MOLE QUANTITY
GENERAL ⇒ SPECIFIC

1. If you are given 128.0 grams of sulphur dioxide gas:

   (a) How many moles is this?

   (b) How many molecules will there be in this much SO_2?

   (c) How many sulphur atoms would be required to make this much SO_2?

   (d) How many grams of sulphur would there be in this much SO_2?

   (e) How many oxygen atoms would be needed to make this much SO_2?

   (f) How many molecules of oxygen gas could you make from the amount of atoms in part (e) ?

2. If you are given 3.600 moles of calcium hydroxide ($Ca(OH)_2$) :

(a) How many moles of hydrogen atoms would be required to make this much $Ca(OH)_2$?

(b) How many grams of hydrogen atoms would be present in this much $Ca(OH)_2$?

(c) How many grams of oxygen atoms would be present in this much $Ca(OH)_2$?

(d) How many grams of calcium atoms would be present in this much $Ca(OH)_2$?

MOLE QUANTITY
GENERAL ⇒ SPECIFIC

1. If you are given 128.0 grams of sulphur dioxide gas:

(a) How many moles is this?

$n(SO_2) = \frac{m}{M} = \frac{128}{64} = 2 \text{ mols}$

$SO_2 = 32 + (16 \times 2)$

(b) How many molecules will there be in this much SO_2?

$2 \text{ mols} \times 6.02 \times 10^{23} = 1.20 \times 10^{24}$

(c) How many sulphur atoms would be required to make this much SO_2?

$n(SO_2) = n(S)$

1.20×10^{24}

(d) How many grams of sulphur would there be in this much SO_2?

$n(SO_2) = n(S)$

$n(S) = \frac{m}{M} \qquad 2 = \frac{m}{32} = 64 \text{ g}$

(e) How many oxygen atoms would be needed to make this much SO_2?

$n(SO_2) \times 2 = n(O)$

$4 \text{ mols} \times 6.02 \times 10^{23} = 2.41 \times 10^{24}$

(f) How many molecules of oxygen gas could you make from the amount of atoms in part (e) ?

$2.41 \times 10^{24} \div 2 = 1.20 \times 10^{24}$

2. If you are given 3.600 moles of calcium hydroxide ($Ca(OH)_2$) :

(a) How many moles of hydrogen atoms would be required to make this much $Ca(OH)_2$?

$n(Ca(OH)_2) \times 2 = n(H)$

$3.6 \times 2 = 7.2$ moles.

(b) How many grams of hydrogen atoms would be present in this much $Ca(OH)_2$?

$n(H) = \frac{m}{M} = 7.2 = \frac{m}{1}$

$= 7.2g.$

(c) How many grams of oxygen atoms would be present in this much $Ca(OH)_2$?

$n(Ca(OH)_2) \times 2 = n(O)$

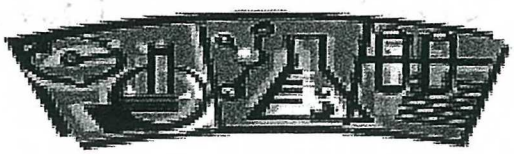
$n(O) = \frac{m}{M} = 7.2 = \frac{m}{16} = 115.2g.$

(d) How many grams of calcium atoms would be present in this much $Ca(OH)_2$?

$n(Ca(OH)_2) = n(Ca).$

$n(Ca) = 3.6 = \frac{m}{M} =$ 40.08

$= 144.29g.$



MOLE CONVERSION MISCELLANEOUS REVISION

1. What is the mass of –

   (a) Avogadro's Number of atoms of calcium?
   (b) 12.04×10^{23} molecules of hydrogen chloride?

2. How many atoms of iron are contained in –

   (a) 0.100 mole iron?
   (b) 3.00 moles iron (III) oxide?

3. Determine the number of moles of –

   (a) sulfur atoms
   (b) oxygen atoms

   in 0.200 mole of sulfur dioxide.

4. Find the number of moles of hydroxide ions in 0.250 mole magnesium hydroxide.

5. What is the mass of 1.00 mole nitrogen

   (a) molecules?
   (b) atoms?

6. Determine the mass of 1.00 mole copper (II) sulfate pentahydrate.

7. What is the mass of –

   (a) 0.200 mole of silver oxide?
   (b) 5 moles of sodium sulfide?

8. Calculate the number of moles of lead (II) chloride in 83.4g lead (II) chloride.

9. Find the number of moles of potassium in –

   (a) 0.100 mole of potassium hydrogensulfate.
   (b) 87.0g of potassium sulfate.

10. How many grams of carbon are contained in 2.50 moles calcium hydrogen-carbonate?

11. Determine –

    (a) the number of moles of nitrogen dioxide in 9.20g of nitrogen dioxide (NO_2).
    (b) the mass of nitrogen in 9.20g of nitrogen dioxide.

12. 1.20 moles of an organic compound has a mass of 84.0g. What is the molecular mass of this compound?

13. Calculate the mass of –

    (a) 1.50 moles of silver nitrate.
    (b) 0.500 mole of sodium carbonate.

14. Determine the number of moles of magnesium nitrate in 43.0g of magnesium nitrate.

15. What is the number of moles of sodium in 284g of sodium carbonate?

16. How many moles of oxygen atoms are contained in a 32.54g sample of zinc oxide?

17. Find the mass of chlorine atoms in

    (a) 1.50 moles of chlorine (Cl_2) gas.
    (b) 0.200 mole of sodium chloride.

18. Calculate the mass of nitrogen in 0.600 mole of ammonium sulfide.

19. Determine the number of moles of calcium in 29.6g of calcium hydroxide.

20. 0.800 mole of a compound has a mass of 51.2g. What is the molar mass of this compound?

Sols to Mole conversion.

1. a) Avogadro = 1 mole = 6.02×10^{23} atoms.
= 40.08 g

b) $\frac{12.04 \times 10^{23}}{6.02 \times 10^{23}}$ = 2 moles = $n(HCl) = \frac{m}{Mr}$

$2 = \frac{m}{36.45}$

mass of HCl = 72.9 g.

2. a) $n(Fe) = 0.1$ mols.
$0.1 \times 6.02 \times 10^{23} = 6.02 \times 10^{22}$ atoms

b) Fe_2O_3 iron III oxide.

$3 \times 6.02 \times 10^{23}$
but 2 iron in Fe_2O_3 $\times 2$
$= 3.61 \times 10^{24}$ atoms.

3. a) SO_2 so 0.20 mole = 0.20 mole of Sulfur

b) $0.20 \times 2 = 0.40$ mole of oxygen.

4. $Mg(OH)_2$ so $0.25 \times 2 = 0.5$ moles

5. a) N_2 = 28 g
b) N = 14 g

6. $CuSO_4 \cdot 5H_2O$.

Cu = 63.55
S = 32.07
O x 4 = 64
5 x H_2O = 90
= 249.62 g

7. a) $Ag_2O = (107.9 \times 2) + 16$
$= 231.8\ g\,mol^{-1}$

$n(Ag_2O) = \frac{m}{M}$ $\quad 0.2 = \frac{m}{231.8\ g\,mol^{-1}}$

$m(Ag_2O) = 46.36g.$

b) $Na_2S = (22.99 \times 2) + 32.07$
$= 78.05\ g\,mol^{-1}$

$n(Na_2S) = \frac{m}{Mr}$ $\quad 5 = \frac{m}{78.05}$

$m(Na_2S) = 390.25g$

8) $PbCl_2 = 207.2 + (35.45 \times 2)$
$= 278.10\ g\,mol^{-1}$

$n(PbCl_2) = \frac{m}{M}$ $\quad = \frac{83.4}{278.10}$

$n(PbCl_2) = 0.30\ mol$

9) a) $KHSO_4 = n(K) = 0.10\ mol$
b) $K_2SO_4 = (39.10 \times 2) + 32.07 + (4 \times 16)$
$= 174.27\ g\,mol^{-1}$

So $\frac{87}{174.27} = 0.50\ mol$

but $\times 2$ as $2K = 1.0\ mol.$

10) $Ca(HCO_3)_2 = 40 + (2 \times 1) + (2 \times 12) + (6 \times 16)$
$= 162\ g\,mol^{-1}$

$n(Ca(HCO_3)_2 \times 2 = n(C)$

So 5 mols of Carbon $n(C) = \frac{m}{M}$ $\quad 5 = \frac{m}{12} = 60g$ of C.

11. a) $M = NO_2 = 14 + (16 \times 2) = 46$

$n(NO_2) = \frac{m}{Mr} = \frac{9.20}{46} = 0.2 mol.$

b) $n(NO_2) = n(N)$

$n(N) = \frac{m}{Mr} \quad 0.2 = \frac{m}{14} \quad m(N) = 2.8g.$

12. $n = \frac{m}{Mr} \quad 1.2 = \frac{84}{Mr} = 70 g mol^{-1}$

13. a) $M = AgNO_3 = 107.86 + 14 + (16 \times 3)$
$= 169.86$

$n(AgNO_3) = \frac{m}{M} \quad 1.5 = \frac{m}{169.86} = 254.79g$

b) $M = Na_2CO_3 = (23 \times 2) + 12 + (16 \times 3)$
$= 106$

$n(Na_2CO_3) = \frac{m}{M} = 0.5 = \frac{m}{106} = 53g$

14. $M = Mg(NO_3)_2 = 24.30 + (14 \times 2) + (6 \times 16)$
$= 148.30$

$n(Mg(NO_3)_2 = \frac{m}{M} = \frac{43}{148.30} = 0.29 mol.$

15. $M = Na_2CO_3 = 106.$

$n(Na_2CO_3) = \frac{284}{106} = 2.68 mol \times 2$ as two Na
$= 5.36 mol$

16. $m = ZnO = 65.41 + 16 = 81.41$

$$n(ZnO) = \frac{m}{M_r} = \frac{32.54}{81.41} = 0.40\,mol$$

$$n(ZnO) = n(O) = 0.40\,mol$$

17. a) $$n(Cl_2) = \frac{m}{M} = 1.5 = \frac{m}{35.45} = 53.17g.$$

but 1 2 atom in Cl_2 $\times 2 = 106.75g.$

b) $$n(NaCl) = n(Cl)$$

$$n(Cl) = \frac{m}{M} = 0.2 = \frac{m}{35.45} = 7.09g$$

18. $(NH_4)_2S$ $n(NH_4)_2S \times 2 = n(N)$

$$n(N) = \frac{m}{M_r} \quad 1.2 = \frac{m}{14} = 16.8g.$$

19. $m = Ca(OH)_2 = 40.07 + (2\times16) + 2$
$= 74.07.$

$$n(Ca(OH)_2 = \frac{29.6}{74.07} = 0.40\,mol$$

$$n(Ca(OH)_2 = n(Ca) = 0.4\,mol$$

20. $$n = \frac{m}{M} = 0.8 = \frac{51.2}{m.}$$

$$m = \frac{51.2}{0.8} = 64\,g\,mol^{-1}$$