SILVERDALE SIXTH FORM

BRIDGING THE GAP
Summer work

Name: _____

Class: _____

Date: _____

Time: **65 minutes**

Marks: **65 marks**

Comments:

Q1.

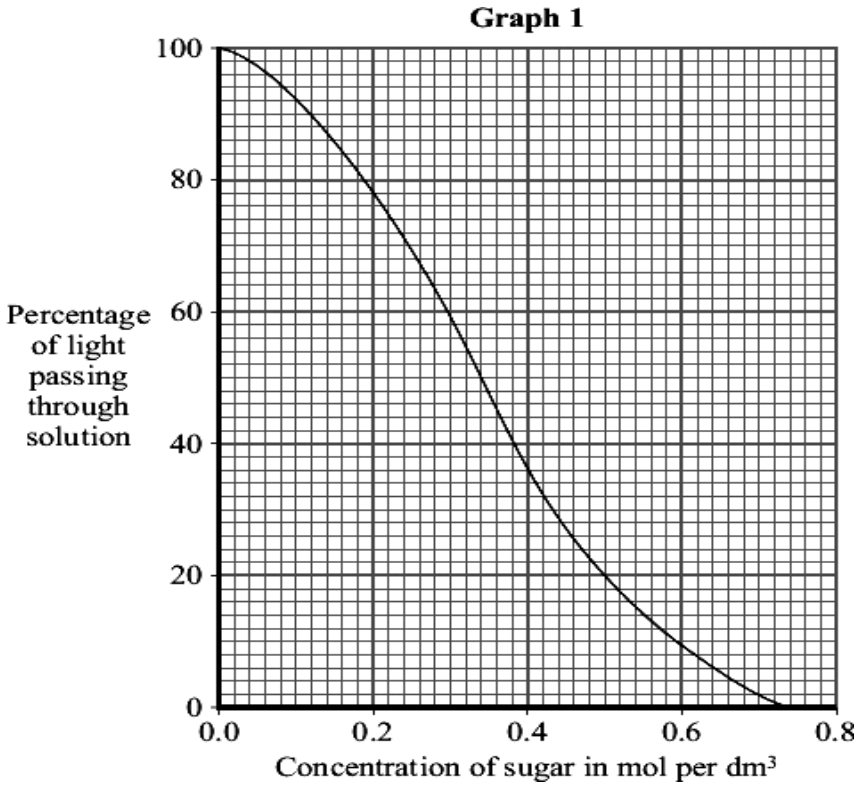
Starch is broken down into sugar by amylase. Amylase is produced in the salivary glands.

(a) Name **two** other organs in the digestive system which produce amylase.

_____ and _____

(2)

(b) A colorimeter measures colour intensity by measuring the percentage of light that passes through a solution. **Graph 1** shows the percentage of light passing through sugar solutions of different concentrations to which a test reagent has been added.



Students used a colorimeter to compare the starch-digesting ability of amylase enzymes obtained from two organs, **P** and **Q**.

- The students collected 5 cm^3 samples of amylase from **P** and **Q** and placed them into a water-bath at 40 °C.
- Two test tubes containing 10 cm^3 samples of starch solution were also placed into the water-bath.
- All the tubes were left in the water-bath for 10 minutes.
- Each amylase sample was added to one of the tubes containing the starch solution.
- The test tubes were placed back into the water-bath.
- Every minute, a few drops were taken from each tube, the test reagent was added and the percentage of light passing through this solution was measured in the colorimeter.

The tubes containing amylase samples and starch solution were left in the water-bath for ten minutes before the amylase was added to the starch.

Explain why.

_____

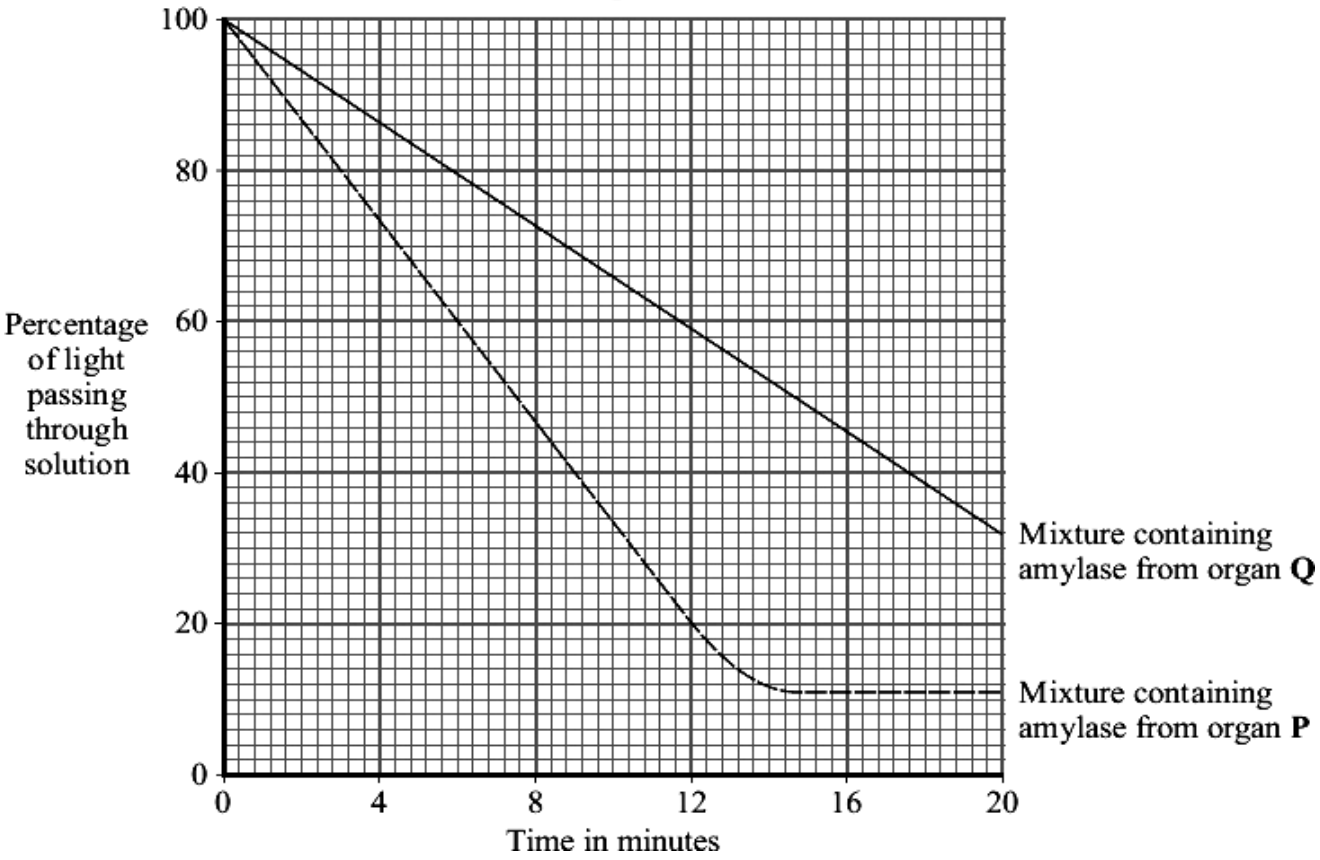
_____

_____

(2)

(c) **Graph 2** shows how the readings from the colorimeter changed over the next 20 minutes.

Graph 2



(i) Use **Graph 1** and **Graph 2** to determine the concentration of sugar in the mixture from organ **Q** after 20 minutes.

_____

Answer _____ mol per dm^3

(1)

(ii) Use your answer to (c)(i) to calculate the rate at which sugar was produced in the mixture containing amylase from organ **Q**.

Show clearly how you work out your answer.

_____

_____

_____

Answer _____ mol per dm^3 per minute **(2)**

(iii) Suggest why the amount of light passing through the mixture from organ **P** did not change after 16 minutes.

_____

_____

_____

(1)

(iv) One of the students suggested that they could have completed their experiment more quickly if the temperature of the water-bath had been set at 80 °C.

This would **not** have been the case.

Explain why.

_____

_____

_____

_____

_____

(2)(Total 10 marks)

Q2.

As embryos develop, some genes in cells are turned off and some genes are turned on.This allows cells to become specialised for particular functions.

Usually, after cells have become specialised, they cannot change again into different types of cells.

(a) What is a gene?

_____

_____

(2)

(b) Scientists have developed a way to change specialised cells back into embryo-like cells by a method called iPS.

Read the information in the box.

Cells made using iPS can be changed into different types of cells. Scientists plan to take skin cells from an endangered species of monkey called a drill and change these cells into iPS cells. These iPS cells can then be changed into egg cells or sperm cells. After fertilisation, the embryo can be inserted into the womb of a female of a non-endangered species called a mandrill. The mandrill is closely related to the drill.

Describe similarities and differences between the iPS method and adult cell cloning.

_____

_____

_____

_____

_____

_____

_____

_____

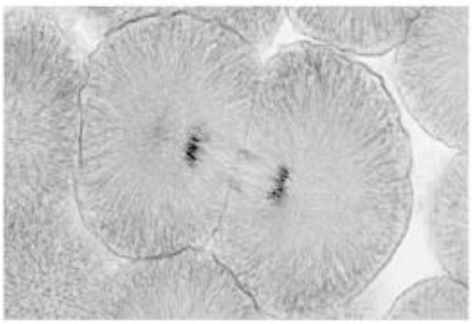
(4) (Total 6 marks)

Q3.

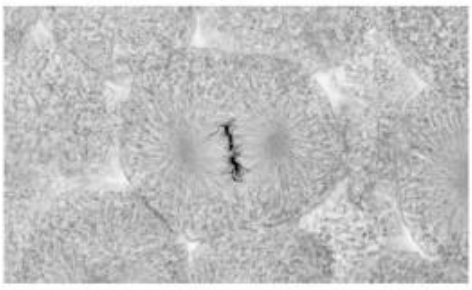
Figure 1 shows photographs of some animal cells at different stages during the cell cycle.

Figure 1

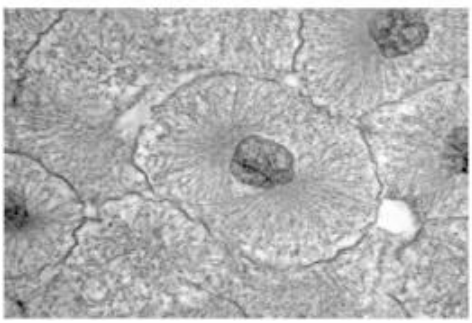
A



B



C



(a) Which photograph in **Figure 1** shows a cell that is **not** going through mitosis?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(b) Describe what is happening in photograph **A**.

_____

_____

_____

_____

_____

(2)

(c) A student wanted to find out more about the cell cycle.

The student made a slide of an onion root tip.

She counted the number of cells in each stage of the cell cycle in one field of view.

The table below shows the results.

		Stages in the cell cycle				
	Non-dividing cells	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Total**
Number of cells	20	9	4	2	1	36

Each stage of the cell cycle takes a different amount of time.

Which stage is the fastest in the cell cycle?

Give a reason for your answer.

Stage _____

Reason _____ **(2)**

(d) The cell cycle in an onion root tip cell takes 16 hours.

Calculate the length of time **Stage 2** lasts in a typical cell.

Give your answer to 2 significant figures.

_____

_____

_____

_____

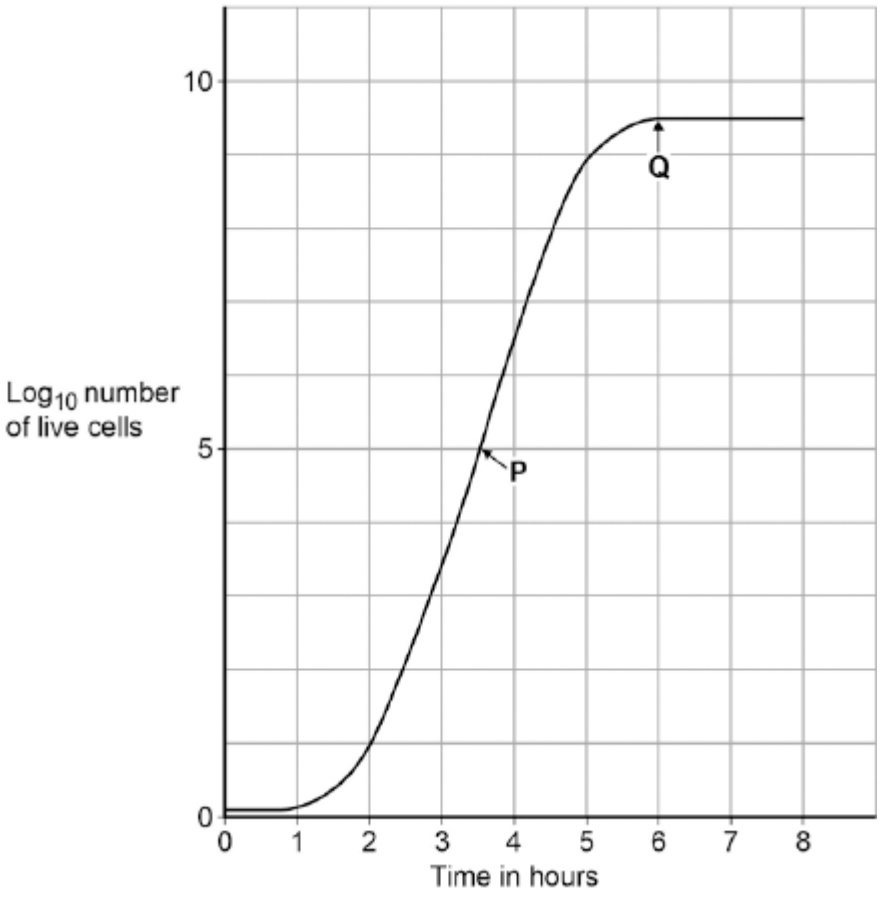
Time in **Stage 2** = _____ minutes

(3)

(e) Bacteria such as *Escherichia coli* undergo cell division similar to mitosis.

Figure 2 shows a growth curve for *E. coli* grown in a nutrient broth.

Figure 2



What type of cell division causes the change in number of *E. coli* cells at **P**?

_____

(1)

(f) Suggest why the number of cells levels out at **Q**.

_____

_____

_____

_____

_____

_____

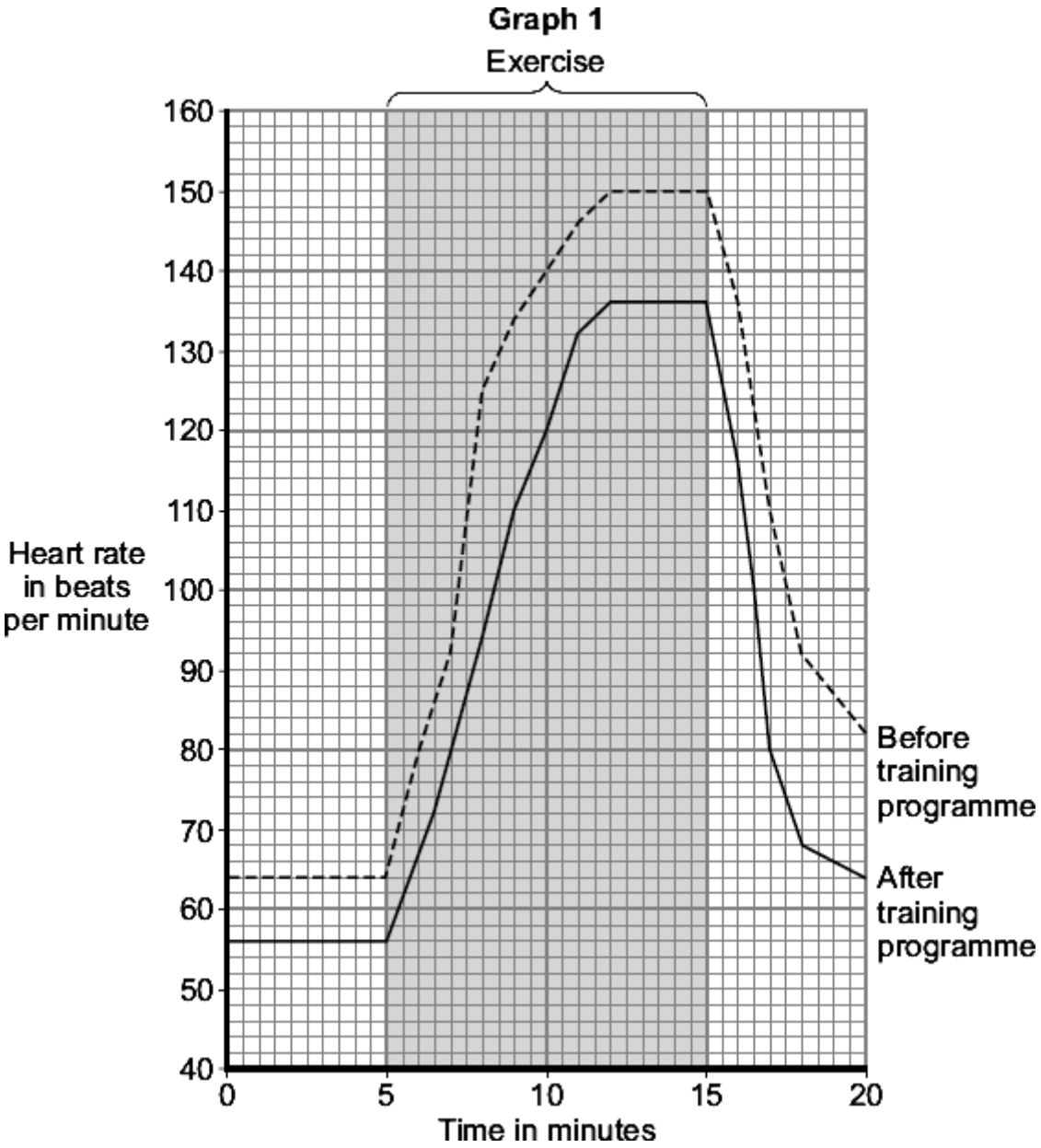
(2)

(Total 11 marks)

Q4.

An athlete carried out a 6-month training programme.

Graph 1 shows the effect of the same amount of exercise on his heart rate before and after the training programme.



(a) (i) Use **Graph 1** to find the heart rate of the **trained** athlete 5 minutes after the start of the exercise.

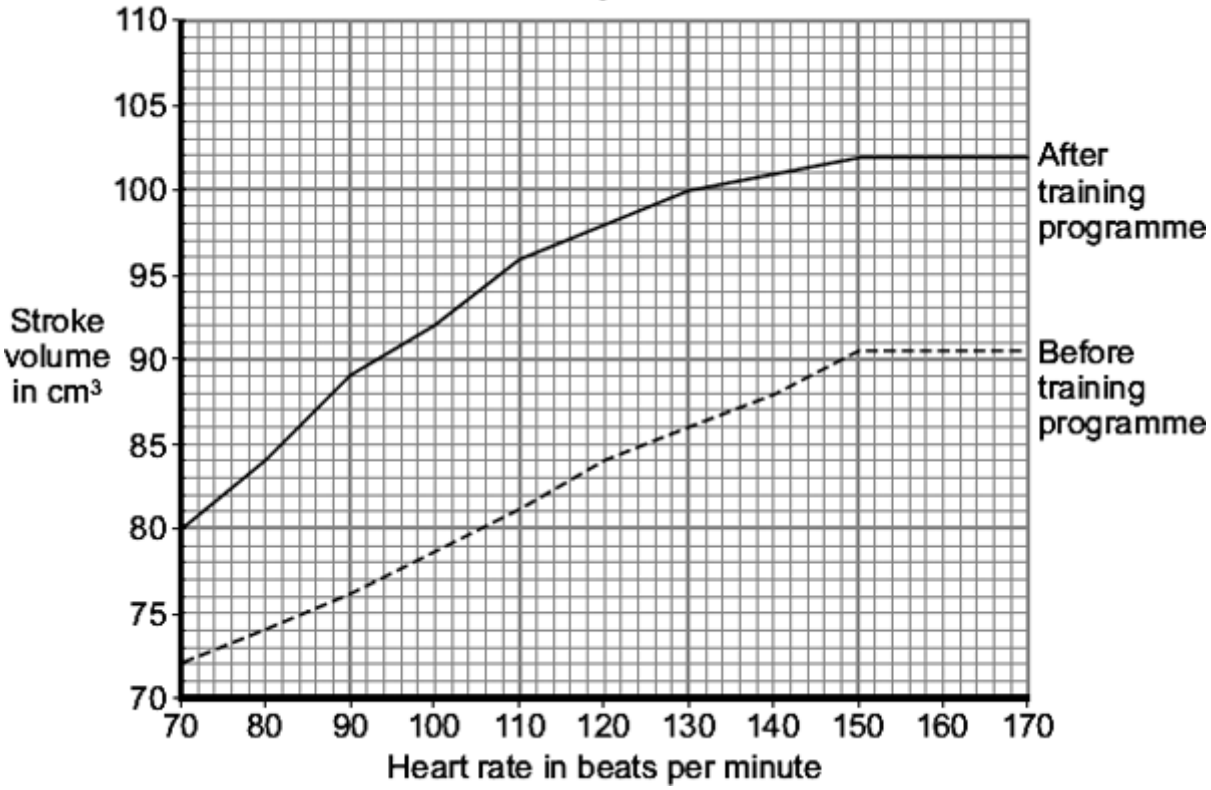
Heart rate = _____ beats per minute

(1)

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Graph 2 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.

Graph 2



(ii) The *cardiac output* is defined as

cardiac output = heart rate × stroke volume

Calculate the cardiac output of the **trained** athlete 5 minutes after the start of the exercise. Use your answer to part (a)(i), and information from **Graph 2**.

Show clearly how you work out your answer.

_____

_____

Cardiac output = _____ cm^3 blood per minute

(2)

(b) **Graph 1** shows that, for the same amount of exercise, the heart of the trained athlete was beating more slowly than it did before the training programme.

Use information from **Graph 2** to explain why.

_____

_____

_____

_____

(2)

(c) An increased cardiac output will provide more oxygen and more glucose to the working muscles.

Explain how this helps the athlete during exercise.

_____

_____

_____

_____

_____

_____

_____

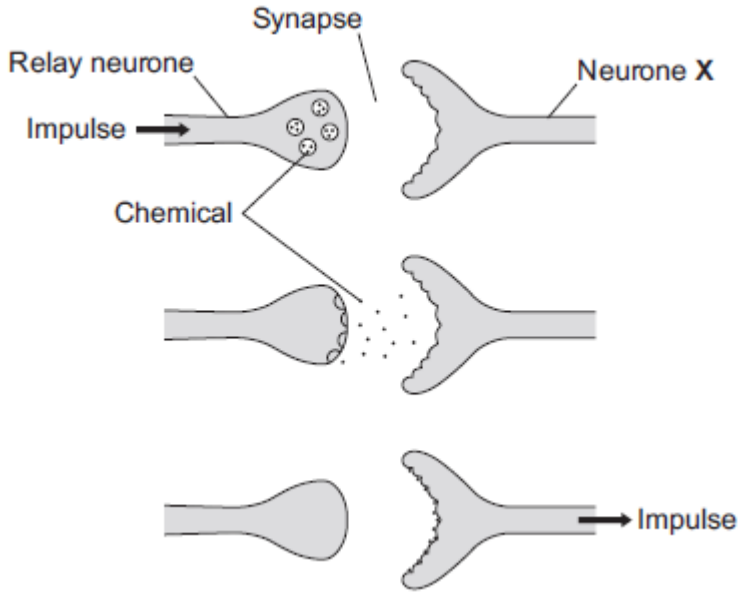
_____

(4)

(Total 9 marks)

Q5.

The diagram below shows how a nerve impulse passing along a relay neurone causes an impulse to be sent along another type of neurone, neurone **X**.



(a) What type of neurone is neurone **X**?

_____

(1)

(b) Describe how information passes from the relay neurone to neurone **X**.
Use the diagram to help you.

_____

_____

_____(3)

(c) Scientists investigated the effect of two toxins on the way in which information passes across synapses. The table below shows the results.

Toxin	Effect at the synapse
Curare	Decreases the effect of the chemical on neurone **X**
Strychnine	Increases the amount of the chemical made in the relay neurone

Describe the effect of each of the toxins on the response by muscles.

Curare _____

_____

_____

Strychnine _____

_____

(2)(Total 6 marks)

Q6.

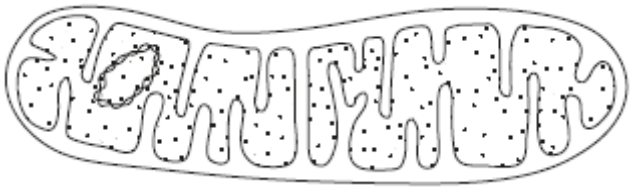
(a) The table shows some parts of cells and two different types of cell.

Complete the table by putting a tick in a box if the structure is present in the type of cell.

	Cell wall	Cell-surface membrane	Nucleus
White blood cell			
Bacterial cell			

(2)

(b) The diagram is of a mitochondrion at a magnification of × 30 000.



Calculate the actual length of this mitochondrion in micrometres (µm). Show your working.

Answer = _____ µm **(2)**

(c) Some scientists support the theory that mitochondria are organelles that evolved from prokaryotic cells.

(i) Give **one** piece of evidence that supports the theory that mitochondria evolved from prokaryotic cells.

_____

_____

_____

(1)

(ii) What is the advantage to cells of having mitochondria?

_____

_____

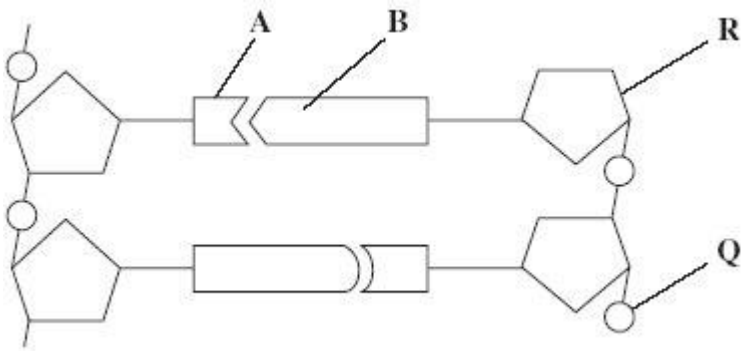
_____

(2)(Total 7 marks)

Q7.

Figure 1 shows a short section of a DNA molecule.

Figure 1



(a) Name parts **R** and **Q**.

(i) **R** _____

(ii) **Q** _____

(2)

(b) Name the bonds that join **A** and **B**.

_____

(1)

(c) Ribonuclease is an enzyme. It is 127 amino acids long.

What is the minimum number of DNA bases needed to code for ribonuclease?

☐

(1)

(d) **Figure 2** shows the sequence of DNA bases coding for seven amino acids in the enzyme ribonuclease.

Figure 2

G T T T A C T A C T C T T C T T C T T T A

The number of each type of amino acid coded for by this sequence of DNA bases is shown in the table.

Amino acid	Number present
Arg	3
Met	2
Gln	1
Asn	1

Use the table and **Figure 2** to work out the sequence of amino acids in this part of the enzyme. Write your answer in the boxes below.

Gln						

(1)

(e) Explain how a change in a sequence of DNA bases could result in a non-functional enzyme.

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

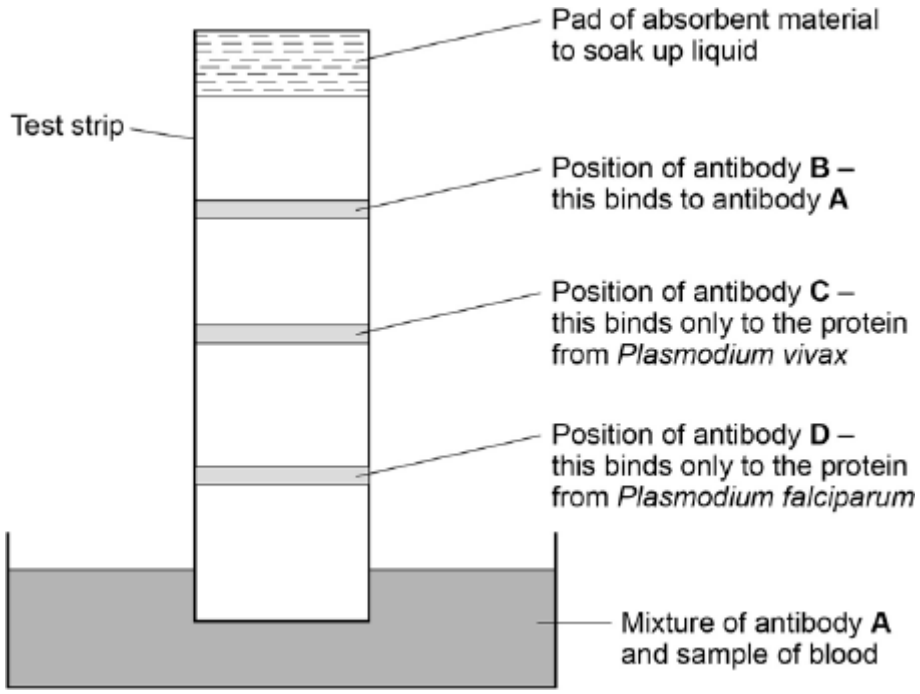
Q8.

Malaria is a disease caused by parasites belonging to the genus *Plasmodium*. Two species that cause malaria are *Plasmodium falciparum* and *Plasmodium vivax*.

A test strip that uses monoclonal antibodies can be used to determine whether a person is infected by *Plasmodium*. It can also be used to find which species of *Plasmodium* they are infected by.

- A sample of a person's blood is mixed with a solution containing an antibody, **A**, that binds to a protein found in both species of *Plasmodium*. This antibody has a coloured dye attached.
- A test strip is then put into the mixture. The mixture moves up the test strip by capillary action to an absorbent pad.
- Three other antibodies, **B**, **C** and **D** are attached to the test strip. The position of these antibodies and what they bind to is shown in **Figure 1**.

Figure 1



(a) Explain why antibody **A** attaches only to the protein found in species of *Plasmodium*.

_____

_____

_____

_____

(2)

(b) Antibody **B** is important if this test shows a person is not infected with *Plasmodium*.

Explain why antibody **B** is important.

_____

_____

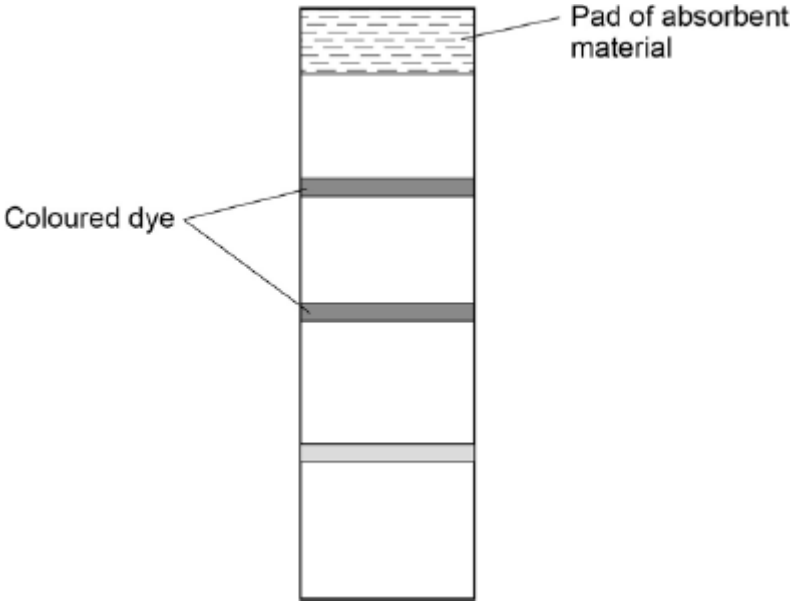
_____

_____

(2)

(c) One of these test strips was used to test a sample from a person thought to be infected with *Plasmodium*. **Figure 2** shows the result.

Figure 2



What can you conclude from this result?

Explain how you reached your conclusion.

_____

_____

_____

_____

_____

_____

(Extra space) _____

_____

_____

_____

(4)

(Total 8 mark)