

12.1 Energy

Question Paper

Course	CIEA Level Biology
Section	12. Energy & Respiration
Topic	12.1 Energy
Difficulty	Medium

Time allowed: 60
Score: /44
Percentage: /100

Question 1a

Desert ecosystems are very arid and few organisms can survive in these harsh conditions. Producers such as cacti and various species of grass form the foundation of most desert food webs. Cacti and grasses are consumed by the primary consumers, which in turn are eaten by the secondary consumers. Fig. 1 shows the flow of energy through a desert ecosystem. The figures in the circles represent the energy transfer in $\text{kJ m}^{-2} \text{ yr}^{-1}$.

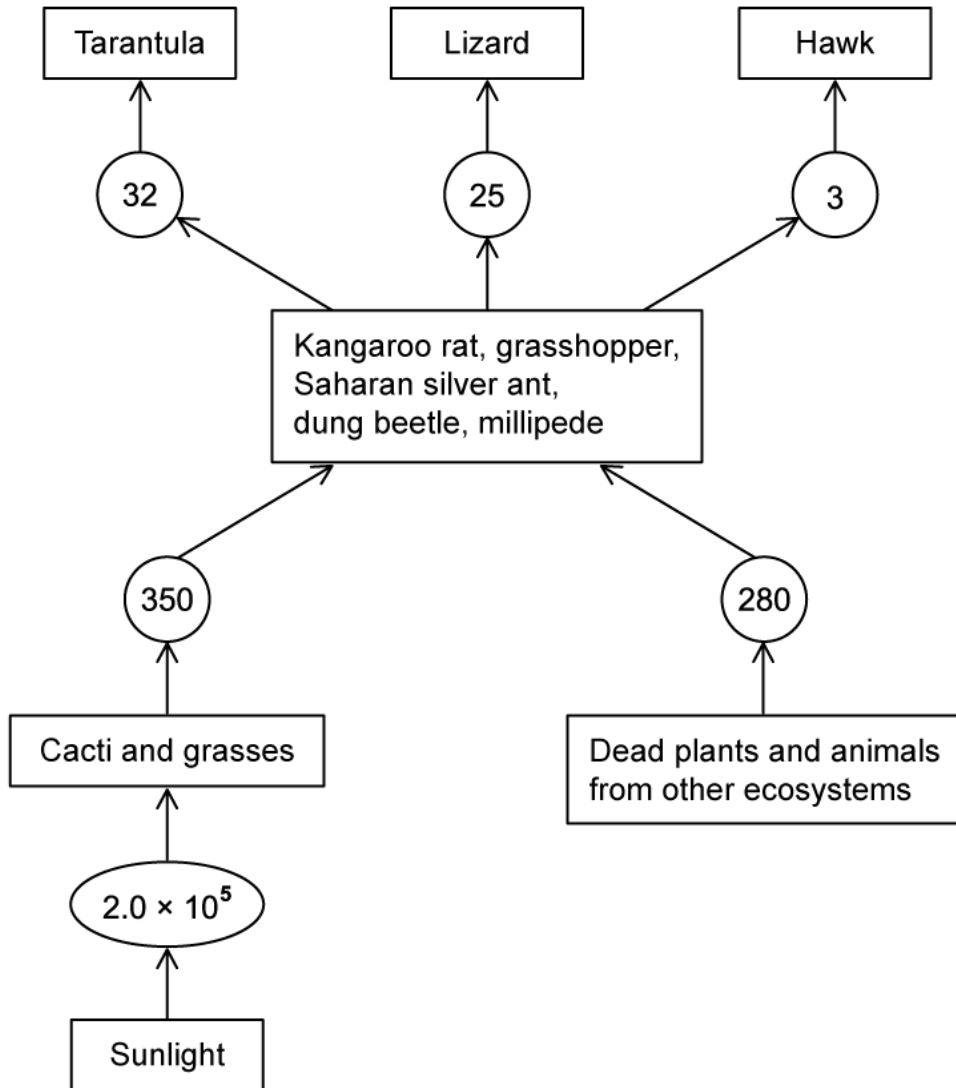


Fig. 1

Calculate the percentage energy transferred from the primary consumers to the secondary consumers in Fig. 1

Show your working and give your answer as a whole number.

[2 marks]

Question 1b

State the energy conversion occurring between the sun and the primary consumers in Fig. 1

[1 mark]

Question 1c

All living organisms require energy in order to perform the functions necessary for life.

Outline the need for energy in living organisms by using suitable examples.

[5 marks]

Question 1d

Photosynthesis and respiration are important processes occurring in living organisms.

Explain how the processes of photosynthesis and respiration assist in the transfer of energy between autotrophs and heterotrophs, with reference to Fig. 1

[3 marks]

Question 2a

Fig.1 shows the structure of a molecule of adenosine triphosphate (ATP).

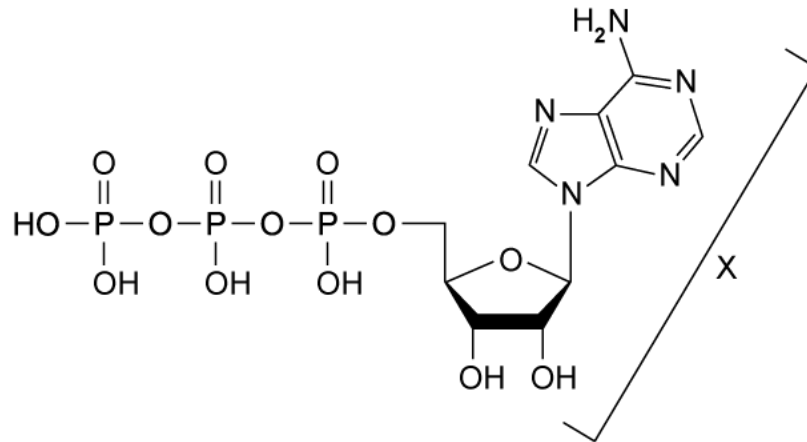


Fig. 1

Identify part **X** of the ATP molecule in Fig.1.

[1 mark]

Question 2b

ATP is described as a 'universal energy currency' for cells.

Explain why ATP can be considered to be a 'universal energy currency'.

[2 marks]

Question 2c

Discuss the main benefits of ATP as an energy currency in living organisms.

[4 marks]

Question 2d

ATP is broken down by a group of enzymes known as ATPases.

(i)

State the type of reaction that is catalysed by ATPases.

[1]

(ii)

Identify the products of the reaction mentioned in part (i).

[1]

[2 marks]

Question 3a

A student set up a respirometer, as illustrated in Fig. 1, to measure the rate of oxygen consumption during respiration in woodlice.

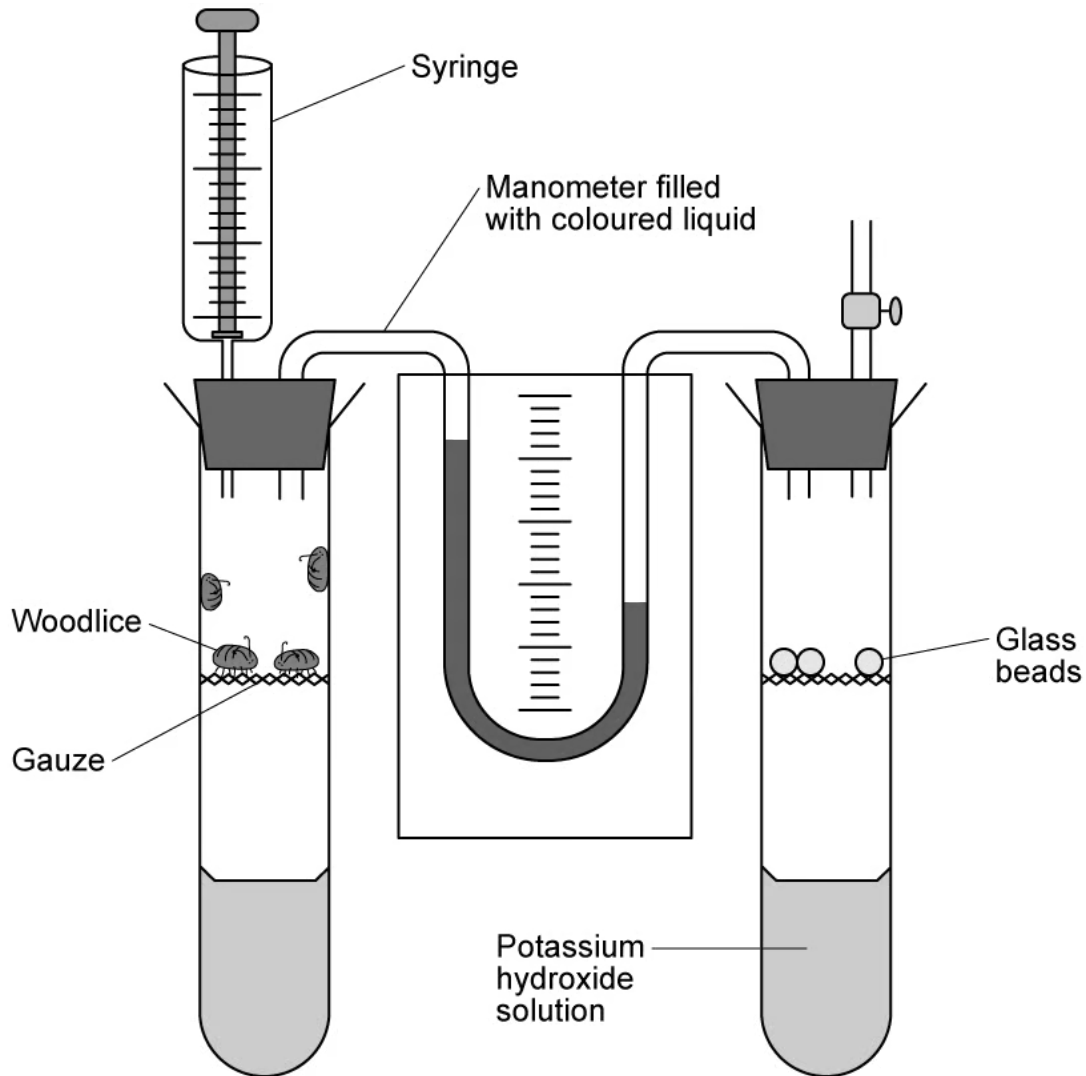


Fig. 1

From Fig. 1:

(i)
Identify the control in this experiment.

[1]

(ii)
State the purpose of the potassium hydroxide solution.

[1]

[2 marks]

Question 3b

The level of the coloured liquid was equal on both sides of the capillary u-tube of the manometer at the beginning of the experiment.

Explain the movement of the liquid in the capillary tube, as illustrated in Fig. 1.

[3 marks]

Question 3c

The student found that the coloured liquid in the capillary tube in Fig. 1 moved 20 mm over the course of an hour. The diameter of the capillary tube was 2 cm.

The volume of the capillary tube can be calculated by using the formula: $\pi r^2 h$, where h represents the distance moved by the manometer fluid in a minute.

Calculate the volume of oxygen consumed in $\text{cm}^3 \text{min}^{-1}$. Show your working.

[2 marks]

Question 3d

The student repeated the experiment from Fig.1, but removed the potassium hydroxide solution. The volume of gas was calculated again and these values were used to calculate the RQ value of the respiratory substrate of the woodlice.

The RQ value was 0.8.

Suggest what the student can deduce from this RQ value.

[2 marks]

Question 4a

Explain why carbohydrates, lipids and proteins have different relative energy values as substrates in respiration in aerobic conditions.

[6 marks]

Question 4b

Define the term respiratory quotient (RQ) **and** describe how you would carry out an investigation to determine the RQ of germinating barley seeds.

[9 marks]

