

Answer **all** questions in the spaces provided.

- 1 (a)** The table contains statements about three biological processes.

Complete the table with a tick if the statement in the first column is true, for each process.

	Photosynthesis	Anaerobic respiration	Aerobic respiration
ATP produced			
Occurs in organelles			
Electron transport chain involved			

(3 marks)

- 1 (b)** Write a simple equation to show how ATP is synthesised from ADP.

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(1 mark)

- 1 (c)** Give **two** ways in which the properties of ATP make it a suitable source of energy in biological processes.

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(2 marks)

- 1 (d)** Humans synthesise more than their body mass of ATP each day. Explain why it is necessary for them to synthesise such a large amount of ATP.

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(2 marks)

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- 2** Scientists measured the mean temperature in a field each month between March and October. The table shows their results.

Month	Mean temperature / °C
March	9
April	11
May	14
June	17
July	20
August	18
September	16
October	14

- 2 (a)** The gross productivity of the plants in the field was highest in July. Use the data in the table to explain why.

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(2 marks)

- 2 (b) (i)** Give the equation that links gross productivity and net productivity.

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(1 mark)

- 2 (b) (ii)** The net productivity of the plants in the field was higher in August than in July. Use the equation in part **(b)(i)** and your knowledge of photosynthesis and respiration to suggest why.

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(2 marks)

- 2 (c)** A horse was kept in the field from March to October. During the summer months, the horse was able to eat more than it needed to meet its minimum daily requirements.

Suggest how the horse used the extra nutrients absorbed.

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(1 mark)

- 2 (d)** The horse's mean energy expenditure was higher in March than it was in August. Use information in the table to suggest why.

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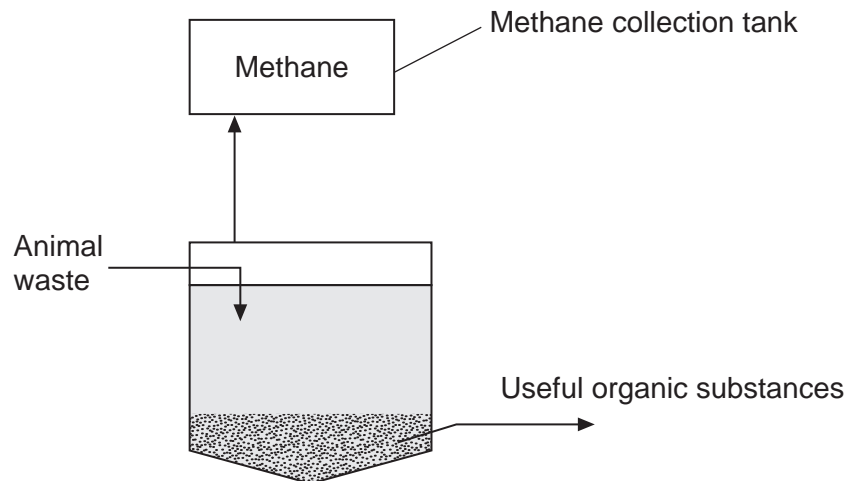
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- 3** Intensive rearing of livestock produces large quantities of waste. Some farmers use an anaerobic digester to get rid of the waste.

In an anaerobic digester, microorganisms break down the large, organic molecules in the waste. This produces methane, which is a useful fuel. It also produces organic substances that can be used as a natural fertiliser.

The diagram shows an anaerobic digester.



- 3 (a) (i)** Suggest **two** advantages of processing waste in anaerobic digesters rather than in open ponds.

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(2 marks)

- 3 (a) (ii)** The anaerobic digester has a cooling system, which is not shown in the diagram. Without this cooling system the digester would soon stop working. Explain why.

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(2 marks)

- 3 (b) (i)** The over-application of fertiliser increases the rate of leaching. Explain the consequences of leaching of fertiliser into ponds and lakes.

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(3 marks)

(Extra Space)

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- 3 (b) (ii)** Give **one** advantage of using natural fertiliser produced in the digester rather than an artificial fertiliser.

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(1 mark)

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ANSWER IN THE SPACES PROVIDED**

4 (a) Explain what is meant by birth rate.

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(1 mark)

4 (b) The table shows life expectancies for babies born in the United Kingdom and in the Sudan in 2009.

	United Kingdom	Sudan
Life expectancy males / years	76.5	50.5
Life expectancy females / years	81.6	52.4

4 (b) (i) Describe the patterns shown by these data.

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(2 marks)

4 (b) (ii) Suggest reasons for the differences in the life expectancy shown by these data.

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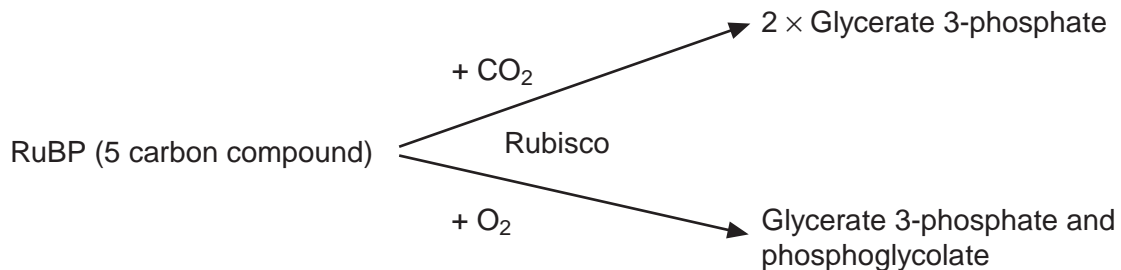
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(2 marks)

- 5** During photosynthesis, carbon dioxide reacts with ribulose biphosphate (RuBP) to form two molecules of glycerate 3-phosphate (GP). This reaction is catalysed by the enzyme Rubisco. Rubisco can also catalyse a reaction between RuBP and oxygen to form one molecule of GP and one molecule of phosphoglycolate. Both the reactions catalysed by Rubisco are shown in **Figure 1**.

Figure 1

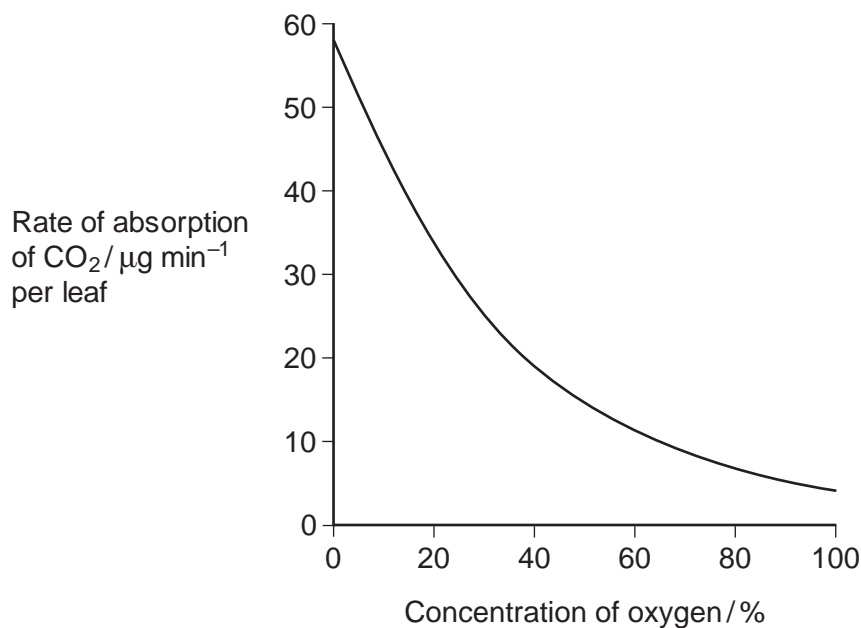
- 5 (a) (i)** Where exactly in a cell is the enzyme Rubisco found?

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- 5 (a) (ii)** Use the information provided to give the number of carbon atoms in **one** molecule of phosphoglycolate.

(1 mark)

- 5 (b)** Scientists investigated the effect of different concentrations of oxygen on the rate of absorption of carbon dioxide by leaves of soya bean plants. Their results are shown in **Figure 2**.

Figure 2

Use **Figure 1** to explain the results obtained in **Figure 2**.

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(2 marks)

5 (c)

Use the information provided and your knowledge of the light-independent reaction to explain why the yield from soya bean plants is decreased at higher concentrations of oxygen. Phosphoglycolate is not used in the light-independent reaction.

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(3 marks)

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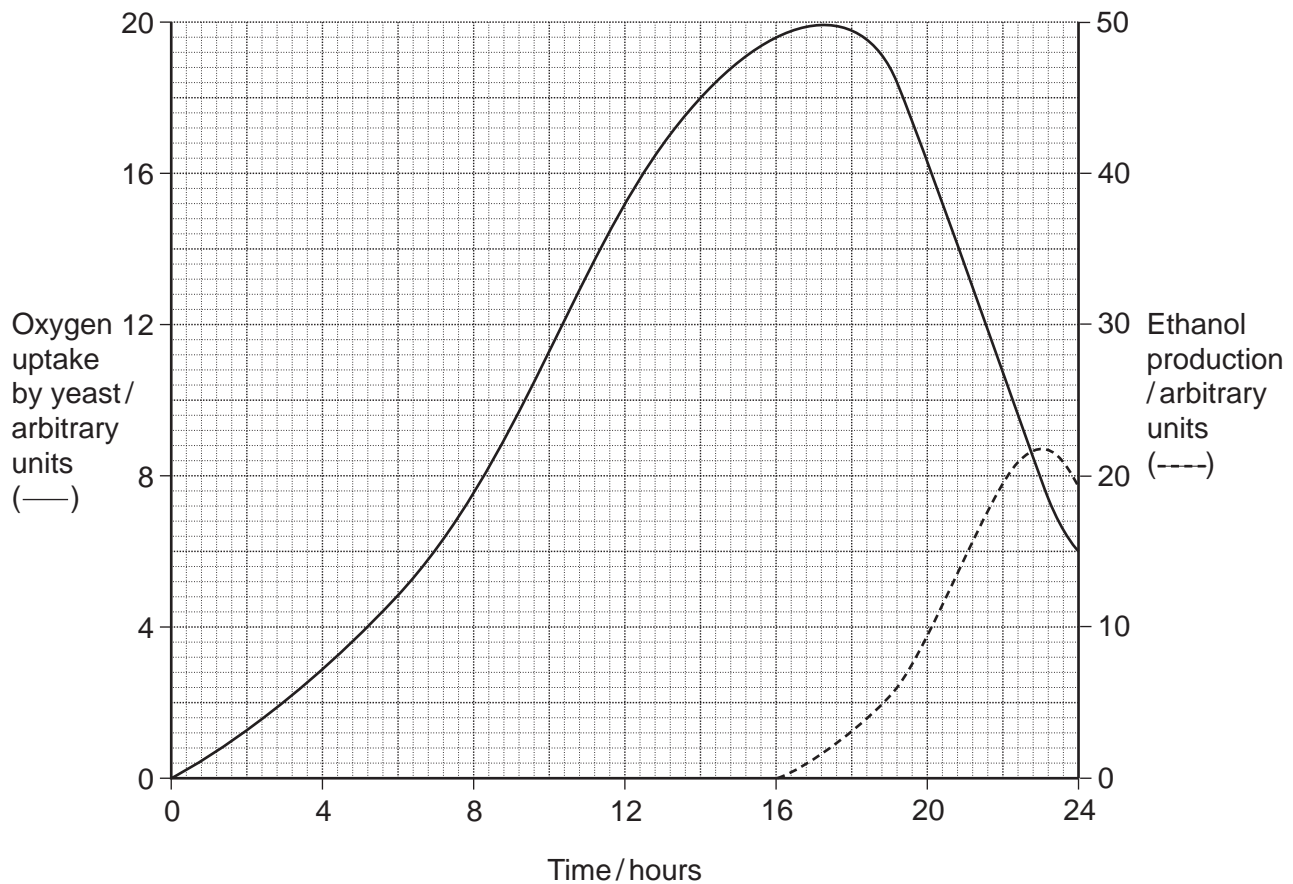
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- 6** Yeast is a single-celled organism. A student investigated respiration in a population of yeast growing in a sealed container. His results are shown in the graph.



- 6 (a)** Calculate the rate of oxygen uptake in arbitrary units per hour between 2 and 4 hours.

Answer arbitrary units per hour
(1 mark)

- 6 (b) (i)** Use the information provided to explain the changes in oxygen uptake during this investigation.

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(3 marks)

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- 6 (b) (ii)** Use the information provided to explain the changes in production of ethanol during this investigation.

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(2 marks)

- 6 (c)** Sodium azide is a substance that inhibits the electron transport chain in respiration. The student repeated the investigation but added sodium azide after 4 hours. Suggest and explain how the addition of sodium azide would affect oxygen uptake and the production of ethanol.

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(3 marks)

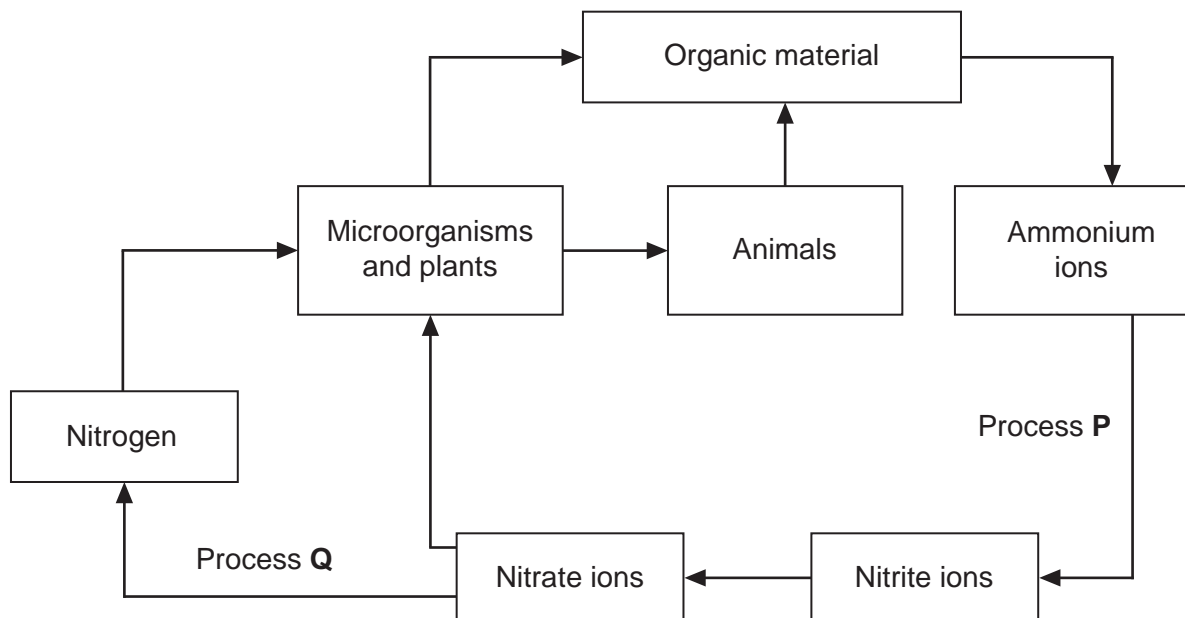
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Answer **all** questions in the spaces provided.

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The diagram shows the nitrogen cycle.



(a) (i) Name process P.

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(1 mark)

(a) (ii) Name process Q.

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(1 mark)

(b) Leguminous crop plants have nitrogen-fixing bacteria in nodules on their roots. On soils with a low concentration of nitrate ions, leguminous crops often grow better than other types of crop. Explain why.

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(2 marks)

- 7 (c)** Applying very high concentrations of fertiliser to the soil can reduce plant growth. Use your knowledge of water potential to explain why.

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(2 marks)

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