WORKSHEET 1

PHOTOSYNTHESIS AND ENERGY SOURCES

Syllabus reference 8.5.1

1 Complete the following to check your understanding. Each blank space can be completed by a term or short phrase.

a All living things need _____ to function and grow. Plants get their energy from the _____ through a process called _____. Other organisms obtain their energy from the _____ they eat.

b Industrialised societies need energy for manufacturing, _____ (cars, trucks), domestic use and many other applications. The sources of most of this energy are the _____ fuels—coal, oil and _____. These fuels are substances that were formed by the action of high _____ and pressure upon decaying plant matter over _____ of years.

c The original source of the energy found in fossil fuels was the _____. Plants converted _____ from the air and water from the ground into _____ compounds such as glucose and starch through the process of photosynthesis. In this process the _____ in the leaves of the plants convert light energy into _____ energy. Because this process absorbs energy, it is called an _____ reaction. This energy may be stored in glucose and other carbohydrates.

d The carbohydrates formed are compounds of _____, hydrogen and oxygen. These compounds are the energy source for animals which release the stored chemical energy through the process of cellular _____.

e The amount of energy released during respiration per mole of glucose is _____ the amount of energy absorbed during photosynthesis. Carbohydrates are considered to be _____ energy compounds because when they react large amounts of energy are _____.

2 Write the chemical equation for photosynthesis.

_____

3 Consider the following statement:

'All sources of energy on Earth came originally from the sun.'

Decide whether you agree or disagree with the statement giving reasons for your decision.

4 Write the chemical equation for cellular respiration.

5 As cells use glucose in the process of cellular respiration to release the energy (2830 kJ.mol^{-1}), some of this energy is stored for later use by the cell. For each mole of glucose that is broken down, the cell converts 1178kJ for storage. Calculate the percentage of the energy released by one mole of glucose that is able to be stored.

6 The annual petrol consumption in Australia is around 16×10^9 litres. The average energy value of petrol is 34 200 kJ/L. Ethanol, which releases 1367 kJ energy per mole may be used as a fuel in motor vehicles.

$$CH_3CH_2OH(l) + 3O_2 \rightarrow CO_2(g) + 3H_2O(l)$$

Australia has 26 million hectares of undeveloped land suitable for growing 'energy crops'. It has been estimated that such crops could produce grain sugar and cassava equivalent to 22 million tonnes of sucrose, and ethanol may be produced by the fermentation of sucrose.

$$C_{12}H_{22}O_{11}(aq) + H_2O(l) \xrightarrow{\text{yeasts}} 2C_6H_{12}O_6(aq)$$

$$C_6H_{12}O_6(l) \rightarrow 2CH_3CH_2OH(aq) + 2CO_2(g)$$

a Assuming a 90% yield of ethanol from sucrose, what percentage of the country's petrol consumption could be saved by the use of this ethanol?

b List any further assumptions you have made.