

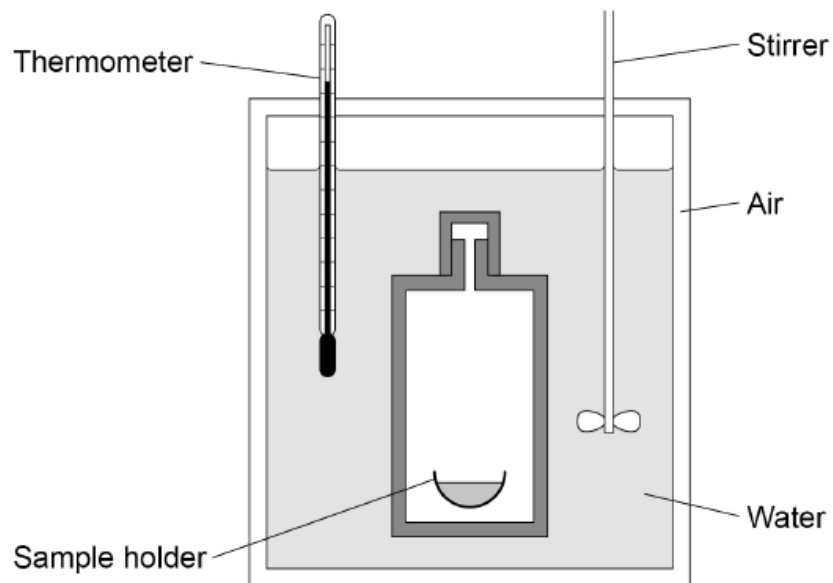
**AQA – Energy transfers in and between organisms – A2 Biology**

1. June/2020/Paper\_2/No.3

0 3

Figure 2 shows one type of calorimeter.

Figure 2



A calorimeter can be used to determine the chemical energy store of biomass. A known mass of biomass is fully combusted in a calorimeter. The heat energy released from this combustion increases the temperature of the water in the calorimeter. The increase in the temperature of a known volume of water is recorded.

0 3 . 1

Other than the thermometer, explain how **two** features of the calorimeter shown in **Figure 2** would enable a valid measurement of the total heat energy released.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

0 3 . 2 A 2 g sample of biomass was fully combusted in a calorimeter.

The volume of water in the calorimeter was  $100 \text{ cm}^3$

The increase in temperature recorded was  $15.7 \text{ }^\circ\text{C}$

$4.18 \text{ J}$  of energy are needed to increase the temperature of  $1 \text{ cm}^3$  of water by  $1 \text{ }^\circ\text{C}$

Use this information to calculate the heat energy released in  $\text{kJ per g}$  of biomass.

Show your working.

[2 marks]

Answer \_\_\_\_\_  $\text{kJg}^{-1}$

Plants and algae produce fuels called biofuels. Scientists have used *Chlorella* to produce biofuel. *Chlorella* is a genus of single-celled photosynthetic alga. *Chlorella* can be grown in open ponds and fermenters.

0 3 . 3 In natural ecosystems, most of the light falling on producers is **not** used in photosynthesis.

Suggest **two** reasons why.

[2 marks]

1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

0 3 . 4 The light absorbed by chlorophyll is used in the light-dependent reaction.

Name the **two** products of the light-dependent reaction that are required for the light-independent reaction.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_

0 3 . 5 *Chlorella* cells can divide rapidly. A culture of 2000 *Chlorella* cells was set up in a fermenter. The cells divided every 90 minutes.

You can assume that there were no limiting factors and that no cells died during the 24 hours.

Calculate the number of cells in the culture after 24 hours.

Give your answer in standard form.

Show your working.

[2 marks]

Answer \_\_\_\_\_

## 2. June/2020/Paper\_2/No.7

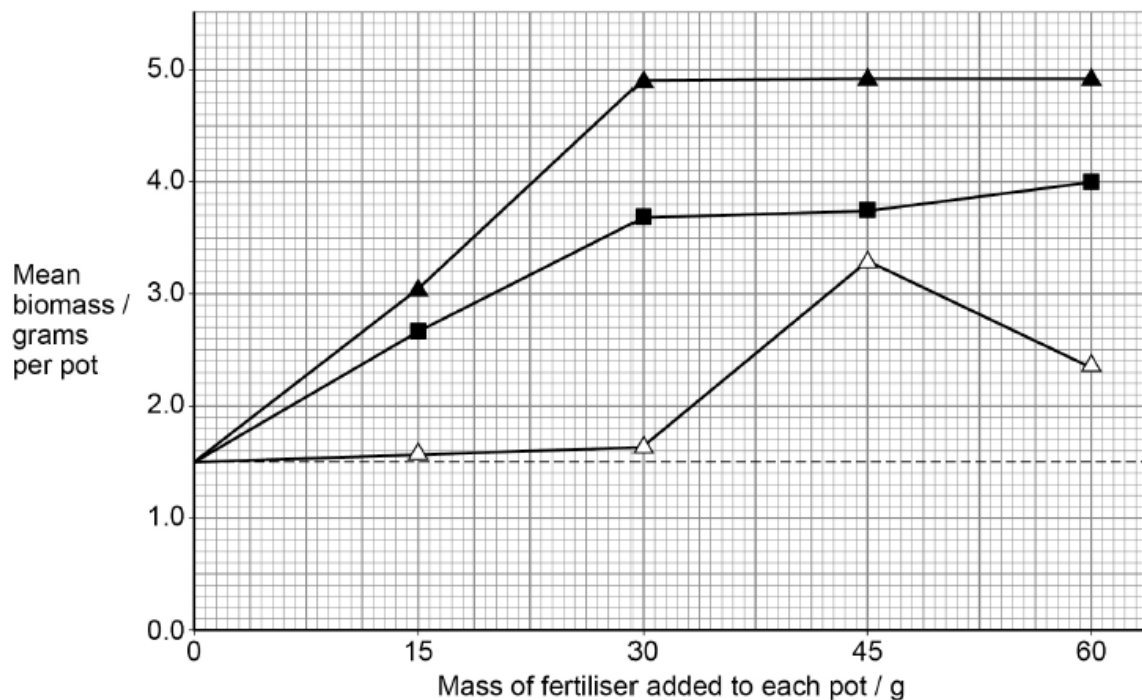
07

A scientist investigated the effects of different fertilisers on the growth of spinach plants. The scientist:

- set up a large sample of identical pots of soil
- added different masses of different fertilisers to selected pots
- did not add fertiliser to the control pots
- planted the same number of young spinach plants in each pot
- after 20 days, determined the biomass of spinach plants in each pot.

The results the scientist obtained after 20 days are shown in **Figure 4**.

**Figure 4**



**Key**

- ▲—▲ Potassium nitrate
- Ammonium sulfate
- △—△ Chicken manure
- Control – no fertiliser added

07.1

Calculate how many times greater the mean growth rate per day was using 37.5 g potassium nitrate than using 37.5 g ammonium sulfate.

Assume the mean biomass of the spinach plants at the start of the investigation was 0.5 g per pot.

[1 mark]

Answer \_\_\_\_\_



## 3. June/2020/Paper\_2/No.10

1 0

Read the following passage.

North American black bears can hibernate for up to 7 months without food or water. The bears survive using the fat stores in their bodies. The bears build up the fat stores during the summer. During hibernation, the heart rate of black bears decreases from a summer mean of 55 beats per minute to 14 beats per minute. Their metabolic rate falls by 75%. 5

In many mammals, 'uncoupling proteins' help to maintain a constant body temperature during hibernation. Uncoupling proteins are found in the inner mitochondrial membrane and act as proton channels during chemiosmosis. However, these proton channels do not generate ATP.

In the mountains of North America, when winter changes into spring, the coat colour of snowshoe hares changes from white to brown. Climatic changes have caused the snow to melt earlier. This has reduced the survival rate of snowshoe hares in these habitats. The change in coat colour occurs when new fur replaces old fur. This is called moulting. Recent research has shown that snowshoe hares within a population moult at different times. Moulting at different times could be a major factor in ensuring the survival of snowshoe hare populations. 10 15

Use the information in the passage and your own knowledge to answer the following questions.

1 0 . 1

Black bears can hibernate for up to 7 months without food or water (lines 1–2).

Suggest and explain how.

[3 marks]

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4. June/2019/Paper\_2/No.1

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|---|---|---|---|
| 0 | 1 | . | 1 |
|---|---|---|---|

 Succession occurs in natural ecosystems. Describe and explain how succession occurs.

**[4 marks]**

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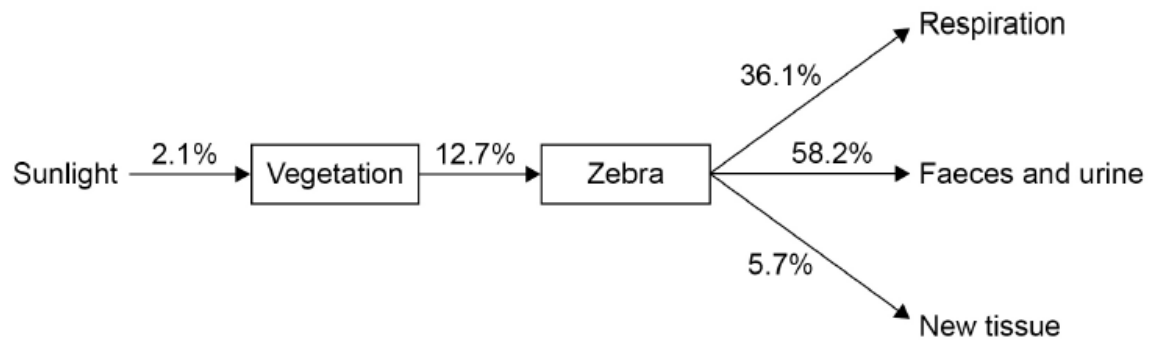
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**Figure 1** shows percentages of energy transferred from sunlight to a zebra in a grassland ecosystem.

**Figure 1**



- 0 1 . 2** Use **Figure 1** to calculate the percentage of sunlight energy that would be transferred into the faeces and urine of a zebra. Give your answer to 3 significant figures. [1 mark]

Answer = \_\_\_\_\_ %

- 0 1 . 3** In this ecosystem the net productivity of the vegetation is  $24\,525\text{ kJ m}^{-2}\text{ year}^{-1}$

Use this information and **Figure 1** to calculate the energy stored in new tissues of the zebra in  $\text{kJ m}^{-2}\text{ year}^{-1}$

[2 marks]

Answer = \_\_\_\_\_  $\text{kJ m}^{-2}\text{ year}^{-1}$

## 5. June/2019/Paper\_2/No.7

07.1

In photosynthesis, which chemicals are needed for the light-dependent reaction?  
Tick (✓) **one** box.

**[1 mark]**

Reduced NADP, ADP, Pi, water and oxygen.

NADP, ATP and water.

Reduced NADP, ATP, water and carbon dioxide.

NADP, ADP, Pi and water.

07.2

Describe what happens during photoionisation in the light-dependent reaction.

**[2 marks]**

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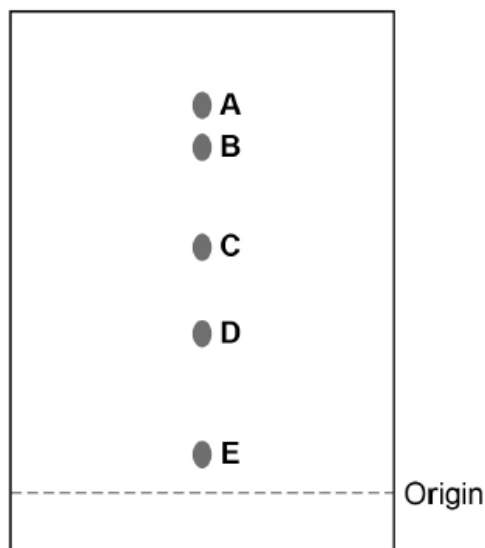
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A student obtained a solution of pigments from the leaves of a plant. Then the student used paper chromatography to separate the pigments.

Figure 5 shows the chromatogram produced.

Figure 5



0 7 . 3

Explain why the student marked the origin using a pencil rather than using ink.

[1 mark]

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0 7 . 4

Describe the method the student used to separate the pigments after the solution of pigments had been applied to the origin.

[2 marks]

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- 07.5 Calculating the  $R_f$  values of the pigments can help to identify each pigment. An  $R_f$  value compares the distance the pigment has moved from the origin with the distance the solvent front has moved from the origin.

$$R_f = \frac{\text{distance pigment has moved from the origin}}{\text{distance solvent front has moved from the origin}}$$

The distance each pigment has moved is measured from the middle of each spot.

Pigment **A** has an  $R_f$  value of 0.95

Use **Figure 5** to calculate the  $R_f$  value of pigment **C**.

[1 mark]

$R_f$  value of pigment **C** = \_\_\_\_\_

- 07.6 The pigments in leaves are different colours. Suggest and explain the advantage of having different coloured pigments in leaves.

[1 mark]

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