Q1.

(a) CFTR is a protein that is found in cell membranes.

This protein is responsible for transporting sodium ions across cell membranes using active transport.

(i) Describe the process of active transport.

(2)

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(ii) In some people a DNA mutation causes the production of a faulty CFTR protein. This results in cystic fibrosis. Explain how an individual can inherit cystic fibrosis from their parents.

(2)

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(iii) The faulty CFTR protein is unable to bind to the endoplasmic reticulum in the cell following protein synthesis. Suggest how this might affect the CFTR protein.

(2)

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(iv) The CFTR protein is made up of 1408 amino acids. Calculate the number of nucleotides found in one strand of the CFTR gene.

(2)

number of nucleotides = ...

(v) Describe the structure of a nucleotide found in a DNA molecule.

(3)

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(b) There are 20 different amino acids that can be joined to form a polypeptide chain. The table gives some base sequences that code for five of these amino acids.

Code	Name of amino acid
AAT or AAC	asparagine
TAT or TAC	tyrosine
TTT or TTC	phenylalanine
CGT or CGG	arginine
CAT or CAC	histidine

Diagram 1 shows part of the gene that codes for a CFTR protein that functions normally.

Diagram 2 shows the same part of the gene with a mutation that causes cystic fibrosis.

AATATCATCTTTGGTGTTTCCTATGAT

Diagram 1

AATATCATCGGTGTTTCCTATGAT

Diagram 2

Describe the changes that occur in the gene and the protein that cause cystic fibrosis.

(3)

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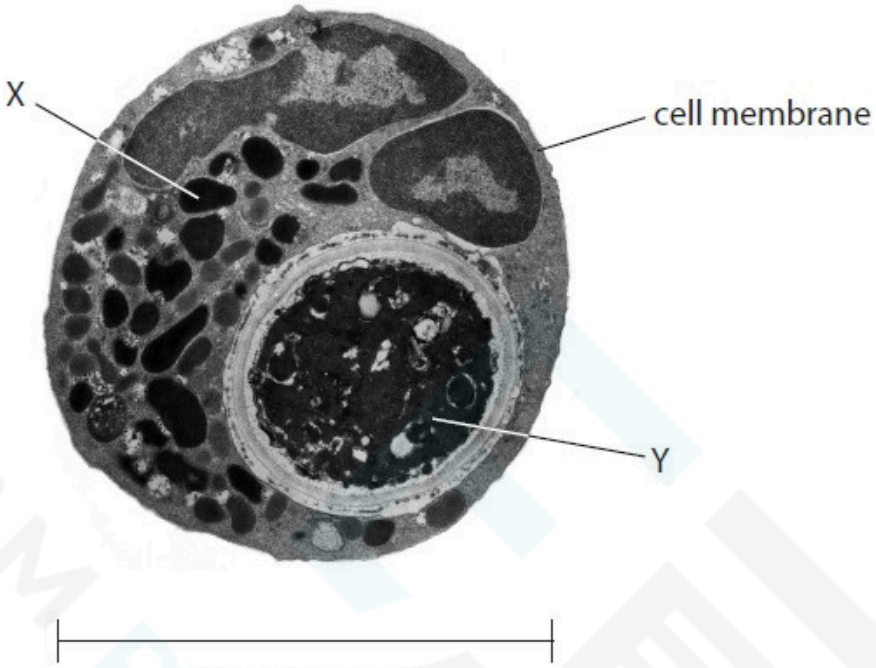
(Total for question = 14 marks)

Q2.

(a) The image is an electron micrograph of a human body cell.



(Source: © Science History Images/Alamy)

(i) The table gives information about parts of the human body cell.

Complete the table by giving the missing information.

(2)

Part	Name of part	Function
X		release energy from glucose
Y	nucleus	

(ii) Electron microscopes and light microscopes can both be used to view body cells.

Which of these is an advantage of using an electron microscope?

(1)

☒ **A** more cell structures can be seen with greater resolution

☒ **B** more cell structures can be seen with less resolution

☒ **C** fewer cell structures can be seen with greater resolution

☒ **D** fewer cell structures can be seen with less resolution

(iii) The actual diameter of this human body cell before magnification is 0.05 mm.

Use information from the image to calculate the magnification of the cell.

(3)

magnification = ...

(b) Body cells produce carbon dioxide.

Describe how carbon dioxide passes from a body cell into the blood.

(2)

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(Total for question = 8 marks)

Q3.
Molecules move in and out of cells by three methods.
These three methods are:

- diffusion
- active transport
- osmosis

(a) Give a definition of diffusion.

(2)

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(b) Give a definition of active transport.

(3)

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(c) Give a definition of osmosis.

(2)

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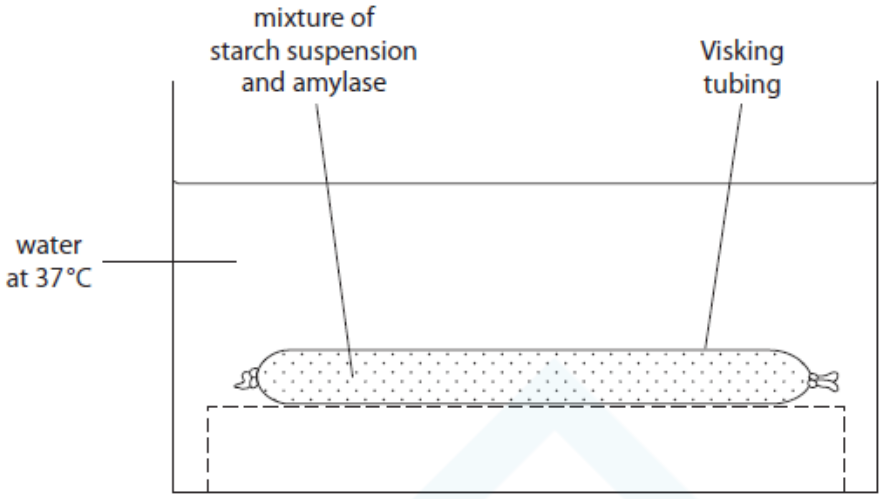
(Total for question = 7 marks)

Q4.
A student carries out an investigation to compare the rates that two different solutions of amylase, P and Q, digest starch.

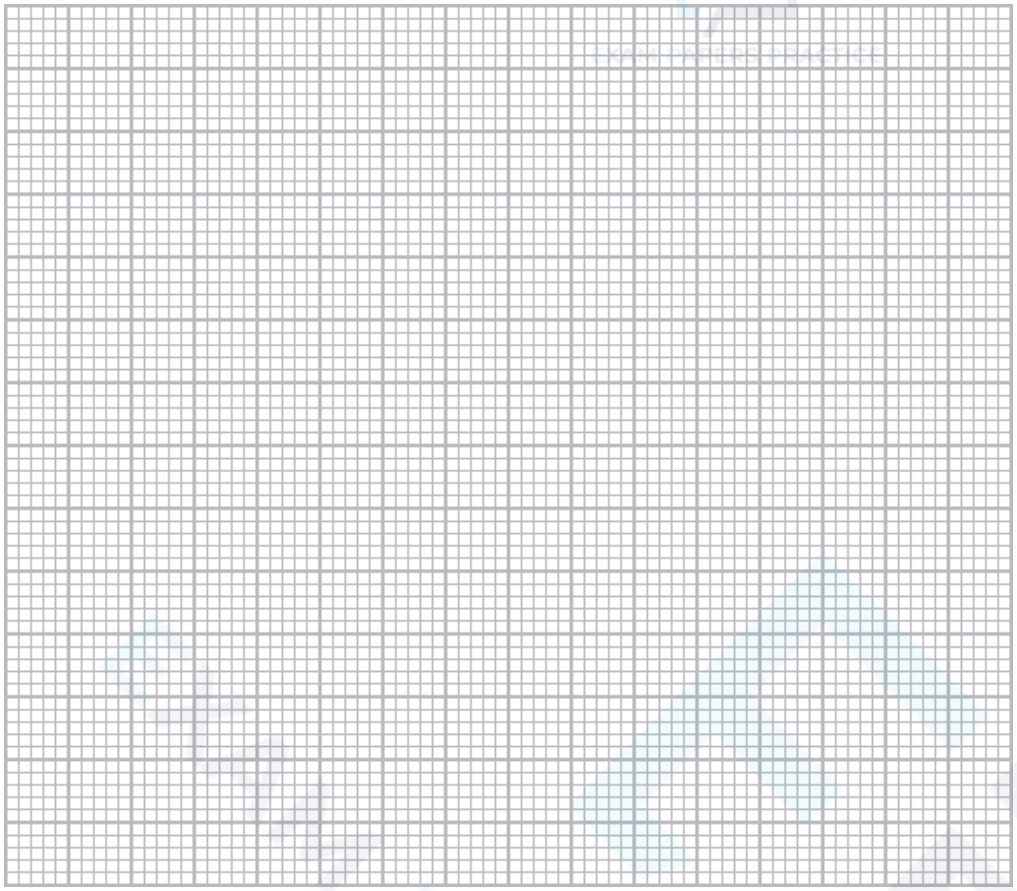
The student mixes 5 cm3 of starch suspension with 5 cm3 of amylase P solution and pours it into the Visking tubing. This is then placed in a water bath at 37 °C, as shown in the diagram.



The experiment is left for four hours. Every hour, the Visking tubing is removed from the water bath. It is dried, weighed and returned to the water bath.
The experiment is repeated, with amylase Q solution instead of amylase P solution.
The table shows the results obtained by the student.

	Increase in mass of tubing / g	
Time / hours	amylase P	amylase Q
0	0.00	0.00
1	0.05	0.20
2	0.10	1.10
3	0.20	1.60
4	0.25	1.80

(a) Plot the results of this investigation joining the points with straight lines. **(5)**



(b) (i) Explain why there is an increase in the mass of the Visking tubing during the investigation.

(3)

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(ii) Explain why the rate of increase of mass is lower after 3 hours in both investigations.

(2)

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(iii) Two factors that are kept constant in the investigation are the concentration of amylase and the pH of the solution.
Explain why these two factors should be kept constant.

(2)

concentration

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pH

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(c) State why the tubing is dried before each weighing.

(1)

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(d) State **two** places in the body where amylase is produced.

(2)

1 .....

2 .....

(e) Describe a test to detect glucose.

(3)

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(Total for question = 18 marks)