

EXTENSION – Aiming for 9

Q1.

New-born mammals produce an enzyme called rennin which clots the protein in milk. New-born mammals can only digest the protein after it clots.

- (a) Pat investigated how pH affects the time for rennin to clot the protein in milk.

She put 2 cm³ of milk into each of four test-tubes, A, B, C and D.
She put these test-tubes and a test-tube of rennin into a water-bath at 35°C.

After a few minutes, Pat transferred 4 drops of the rennin into test-tubes A, B and C. She varied the pH by adding the chemicals shown in the table. To test-tube D she added 2 drops of hydrochloric acid only.

The table below shows the results of Pat's experiment.

	test-tube A	test-tube B	test-tube C	test-tube D
	2 cm ³ milk 4 drops rennin	2 cm ³ milk 4 drops rennin	2 cm ³ milk 4 drops rennin	2 cm ³ milk no rennin
chemical added	2 drops sodium hydroxide	2 drops distilled water	2 drops hydrochloric acid	2 drops hydrochloric acid
time for the milk to clot, in seconds	no clotting	34	10	200

- (i) Use the results of test-tubes C and D to state the function of the enzyme in the clotting process.

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1 mark

- (ii) Use Pat's results to explain why rennin clots milk quickly in the stomach.

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1 mark

- (iii) Suggest what happens to the activity of rennin as it passes from the stomach into the small intestine. Explain your answer.

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2 marks

- (b) Pat then investigated how temperature affects the time for rennin to clot milk. She prepared four water-baths, at 0°C, 25°C, 35°C and 60°C.

Into each water-bath she put a test-tube containing 2 cm³ of milk and a test-tube containing rennin plus a chemical to give the correct pH.

In each water-bath, she transferred four drops of the rennin into the test-tube of milk and timed how long it took for the milk to clot. The table shows her results.

temperature of water-bath, in °C	time for milk to clot, in seconds
0	no clotting
25	23
35	10
60	no clotting

- (i) Explain why **no clotting** occurred in the test-tube at 60°C.

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1 mark

- (ii) Pat took the test-tube out of the water-bath at 0°C and put it into the water-bath at 35°C. The milk clotted.
 Why was clotting still possible in this test-tube?

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1 mark

- (iii) Raising the temperature from 25°C to 35°C made the milk clot more quickly.
 How could Pat change her experiment to show more precisely how temperature affects the time it takes for milk to clot?

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1 mark

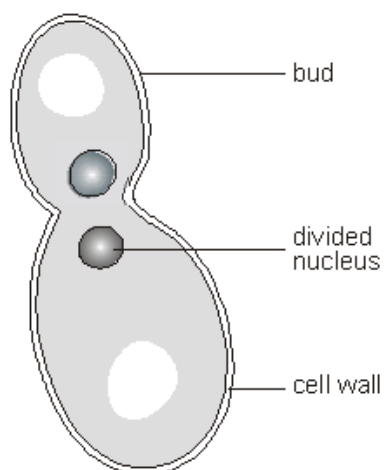
- (c) After rennin clots milk protein, a different enzyme helps to digest the protein. What are the products of protein digestion?

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1 mark

Maximum 8 marks

Q2. The diagram shows a yeast cell reproducing asexually, by budding.



- (a) The nucleus of the yeast cell contained 16 chromosomes before it divided. How many chromosomes will there be in the nucleus of the bud?

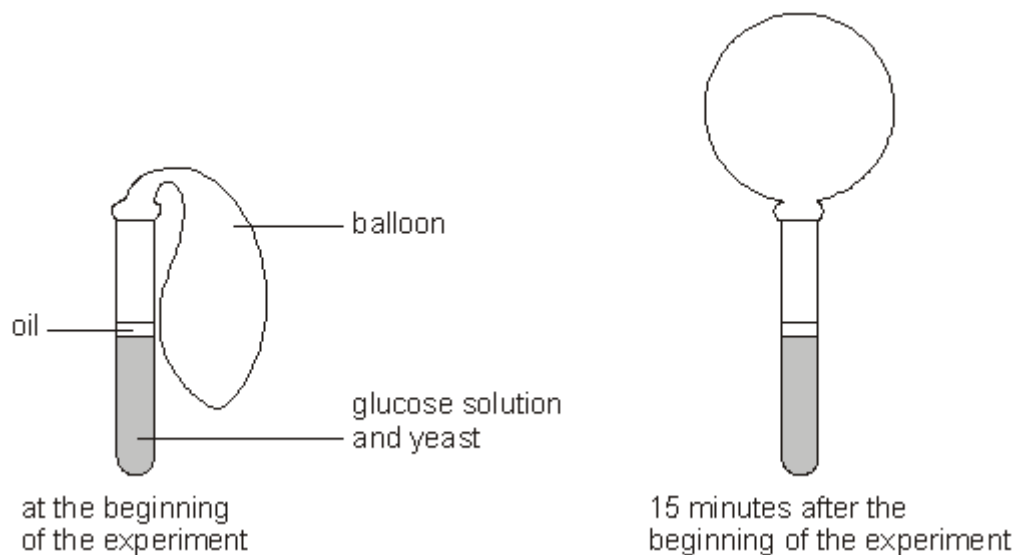
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1 mark

- (b) A solution of glucose was boiled and then cooled to room temperature. Some yeast was added to the glucose solution in a test-tube. A balloon was attached tightly around the mouth of the test-tube, which was kept at room temperature.

A gas was produced which caused the balloon to inflate.

The diagrams below show the apparatus at the beginning of the experiment and 15 minutes later.



- (i) Name the process which caused the gas to be given off.

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1 mark

- (ii) Write a word equation for this reaction.

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1 mark

- (c) In a second experiment, instead of yeast, the liquid from crushed yeast cells was added to glucose solution. The balloon became inflated again

In a third experiment, the liquid from crushed yeast cells was boiled, cooled to room temperature and then added to glucose solution. This time no gas was given off and the balloon did **not** inflate.

Explain why gas was **not** given off in the third experiment.

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1 mark
 Maximum 4 marks

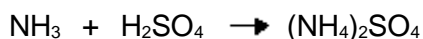
Q3.

The names and formulae of five compounds are listed in the table below.

name of compound	formula of compound
ammonia	NH ₃
ammonium chloride	NH ₄ Cl
ammonium sulphate	(NH ₄) ₂ SO ₄
sodium hydroxide	NaOH
sodium sulphate	Na ₂ SO ₄

- (a) Ammonia and sulphuric acid react to give ammonium sulphate, (NH₄)₂SO₄.

- (i) Balance the equation for this reaction.



1 mark

- (ii) Complete and balance the symbol equation for the reaction between sodium hydroxide and sulphuric acid.



3 marks

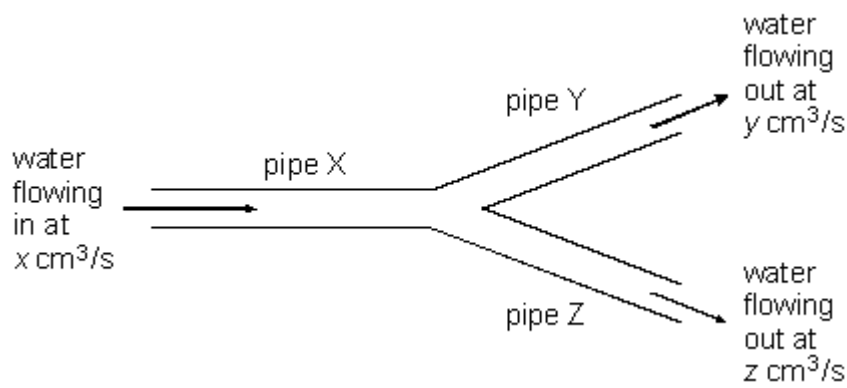
- (b) The formula for ammonia is NH₃.
 One atom of nitrogen weighs fourteen times as much as one atom of hydrogen.
 What is the total mass of hydrogen in 17 g of ammonia?

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1 mark
 Maximum 5 marks

Q4.

The flow of water through tubes can be used as a model to explain some of the rules about electrical circuits.



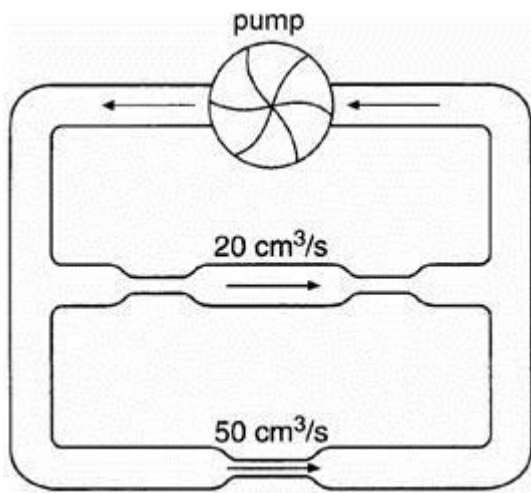
The diagram shows a junction in a water pipe.
The rate of flow in the pipes is measured in cm^3/s .

- (a) What is the relationship between the rate of flow in the three pipes, **X**, **Y** and **Z**?

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1 mark

- (b) The diagram below shows a ‘water circuit’, in which water is forced round by a pump. The rates of flow at two places are written on the diagram.



- (i) At what rate is water flowing:

into the pump? cm^3/s

out of the pump? cm^3/s

1 mark

- (ii) The ‘water circuit’ can be used as a model of an electrical circuit.
Each part of the ‘water circuit’ is equivalent to a part of an electrical circuit.

What is the electrical equivalent of the water?

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1 mark

A family, who did not understand electricity very well, always made sure there was a bulb in each of the light fittings in their house. They were afraid that electricity would escape from an empty light socket when the switch was turned on.

- (c) Explain why electricity does **not** escape from an empty light socket.

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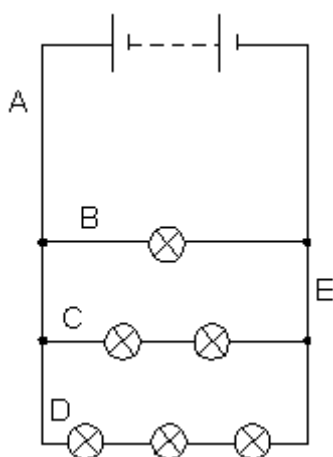
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1 mark
Maximum 4 marks

Q5.

- (a) An electrical current is a flow of charge. The diagram shows a circuit containing six identical bulbs.



In which part of the circuit, A, B, C, D or E, is there:

- (i) the greatest flow of charge?
- (ii) the least flow of charge?

2 marks

- (b) Sulphur is an electrical insulator, but it can be made to conduct electricity if a very bright light shines on it.

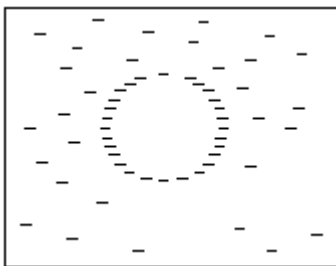
- (i) A slab of sulphur is rubbed with a piece of woollen cloth.
Explain how this gives the sulphur a negative electrical charge.

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1 mark

- (ii) A very bright light shines onto a small circular area in the centre of the charged slab of sulphur. The pattern of charge on the sulphur alters. The simplified diagram represents the new pattern of charge.



Explain why the pattern alters in this way.

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1 mark
Maximum 4 marks

