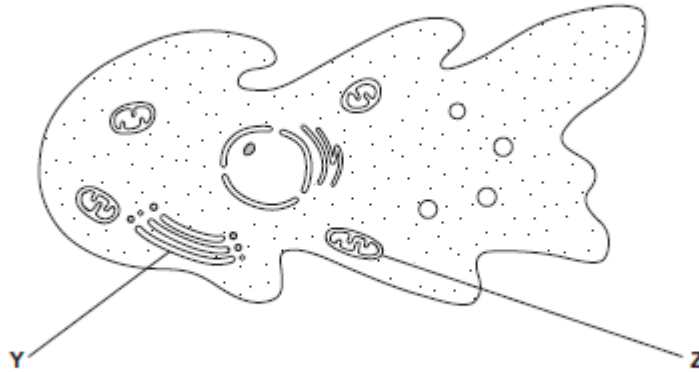


- 1 An amoeba is a single-celled, eukaryotic organism. Scientists used a transmission electron microscope to study an amoeba. The diagram shows its structure.



- 1 (a) (i) Name organelle Y.

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(1 mark)

- 1 (a) (ii) Name **two** other structures in the diagram which show that the amoeba is a eukaryotic cell.

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(2 marks)

- 1 (b) What is the function of organelle Z?

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(1 mark)

- 1 (c) The scientists used a transmission electron microscope to study the structure of the amoeba. Explain why.

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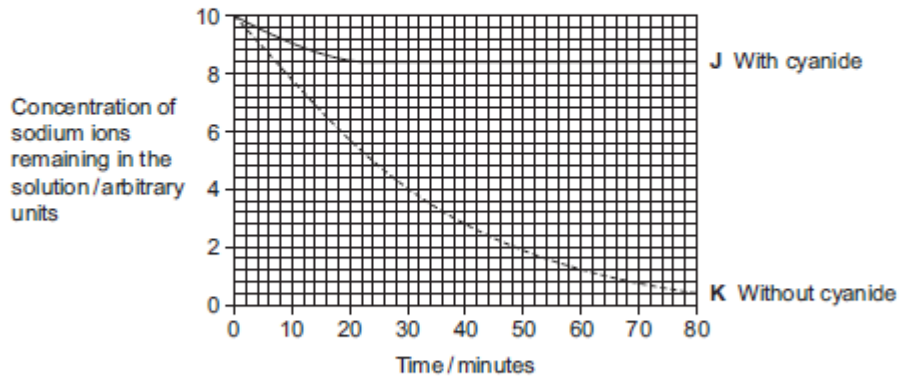
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(2 marks)

2 A scientist investigated the effect of cyanide on the uptake of sodium ions by animal tissue. He set up two beakers, **J** and **K**. He put equal volumes of a solution containing sodium ions and equal masses of an animal tissue in each beaker.

- He added cyanide to beaker **J**.
- He did not add cyanide to beaker **K**.

He measured the concentration of sodium ions remaining in the solution in each beaker, for 80 minutes. The graph shows his results.



- (a) Calculate the rate of uptake of sodium ions by the tissue in beaker **K** for the first 30 minutes. Show your working.

Answer arbitrary units per minute
(2 marks)

- (b) Adding cyanide affects the uptake of sodium ions by the tissue. Use the graph to describe how.

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(2 marks)

- (c) Cyanide is a substance which affects respiration.
Use information in the question to explain the effect of cyanide on the uptake of sodium ions by the tissue.

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(3 marks)

- 3 (a) What is a pathogen?

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(1 mark)

- (b) When a pathogen enters the body it may be destroyed by phagocytosis.
Describe how.

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(4 marks)

(Extra space)

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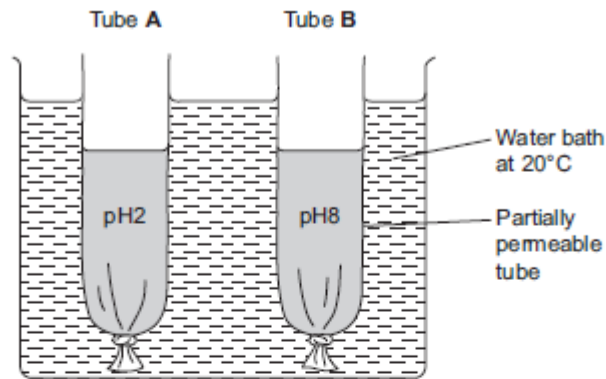
- (c) When a pathogen causes an infection, plasma cells secrete antibodies which destroy this pathogen.

Explain why these antibodies are only effective against a specific pathogen.

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(2 marks)

- 4 A student investigated the effect of pH on the activity of the enzyme amylase. She set up the apparatus shown in the diagram.



The tubes were made from Visking tubing. Visking tubing is partially permeable. She added an equal volume of amylase solution and starch to each tube.

- She added a buffer solution at pH2 to tube **A**.
- She added an equal volume of buffer solution at pH8 to tube **B**.

After 30 minutes, she measured the height of the solutions in both tubes. She then tested the solutions in tubes **A** and **B** for the presence of reducing sugars.

- (a) Describe how the student would show that reducing sugars were present in a solution.

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(3 marks)

- (b) After 30 minutes, the solution in tube **B** was higher than the solution in tube **A**.
- (b) (i) Explain why the solution in tube **B** was higher.

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(3 marks)

(b) (ii) The student concluded from her investigation that the optimum pH of amylase was pH8. Is this conclusion valid? Explain your answer

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(1 mark)

5 Read the following passage.

Gluten is a protein found in wheat. When gluten is digested in the small intestine, the products include peptides. Peptides are short chains of amino acids. These peptides cannot be absorbed by facilitated diffusion and leave the gut in faeces.

Some people have coeliac disease. The epithelial cells of people with coeliac disease do not absorb the products of digestion very well. In these people, some of the peptides from gluten can pass between the epithelial cells lining the small intestine and enter the intestine wall. Here, the peptides cause an immune response that leads to the destruction of microvilli on the epithelial cells. 5

Scientists have identified a drug which might help people with coeliac disease. It reduces the movement of peptides between epithelial cells. They have carried out trials of the drug with patients with coeliac disease. 10

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

(a) Name the type of chemical reaction which produces amino acids from proteins.

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(1 mark)

(b) The peptides released when gluten is digested cannot be absorbed by facilitated diffusion (lines 2–3). Suggest why.

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(3 marks)

- 6 Taxol is a drug used to treat cancer. Research scientists investigated the effect of injecting taxol on the growth of tumours in mice. Some of the results are shown in **Figure 3**.

Figure 3

Number of days of treatment	Mean volume of tumour / mm ³	
	Control group	Group injected with taxol in saline
1	1	1
10	7	2
20	21	11
30	43	20
40	114	48
50	372	87

- (a) Suggest how the scientists should have treated the control group.

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 (2 marks)

- (b) Suggest and explain **two** factors which should be considered when deciding the number of mice to be used in this investigation.

1

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 (2 marks)

- (c) The scientists measured the volume of the tumours. Explain the advantage of using volume rather than length to measure the growth of tumours.

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 (1 mark)

- (d) The scientists concluded that taxol was effective in reducing the growth rate of the tumours over the 50 days of treatment. Use suitable calculations to support this conclusion.

(2 marks)

- (e) In cells, taxol disrupts spindle activity. Use this information to explain the results in the group that has been treated with taxol.

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(3 marks)

- (f) The research scientists then investigated the effect of a drug called OGF on the growth of tumours in mice. OGF and taxol were injected into different mice as separate treatments or as a combined treatment. **Figure 4** and **Figure 5** show the results from this second investigation.

Figure 4

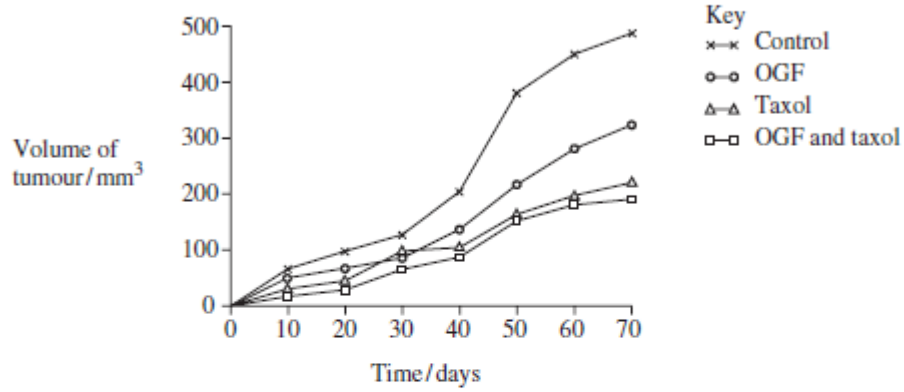


Figure 5

Treatment	Mean volume of tumour following 70 days treatment /mm ³ (± standard deviation)
OGF	322 (± 28.3)
Taxol	207 (± 22.5)
OGF and taxol	190 (± 25.7)
Control	488 (± 32.4)

- (f) (i) What information does standard deviation give about the volume of the tumours in this investigation?

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(1 mark)

- (f) (ii) Use **Figure 4** and **Figure 5** to evaluate the effectiveness of the two drugs when they are used separately and as a combined treatment.

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(4 marks)