Week 6. Mrs Kennock copy

Moles – Reacting mass calculations

1) What mass of carbon dioxide is formed when 20 g of calcium carbonate reacts with hydrochloric acid?

$CaCO_3 + 2\,HCl \rightarrow CaCl_2 + H_2O + CO_2$ (3)

$\frac{20}{40.1 + 12 + 3(16)} = \frac{20}{100.1} = 0.1998$ mols. 1 : 1 $0.1998 \times (12 + 2(16)) = 0.1998 \times 44 = 8.8\,g$

2) What mass of oxygen reacts with 192 g of magnesium?

$2\,Mg + O_2 \rightarrow 2\,MgO$ (3)

$\frac{192}{24.3} = 7.903$ 2 : 1 ∴ mols O_2 = 3.95.

1 : 1/2

mass O_2 = 3.95 + 32 = 126.4 g.

3) What mass of carbon monoxide is needed to react with 1 kg of iron oxide?

$Fe_2O_3 + 3\,CO \rightarrow 2\,Fe + 3\,CO_2$ (3)

$\frac{1000}{2(55.8) + (16 \times 3)} = \frac{1000}{159.6} = 6.265$ 1 : 3

mols CO = 18.79

mass CO = 18.79699 × 28 = 526.32 g.

4) What mass of oxygen is needed to react with 184 g of sodium?

$4\,Na + O_2 \rightarrow 2\,Na_2O$ (3)

$\frac{184}{23} = 8$ mols Na 4 : 1

1 : 1/4

∴ mols O_2 = 2 mass = 2 × 32 = 64 g.

5) What mass of sodium carbonate is formed when 8.4 g of sodium hydrogencarbonate ($NaHCO_3$) is decomposed by heat?

$2\,NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$ (3)

$\frac{8.4}{23 + 1 + 12 + 3(16)} = \frac{8.4}{84} = 0.10$ mols. 2 : 1

1 : 1/2.

∴ mols of Na_2CO_3 = 0.05 mass = 0.05 × 106 = 5.3 g.

6) What mass of oxygen is needed to react with 4.5 g of ethane (C_2H_6)?

$2\,C_2H_6 + 7\,O_2 \rightarrow 4\,CO_2 + 6\,H_2O$ (3)

$\frac{4.5}{2(12) + 6} = \frac{4.5}{30} = 0.15$ 2 : 7

1 : 7/2

$0.525 \times 32 = 16.8\,g\ O_2$

0.15 : 0.525

7) What mass of ammonia is made when 5.6 g of nitrogen reacts with excess hydrogen?

$N_2 + 3\,H_2 \rightarrow 2\,NH_3$ (3)

$\frac{5.6}{28} = 0.2$. 1 : 3 2

0.2 : ~~0.6~~. 0.4

$0.4 \times (17) = 6.8g$.

8) What mass of sulphur dioxide is formed from 96 g of sulphur trioxide?

$2\,SO_3 \rightarrow 2\,SO_2 + O_2$ (3)

$\frac{96}{80.1} = 1.198$. 2 : 2. mass = 76.8g.

9) What mass of potassium oxide is formed when 9.75 g of potassium is burned in oxygen?

$4\,K + O_2 \rightarrow 2\,K_2O$ (3)

$\frac{9.75}{39.1} = 0.249$. ~~4 : 1~~ ~~1 : 1/4~~ 4 : 2, 2 : 1, 1 : 1/2

$K_2O = 0.1246$

$= 0.1246 \times (39.1 + 39.1 + 16)$

$= 11.74g$

10) What mass of hydrogen is formed when 0.2 g of calcium reacts with hydrochloric acid?

$Ca + 2\,HCl \rightarrow CaCl_2 + H_2$ (3)

$\frac{0.2}{40.1} = 0.0049$ Ca : H_2 1 : 1

mass $H_2 = 0.00498 \times 2 = 0.0099$ g

$= 0.01$ g.

11) What mass of sodium is needed to reduce 1 kg of titanium chloride?

$TiCl_4 + 4\,Na \rightarrow Ti + 4\,NaCl$ (3)

$\frac{1000}{47.9 + 4(35.5)} = \frac{1000}{189.9} = 5.266$ 1 : 4

5.266 : 21.06

$21.06 \times 23 = 484.46g$

12) What mass of carbon monoxide is needed to reduce 1 kg of iron oxide to iron?

$Fe_2O_3 + 3\,CO \rightarrow 2\,Fe + 3\,CO_2$ (3)

$\frac{1000}{189.9} = $ ~~6.265~~ 5.265 1 : 3

~~6.265~~ : ~~18.796~~

5.265 15.797.

15.797

~~18.796~~ $\times$ ~~3~~ (12+16)

$\times$ (28) = 522.3

AS Q 3

13) What mass of oxygen is needed to burn 110 g of propane (C_3H_8)?

$C_3H_8 + 5\,O_2 \rightarrow 3\,CO_2 + 5\,H_2O$ (3)

$\frac{110}{3(12)+8} = \frac{110}{44} = 2.5$ 1 : 5

2.5 : 12.5

$12.5 \times 32 = 400g$

14) 4.17 g of hydrated barium bromide crystals ($BaBr_2.nH_2O$) gave 3.72 g of anhydrous barium bromide on heating to constant mass. Work out the relative molecular mass (M_r) of the hydrated barium bromide and the value of *n*.

$BaBr_2.nH_2O \rightarrow BaBr_2 + n\,H_2O$ (3)

$BaBr_2$ H_2O

3.72 (4.17 − 3.72) = 0.45

n = 2 $BaBr_2.2H_2O$.

RMM 296.8 18.

No mols 0.0125 0.025

÷ Smallest 1 : 2