

# CH1011

# Tutorial 1 Answers

1. How many significant figures in the following numbers:

2.304e-6

0.0010

2.0010

4

2

5

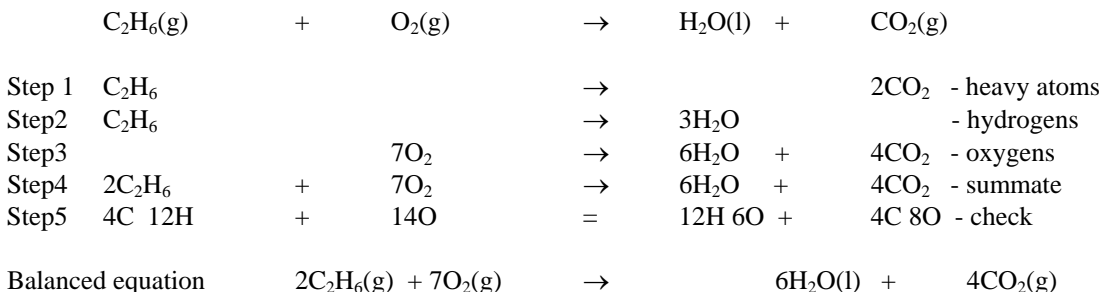
- remember that all digits to the RHS of the decimal point have been measured unless it is 0.xxxx in which case it is all digits to the RHS of the first non-zero digit that are significant.

2. What is the alkaline metal in the 3<sup>rd</sup> period and how many protons does it have?

Write down the atomic symbol for this element and include the atomic number.

Sodium. Na<sub>11</sub> this element has 11 protons

3. Balance the following equation:



4. The above equation is a combustion reaction between ethane and oxygen that is responsible for the formation of CO<sub>2</sub> which is one of the major green house gases. If 300 g of ethane were combusted in a reaction vessel with 900g of oxygen how much carbon dioxide would be formed in kilograms (kg)?

$$M_{C_2H_6} = (2 \times 12.0) + (6 \times 1.0) = 30.0 \text{ g mol}^{-1}$$

$$M_{O_2} = (2 \times 16.0) = 32.0 \text{ g mol}^{-1}$$

$$M_{CO_2} = (1 \times 12.0) + (2 \times 16.0) = 44.0 \text{ g mol}^{-1}$$

$$n_{C_2H_6} = 300 \text{ g} / 30.0 \text{ g mol}^{-1} = 10.0 \text{ mol}$$

$$n_{O_2} = 900 \text{ g} / 32.0 \text{ g mol}^{-1} = 28.1 \text{ mol}$$

For 100 mol of C<sub>2</sub>H<sub>6</sub> we would need (7/2 x 10.0) mol of O<sub>2</sub> which is 35 mol of O<sub>2</sub>.

As we have 28.1 mol of O<sub>2</sub> available the **limiting reagent is oxygen**.

What has been done here is to convert the reaction stoichiometry by dividing all the stoichiometric coefficients by the coefficient of the reactant we are looking at, here 2 for C<sub>2</sub>H<sub>6</sub>, so that we have the reaction in terms of 1 mol of C<sub>2</sub>H<sub>6</sub>. Therefore if 1 mol of C<sub>2</sub>H<sub>6</sub> reacts with 7/2 mols of O<sub>2</sub> then 10.0mol will react with 7/2 x 10.0 mol of O<sub>2</sub> - this is the **ideal amount** predicted which must be compared with the actual amount we have (28.1 mol).

From 28.1 mol of O<sub>2</sub> we get (4/7 x 28.1) mol of CO<sub>2</sub> that is 16.1 mol of CO<sub>2</sub>

Here we have converted the reaction stoichiometry again, now by dividing the balanced equation through by 7, the coefficient of the limiting reagent, so that for 1 mol of O<sub>2</sub> we get 4/7 mol of CO<sub>2</sub>. Therefore if we have 28.1 mol of O<sub>2</sub> we get 4/7 mol of CO<sub>2</sub>.

$$m_{CO_2} = n_{CO_2} \times M_{CO_2} = 16.1 \text{ mol} \times 44.0 \text{ g mol}^{-1} = 707 \text{ g} = \mathbf{0.71 \text{ kg of carbon dioxide}}$$

$$707 \times 10^{-3} = 0.707 - \text{this is the conversion g to kg}$$

The significant figures are based on H 1.0 (2 sig. fig.)

5. Name the following compounds:

$\text{P}_4\text{O}_6$	$\text{V}_2\text{O}_5$	$\text{H}_2\text{SO}_3$
tetraphosphorous hexoxide	vanadium(V) oxide	sulphurous acid