C}$  isotope
- 3) Atomic mass unit =  $\frac{1}{12} \times 1.993 \times 10^{-23}\text{g}$   
 $= 0.166 \times 10^{-23}\text{g}$
- 4) Relative atomic mass ( $A_r$ ) = (Mass of an atom) / (atomic mass unit)  
 $(A_r) = (\text{Mass of an atom}) / (\frac{1}{12}$ <sup>th</sup> of mass of  $^{12}\text{C}$  isotope)  
 $(A_r) = (\text{Mass of an atom}) / \frac{1}{12} \times 1.993 \times 10^{-23}\text{g}$   
 $(A_r) = (\text{Mass of an atom}) / 0.166 \times 10^{-23}\text{g}$
- 5) Mass of a calcium atom is  $6.64 \times 10^{-23}\text{g}$ . Mass of a  $^{12}\text{C}$  isotope is  $1.993 \times 10^{-23}\text{g}$ . Calculate the relative atomic mass ( $A_r$ ) of Calcium.

$$\begin{aligned}
 \text{Relative atomic mass } (A_r) &= (\text{Mass of an atom}) / (\text{Atomic mass unit}) \\
 &= (\text{Mass of an atom}) / (\frac{1}{12}$$
<sup>th</sup> of mass of  $^{12}\text{C}$  isotope)  
 &=  $(6.64 \times 10^{-23}\text{g}) / (\frac{1}{12} \times 1.993 \times 10^{-23}\text{g})$   
 &=  $(6.64 \times 10^{-23}\text{g}) / (0.166 \times 10^{-23}\text{g})$   
 &= 40
 \end{aligned}

- 6) Relative atomic mass of magnesium is 24. Atomic mass unit is  $0.166 \times 10^{-23}\text{g}$ . Find the mass of a magnesium atom.

$$\begin{aligned}
 (A_r) &= (\text{Mass of an atom}) / (\text{Atomic mass unit}) \\
 24 &= (\text{Mass of Mg atom}) / (\frac{1}{12}$$
<sup>th</sup> of mass of  $^{12}\text{C}$  isotope)  
 24 &= (\text{Mass of Mg atom}) / (\frac{1}{12} \times 1.993 \times 10^{-23}\text{g}) \\
 24 &= (\text{Mass of Mg atom}) / (0.166 \times 10^{-23}\text{g}) \\
 24 \times (0.166 \times 10^{-23}\text{g}) &= (\text{Mass of Mg atom}) \\
 3.984 \times 10^{-23}\text{g} &= (\text{Mass of Mg atom})
 \end{aligned}

7) Molecule is a substance having 2 or more atoms.



8) Relative molecular mass ( $M_r$ ) = (mass of a molecule) / (atomic mass unit)

$$(M_r) = (\text{mass of a molecule}) / (1/12^{\text{th}} \text{ of mass of } ^{12}\text{C isotope})$$

$$(M_r) = (\text{mass of a molecule}) / (1/12 \times 1.993 \times 10^{-23} \text{g})$$

$$(M_r) = (\text{mass of a molecule}) / (0.166 \times 10^{-23} \text{g})$$

9) Relative atomic mass ( $A_r$ ) of some elements

H=1	C=12	N=14	O=16	Na=23	Mg=24
Al=27	S=32	Cl=35.5	K=39	Ca=40	Cu=63.5

10) Find the relative molecular mass ( $M_r$ ) of the following

(i) NaCl

$$23+35.5$$

$$58.5$$

(ii) H<sub>2</sub>O

$$(1 \times 2) + 16$$

$$2 + 16$$

$$18$$

(iii) Mg(OH)<sub>2</sub>

$$24 + (16 \times 2) + (1 \times 2)$$

$$24 + 32 + 2$$

$$58$$

- (iv)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$   
 $63.5 + 32 + (16 \times 4) + (1 \times 10) + (16 \times 5)$   
 $63.5 + 32 + 64 + 10 + 80$   
 249.5
- (v)  $\text{C}_6\text{H}_{12}\text{O}_6$  (180)
- (vi)  $(\text{NH}_4)_2\text{SO}_4$  (132)
- (vii)  $(\text{NH}_2)_2\text{CO}$  (60)
- (viii)  $\text{Fe}_2\text{O}_3$  (160)
- (ix)  $\text{CaCO}_3$  (100)
- (x)  $\text{NaOH}$  (40)
- 11) 1 pair = 2  
 1 dozen = 12  
 1 century = 100  
 1 millennium = 1000  
 1 mole =  $6.022 \times 10^{23}$
- 12) No. of H atoms in 1  $\text{H}_2\text{O}$  molecule = 2  
 No. of H atoms in 1 dozen of  $\text{H}_2\text{O}$  molecules = 2dozen  
 No. of H atoms in 1mol of  $\text{H}_2\text{O}$  molecules = 2mol  
 No. of H atoms in 4mol of  $\text{H}_2\text{O}$  molecules = 4 x 2mol  
 = 8mol  
 =  $8 \times 6.022 \times 10^{23}$
- 13) Molar mass = mass of 1 mole of substance
- 14) Molar mass is measured in  $\text{gmol}^{-1}$  (grams per mole)
- 15) Molar mass of atoms = mass of 1 mole of atoms  
 = Relative atomic mass in grams
- 16) Find the molar mass of Mg (Mg=24)  
 Relative atomic mass of Mg = 24  
 Molar mass of Mg =  $24 \text{ gmol}^{-1}$

- 17) Molar mass of molecules = mass of 1 mole of molecules  
 = Relative molecular mass in grams
- 18) Find the molar mass of  $\text{Mg(OH)}_2$  (H=1, O=16, Mg=24)  
 Relative molecular mass of  $\text{Mg(OH)}_2 = 24+(16 \times 2)+(1 \times 2)$   
 $= 24+32+2$   
 $= 58$   
 Molar mass of  $\text{Mg(OH)}_2 = 58 \text{ gmol}^{-1}$
- 19)  $n = m / M$
- n=number of substances in moles (mol)
  - m=mass of the substance in grams (g)
  - M=molar mass in grams per mole ( $\text{gmol}^{-1}$ )
- 20) Find the mass of 2.5mol of Ca (Ca=40)  
 Relative atomic mass ( $A_r$ ) of Ca = 40  
 Molar mass of Ca =  $40 \text{ gmol}^{-1}$   
 $n=m/M$   
 $2.5 \text{ mol} = m / 40 \text{ gmol}^{-1}$   
 $2.5 \text{ mol} \times 40 \text{ gmol}^{-1} = m$   
 $100 \text{ g} = m$   
 Mass of 2.5mol of Ca = 100g
- 21) Find the number of  $\text{H}_2\text{O}$  molecules in 27g (H=1, O=16)  
 Relative molecular mass ( $M_r$ ) of  $\text{H}_2\text{O} = 18$   
 Molar mass of  $\text{H}_2\text{O} = 18 \text{ gmol}^{-1}$   
 $n=m/M$   
 $n=27 \text{ g} / 18 \text{ gmol}^{-1}$   
 $n=1.5 \text{ mol}$   
 $n=1.5 \times 6.022 \times 10^{23}$   
 Number of  $\text{H}_2\text{O}$  molecules in 27g =  $1.5 \times 6.022 \times 10^{23}$

- 22) Find the number of O atoms in 25g of  $\text{CaCO}_3$  (C=12, O=16, Ca=40)  
 Relative molecular mass ( $M_r$ ) of  $\text{CaCO}_3$  = 100  
 Therefore the molar mass of  $\text{CaCO}_3$  =  $100\text{g mol}^{-1}$   
 $n = m/M$   
 $n = 25\text{g}/100\text{g mol}^{-1}$   
 $n = 1/4\text{mol}$   
 $n = 0.25\text{mol}$   
 Number of  $\text{CaCO}_3$  molecules in 25g = 0.25mol  
  
 No. of O atoms in 1  $\text{CaCO}_3$  molecules = 3  
 No. of O atoms in 1mol of  $\text{CaCO}_3$  molecules = 3mol  
 No. of O atoms in 0.25mol of  $\text{CaCO}_3$  molecules =  $0.25 \times 3\text{mol}$   
 = 0.75mol  
 =  $0.75 \times 6.022 \times 10^{23}$
- 23) Find the mass of 0.25mol of  $\text{C}_6\text{H}_{12}\text{O}_6$  (H=1, C=12, O=16)
- 24) Find the number of  $(\text{NH}_4)_2\text{SO}_4$  molecules in 26.4g  
 (H=1, N=14, O=16, S=32)
- 25) Find the number of H atoms in 20g of  $(\text{NH}_2)_2\text{CO}$   
 (H=1, C=12, N=14, O=16)

### Assessment on Lesson 7

- The mass of a Ca atom is  $6.64 \times 10^{-23}\text{g}$ .  
 The mass of a  $^{12}\text{C}$  isotope is  $1.993 \times 10^{-23}\text{g}$   
 Find the relative atomic mass ( $A_r$ ) of Ca (40)
  
- Relative atomic mass ( $A_r$ ) of S is 32  
 The atomic mass unit is  $0.166 \times 10^{-23}\text{g}$   
 Find the mass of a S atom ( $5.312 \times 10^{-23}\text{g}$ )

3. Find the total number of atoms in

(i)	H <sub>2</sub>	(2)
(ii)	NH <sub>3</sub>	(4)
(iii)	SO <sub>2</sub>	(3)
(iv)	MgO	(2)
(v)	Na <sub>2</sub> O	(3)
(vi)	Ca(OH) <sub>2</sub>	(5)
(vii)	NH <sub>4</sub> OH	(7)
(viii)	Ca(HCO <sub>3</sub> ) <sub>2</sub>	(11)
(ix)	MgCl <sub>2</sub>	(3)
(x)	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	(17)

4. Find the relative molecular mass (M<sub>r</sub>) of

(xi)	H <sub>2</sub>	(2)
(xii)	NH <sub>3</sub>	(17)
(xiii)	SO <sub>2</sub>	(64)
(xiv)	MgO	(40)
(xv)	Na <sub>2</sub> O	(62)
(xvi)	Ca(OH) <sub>2</sub>	(74)
(xvii)	NH <sub>4</sub> OH	(35)
(xviii)	Ca(HCO <sub>3</sub> ) <sub>2</sub>	(162)
(xix)	MgCl <sub>2</sub>	(95)
(xx)	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	(342)

5. Find the molar mass of the following

(i)	C	(12g mol <sup>-1</sup> )
(ii)	Al	(27g mol <sup>-1</sup> )
(iii)	S	(32 g mol <sup>-1</sup> )
(iv)	Cu	(63.5g mol <sup>-1</sup> )
(v)	Na	(23g mol <sup>-1</sup> )
(vi)	H <sub>2</sub>	(2 g mol <sup>-1</sup> )
(vii)	NH <sub>3</sub>	(17g mol <sup>-1</sup> )

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(viii) SO <sub>2</sub>	(64 gmol <sup>-1</sup> )
(ix) MgO	(40gmol <sup>-1</sup> )
(x) Na <sub>2</sub> O	(62gmol <sup>-1</sup> )
(xi) Ca(OH) <sub>2</sub>	(74gmol <sup>-1</sup> )
(xii) NH <sub>4</sub> OH	(35gmol <sup>-1</sup> )
(xiii) Ca(HCO <sub>3</sub> ) <sub>2</sub>	(162gmol <sup>-1</sup> )
(xiv) MgCl <sub>2</sub>	(95gmol <sup>-1</sup> )
(xv) Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	(342gmol <sup>-1</sup> )
6. Find the mass of 0.25mol of NaOH	(10g)
7. Find the mass of 0.5mol of (NH <sub>2</sub> ) <sub>2</sub> CO	(30g)
8. Find the number of NH <sub>3</sub> molecules in 68g	(4x6.022x10 <sup>23</sup> )
9. Find the number of CO <sub>2</sub> molecules in 110g	(2.5x6.022x10 <sup>23</sup> )
10. Find the number of Cl atoms in 38g of MgCl <sub>2</sub>	(0.8x6.022x10 <sup>23</sup> )
11. Find the total number of atoms in 68.4g of Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	(3.4x6.022x10 <sup>23</sup> )
12. Find the total number of atoms in 10g of NaOH	(0.75x6.022x10 <sup>23</sup> )