

1. How can the rate of photosynthesis of a plant be directly measured?
- A. By measuring the rate of oxygen produced
 - B. By measuring the rate of carbon dioxide produced
 - C. By measuring the rate of plant growth
 - D. By measuring the rate of light absorbed

(Total 1 mark)

2. Which process produces the most ATP per molecule of glucose?
- A. Anaerobic respiration in a yeast cell
 - B. Aerobic respiration in a bacterial cell
 - C. Glycolysis in a human liver cell
 - D. The formation of lactic acid in a human muscle cell

(Total 1 mark)

3. Which type of light is **least** useful for photosynthesis in terrestrial plants?
- A. Blue
 - B. Green
 - C. White
 - D. Red

(Total 1 mark)

4. What is the source of the oxygen released into the air as a product of photosynthesis?
- A. Chlorophyll
 - B. Carbon dioxide only
 - C. Water only
 - D. Both water and carbon dioxide

(Total 1 mark)

5. The rate of photosynthesis in the marine seagrass, *Zostera marina*, was investigated under a range of pH conditions. After a period of darkness, the plants were illuminated at a constant light intensity at 15°C and the rate of photosynthesis was measured. *Zostera marina* can use both dissolved carbon dioxide (CO₂) and hydrogen carbonate ions for photosynthesis. The rate of photosynthesis is plotted on the y-axis on the left. In addition, the concentration of carbon dioxide was measured for each pH investigated and is plotted on the y-axis on the right.

[Source: Plant physiology by AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS. Copyright 2008 Reproduced with permission of AMERICAN SOCIETY OF PLANT BIOLOGISTS in the format CD ROM via Copyright Clearance Center.]

- (a) State the carbon dioxide concentration at pH 7.2.

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(1)

(b) Calculate the percentage decrease in the rate of photosynthesis from pH 7 to pH 7.5.

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(1)

(c) Outline the relationship between pH and the rate of photosynthesis.

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(2)

(d) Suggest how *Zostera marina* can perform photosynthesis even at very low carbon dioxide concentrations.

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(1)

(e) Based on the information and data provided, discuss the role of **one** limiting factor, other than carbon dioxide, and suggest how this would affect the rate of photosynthesis.

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(2)

(Total 7 marks)

6. Which of the following is part of the process of cellular respiration?
- A. Changes in the volume of the thoracic cavity
 - B. Exchange of gases across the surface of the alveoli
 - C. Exchange of gases across the surface of capillaries
 - D. Glycolysis

(Total 1 mark)

7. (a) Draw a labelled diagram of a mitochondrion.

(3)

(b) Explain how the structure of a mitochondrion is adapted for its function.

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(2)
(Total 5 marks)

8. Investigators carried out experiments to find the relationship between the energy used by mice (the metabolic rate) and their activity. They found that the amount of time mice are active depends on the time of day, whether they are single or in groups and on the temperature of their surroundings. The bar chart below shows the percentage of time mice were active during three-hour periods at three different temperatures.

[Source: L E Mount and J V Willmott. 1967. *Journal of Physiology*. Vol 190. Pp 371–380. Published by Wiley-Blackwell. Used with permission]

- (a) Calculate how many minutes the group mice are active between 21:00 and 00:00 at 8 °C.

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(1)

- (b) Outline the relationship between activity and temperature from 21:00 to 03:00 in all of the mice.

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(1)

- (c) Animals which are active at night are nocturnal. Suggest **one** advantage for mice being nocturnal.

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(1)

The investigators also found that the metabolic rate of the mice changed at different times of the day. Mice were kept at one of the three constant temperatures for 24 hours and their oxygen consumption was measured. The graph below shows the results for single mice and the mean values for group mice.

[Source: L E Mount and J V Willmott. 1967. Journal of Physiology. Vol 190. Pp 371–380. Published by Wiley-Blackwell. Used with permission]

(d) State the relationship between temperature and metabolic rate.

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(1)

(e) Compare the results for the single mice at 15 °C with those for the group mice at 15 °C.

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(2)

(f) Suggest **one** reason why the results differ for single mice and group mice.

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(1)

(g) Explain why oxygen consumption is used as a measure of metabolic rate.

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(2)

- (h) Using the data from both graphs, evaluate the hypothesis that increased activity causes an increase in metabolic rate in mice.

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(2)
(Total 11 marks)