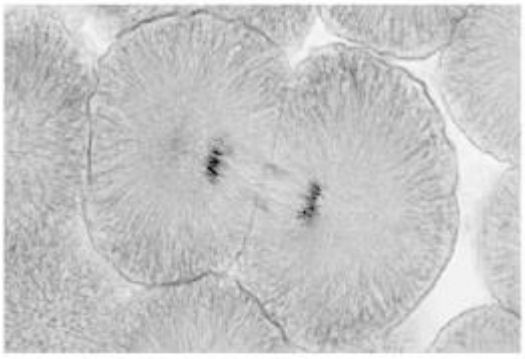
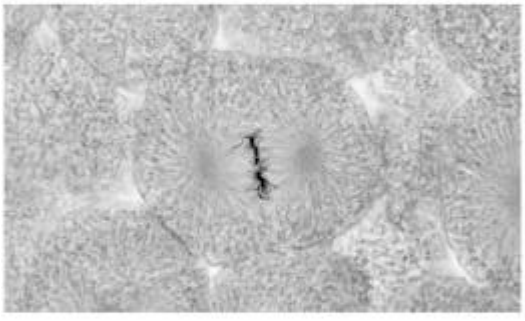
**Q1.Figure 1** shows photographs of some animal cells at different stages during the cell cycle.

**Figure 1**

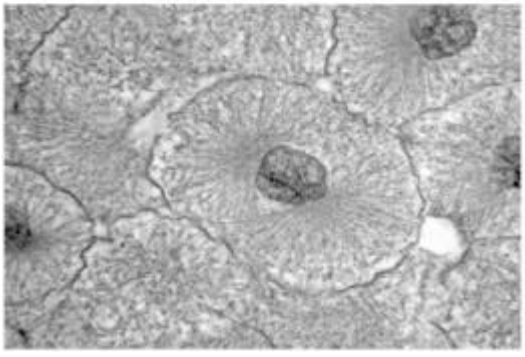
A



B



C



A © Ed Reschke/Photolibrary/Getty Images
B © Ed Reschke/Oxford Scientific/Getty Images
C © Ed Reschke/Photolibrary/Getty Images

(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**.

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**(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.

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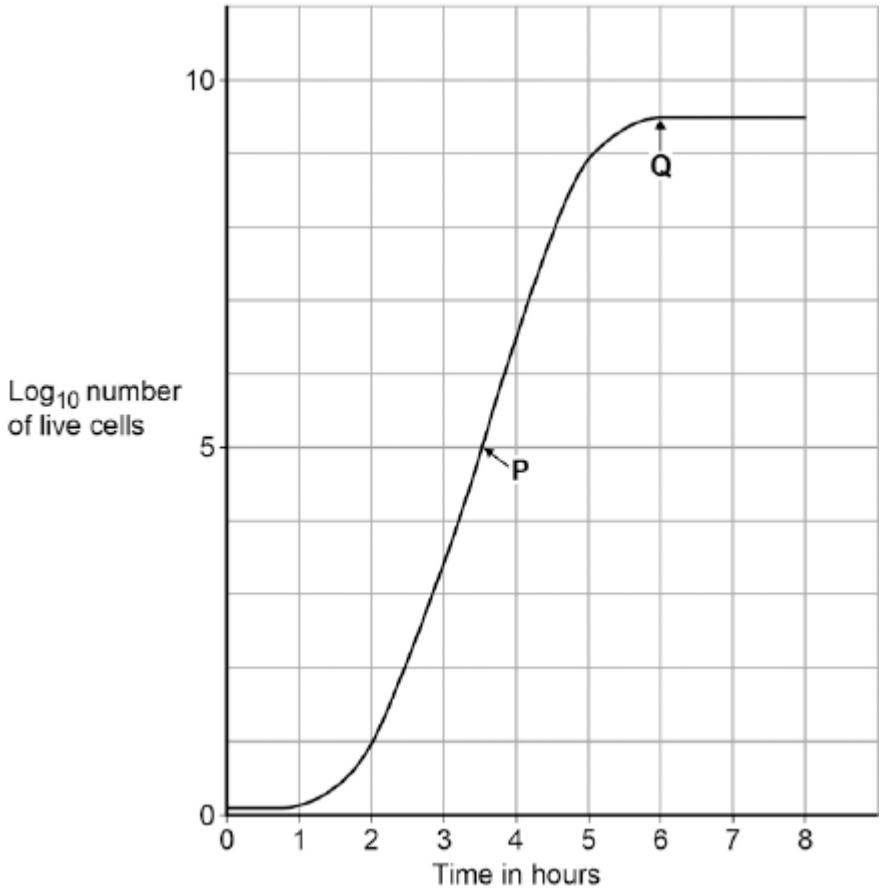
Time in **Stage 2** = ..... minutes

**(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**?

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**(1)**

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

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**(2)**

**(Total 11 marks)**

**Q2.** The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.




(a) Suggest how the fibres labelled **X** help in blood clot formation.

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**(1)**

(b) The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

Use the formula to calculate the magnification of the photograph.

Diameter on photograph = Real diameter × Magnification

.....

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Magnification = .....

**(2)**

(c) Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

(i) Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

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**(1)**

(ii) Explain the advantages of red blood cells passing through a capillary one at a time.

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**(3)**

**(Total 7 marks)**

**Q3.** Some students investigated the effect of pH on the growth of one species of bacterium.

They transferred samples of bacteria from a culture of this species to each of eight flasks. Each flask contained a solution of nutrients but at a different pH.

After 24 hours, the students measured the amount of bacterial growth.

(a) It was important that the flasks in which the bacteria grew were not contaminated with other microorganisms.

Describe **two** precautions the students should have taken to prevent this contamination.

1 .....

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2 .....

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**(2)**

(b) To see the effect of pH on the growth of the bacteria, other conditions should be kept constant.

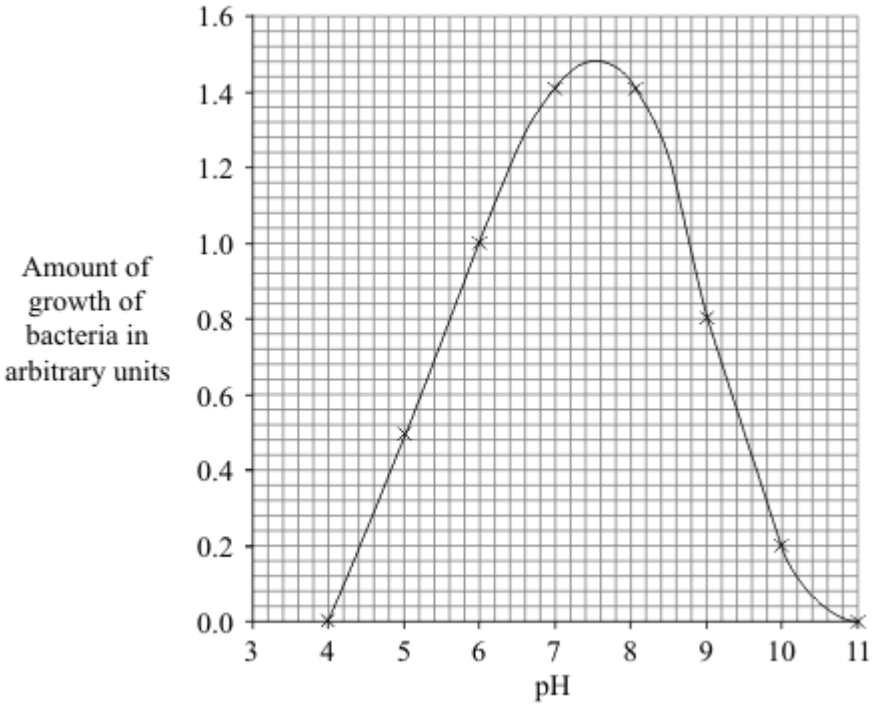
Suggest **two** conditions which should have been kept constant for all eight flasks.

1 .....

2 .....

**(2)**

(c) The graph shows the results of the investigation.




The students wanted to find the best pH for the growth of this species of bacterium.

(i) Use the graph to estimate the pH at which the bacteria would grow best.

pH .....

**(1)**

(ii) What could the students do to find a more accurate value for the best pH for growth of the bacteria?

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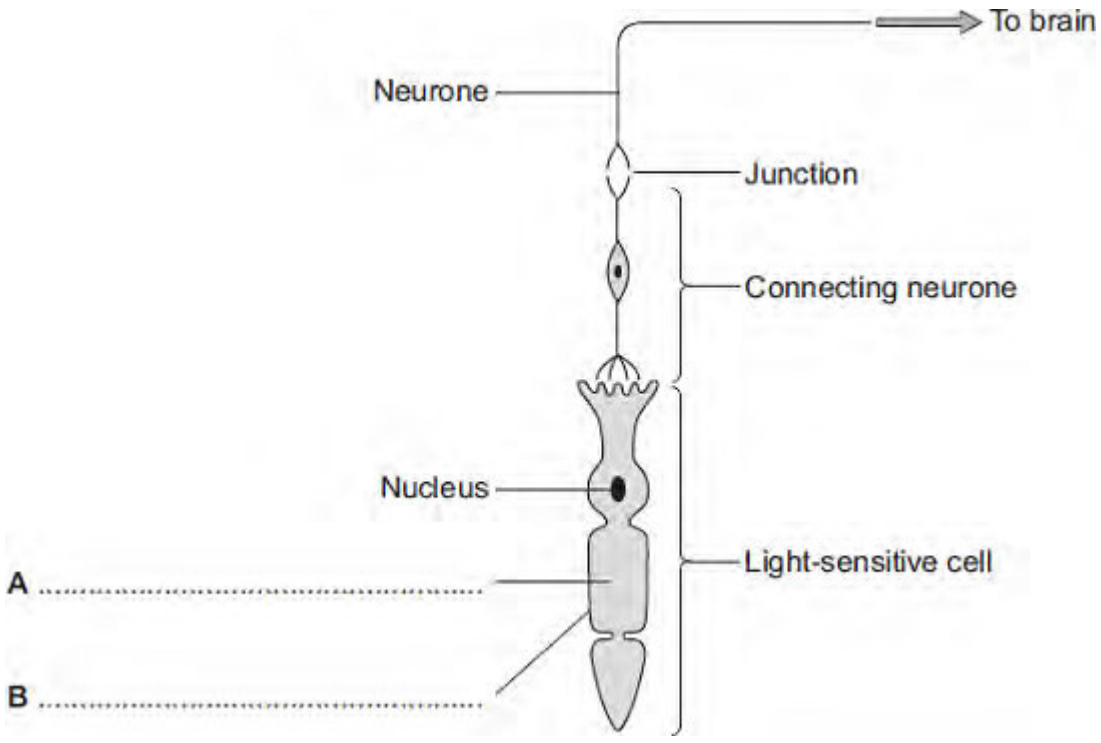
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**(1)**

**(Total 6 marks)**

**Q4.Diagram 1** shows cells from the light-sensitive layer in the eye.

**Diagram 1**




(a) On **Diagram 1**, add labels to name part **A** and part **B** of the light-sensitive cell.

**(2)**

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

.....

**(1)**

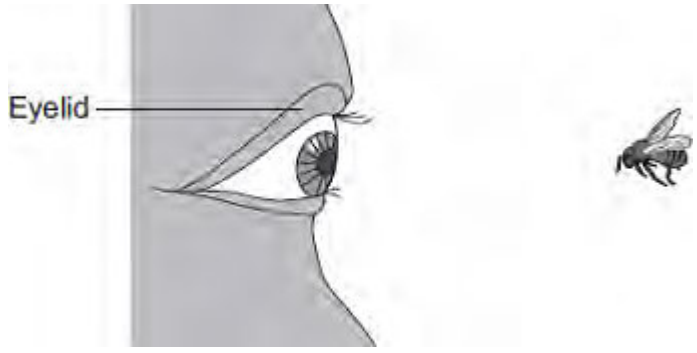
(ii) In what form is information passed across the junction?

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**(1)**

(c) Diagram **2** shows a bee flying towards a man's eye.




In the *blink reflex* , light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

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**(4)**
**(Total 8 marks)**

**Q5.** The table shows the concentrations of three mineral ions in the roots of a plant and in the water in the surrounding soil.

| Mineral ion | Concentration in millimoles per kilogram | |
|---|---|---|
| | **Plant root** | **Soil** |
| Calcium | 120 | 2.0 |
| Magnesium | 80 | 3.1 |
| Potassium | 250 | 1.2 |

(a) (i) The plant roots could **not** have absorbed these mineral ions by diffusion.

Explain why.

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**(2)**

(ii) Name the process by which the plant roots absorb mineral ions.

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**(1)**

(b) How do the following features of plant roots help the plant to absorb mineral ions from the soil?

(i) A plant root has thousands of root hairs.

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**(1)**

(ii) A root hair cell contains many mitochondria.

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**(2)**

(iii) Many of the cells in the root store starch.

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**(1)**

**(Total 7 marks)**

**Q6.**(a) Mr and Mrs Smith both have a history of cystic fibrosis in their families.
Neither of them has cystic fibrosis.
Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

**(3)**

(b) Mr and Mrs Smith decided to visit a genetic counsellor who discussed embryo screening.

Read the information which they received from the genetic counsellor.

- Five eggs will be removed from Mrs Smith's ovary while she is under an anaesthetic.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs Smith's uterus and she may become pregnant.
- Any unsuitable embryos will be destroyed.

(i) Suggest why it is helpful to take five eggs from the ovary and not just one egg.

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**(1)**

(ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion to your evaluation.

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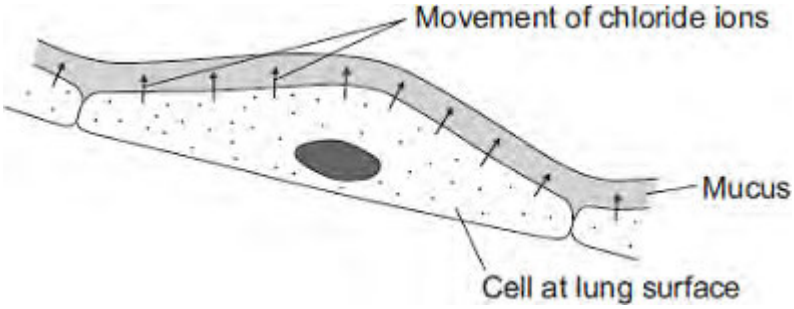
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**(4)**

(c) In someone who has cystic fibrosis the person's mucus becomes thick.

The diagram shows how, in a healthy person, cells at the lung surface move chloride ions into the mucus surrounding the air passages.




The movement of chloride ions causes water to pass out of the cells into the mucus.

Explain why.

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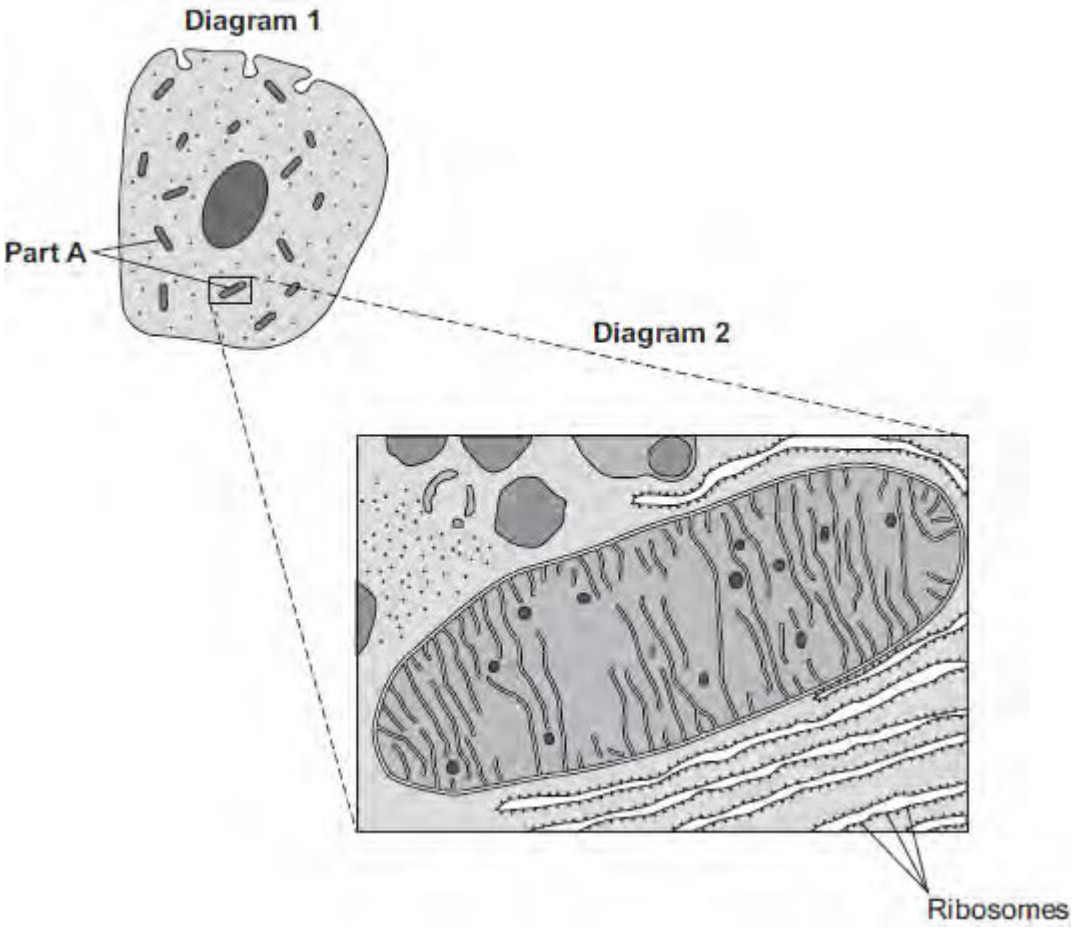
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**(3)**
**(Total 11 marks)**

**Q7.Diagram 1** shows a cell from the pancreas.

**Diagram 2** shows part of the cell seen under an electron microscope.




Part **A** is where most of the reactions of aerobic respiration happen.

(a) (i) Name part **A**.

.....

**(1)**

(ii) Complete the equation for aerobic respiration.

glucose + oxygen ⟶ ..... + ..... (+ energy)

**(2)**

(iii) Part **A** uses oxygen.

Explain how oxygen passes from the blood to part **A**.

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**(3)**

(b) The pancreas cell makes enzymes.

Enzymes are proteins.

Describe how the ribosomes and part **A** help the cell to make enzymes.

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**(3)**
**(Total 9 marks)**