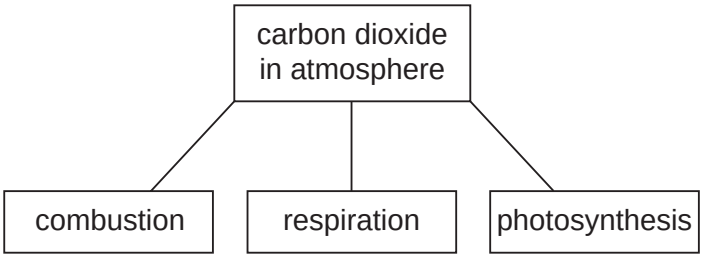
1 The diagram shows some of the processes which determine the percentage of carbon dioxide in the atmosphere.



(a) Explain how the following two processes alter the percentage of carbon dioxide in the atmosphere.

(i) combustion

.....

.....

..... [3]

(ii) respiration

.....

.....

..... [3]

(b) Photosynthesis reduces the percentage of carbon dioxide in the atmosphere.

(i) Complete the word equation for photosynthesis.

carbon dioxide + water → ..... + ... [2]

(ii) State **two** essential conditions for the above reaction to occur.

.....

..... [2]

[Total: 10]

2 Two important greenhouse gases are methane and carbon dioxide.

(a) Methane is twenty times more effective as a greenhouse gas than carbon dioxide. The methane in the atmosphere comes from both natural and industrial sources.

(i) Describe **two** natural sources of methane.

.....

..... [2]

(ii) Although methane can persist in the atmosphere for up to 15 years, it is eventually removed by oxidation.
What are the products of this oxidation?

..... [2]

(b) How do the processes of respiration, combustion and photosynthesis determine the percentage of carbon dioxide in the atmosphere?

.....

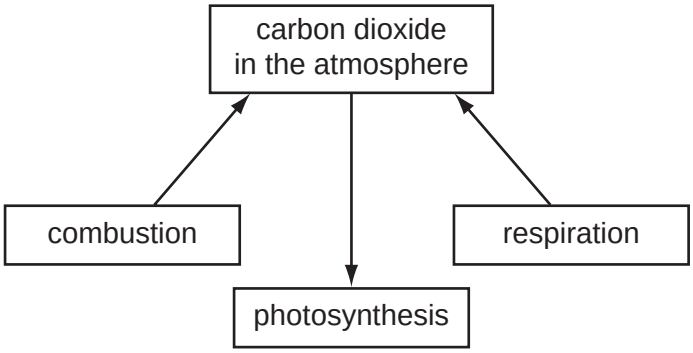
.....

.....

..... [4]

[Total: 8]

3 The diagram shows part of the carbon cycle. This includes some of the processes which determine the percentage of carbon dioxide in the atmosphere.



(i) Carbon dioxide is one greenhouse gas. Name another one.

..... [1]

(ii) Explain the term *respiration* and how this process increases the percentage of carbon dioxide in the atmosphere.

.....

.....

..... [3]

(iii) Explain why the combustion of waste crop material should not alter the percentage of carbon dioxide in the atmosphere.

.....

..... [2]

(iv) In 1960 the percentage of carbon dioxide in the atmosphere was 0.032% and in 2008 it was 0.038%. Suggest an explanation for this increase.

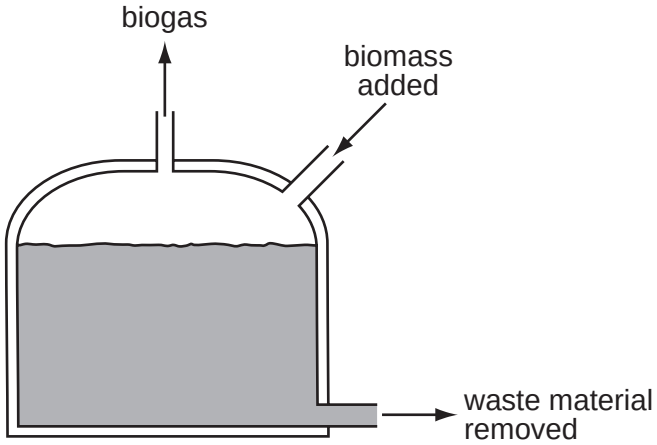
.....

..... [2]

[Total: 8]

4 In the absence of oxygen, certain bacteria decompose carbohydrates to biogas. This is a mixture of gases mainly methane and carbon dioxide.
Biogas is becoming an increasingly important fuel around the world.

A diagram of a simple biogas generator is given below. Typically, it contains biomass - animal manure, plant material etc.



(a) (i) What is meant by the term *carbohydrate*?

.....

..... [2]

(ii) The reaction in the generator is an example of anaerobic respiration.
Anaerobic means in the absence of oxygen. What does *respiration* mean?

.....

..... [2]

(iii) The generator must produce some carbon dioxide.
Why is it impossible for it to produce only a hydrocarbon such as methane?

..... [1]

(iv) Suggest a use for the nitrogen-rich solid removed from the generator.

..... [1]

(b) (i) In an experiment, a 60 cm^3 sample of biogas required 80 cm^3 of oxygen for the complete combustion of the methane in the sample.
Calculate the percentage of methane in the sample of biogas. Assume that biogas contains only methane and carbon dioxide.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

.....

.....

..... [2]

(ii) Carbon dioxide is acidic and methane is neutral.
Suggest another way of measuring the volume of methane in the sample.

.....

..... [2]

[Total: 10]