



GCE AS/A LEVEL – **NEW**

**2400U10-1**

**BIOLOGY – AS UNIT 1**

**BASIC BIOCHEMISTRY AND CELL ORGANISATION**

**THURSDAY, 25 MAY 2017 – AFTERNOON**

**1 hour 30 minutes plus your additional time allowance**

**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** 2 \_\_\_\_\_

<b>For Examiner's use only</b>		
<b>Question</b>	<b>Maximum Mark</b>	<b>Mark Awarded</b>
<b>1.</b>	<b>9</b>	
<b>2.</b>	<b>13</b>	
<b>3.</b>	<b>10</b>	
<b>4.</b>	<b>15</b>	
<b>5.</b>	<b>14</b>	
<b>6.</b>	<b>10</b>	
<b>7.</b>	<b>9</b>	
<b>Total</b>	<b>80</b>	

## **ADDITIONAL MATERIALS**

**In addition to this examination paper, you will need a calculator and a ruler.**

## **INSTRUCTIONS TO CANDIDATES**

**Use black ink, black ball-point pen or your usual method. Do not use gel pen. Do not use correction fluid.**

**Write your name, centre number and candidate number in the spaces provided on the front cover.**

**Answer ALL questions.**

**Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.**

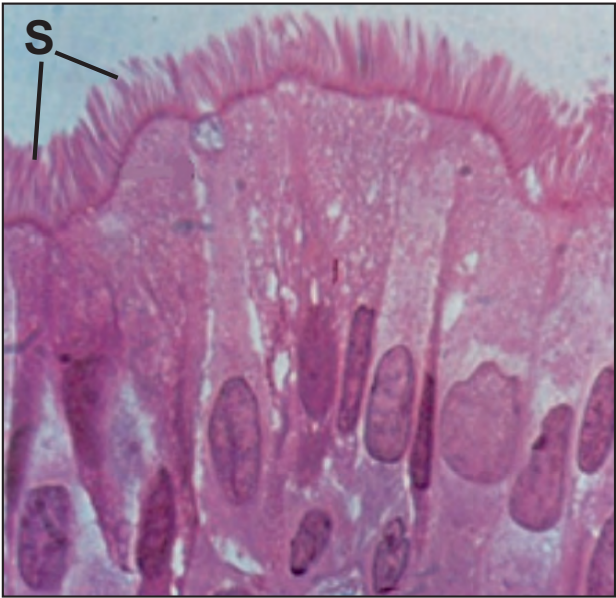
**INFORMATION FOR CANDIDATES**

**The number of marks is given in brackets at the end of each question or part-question.**

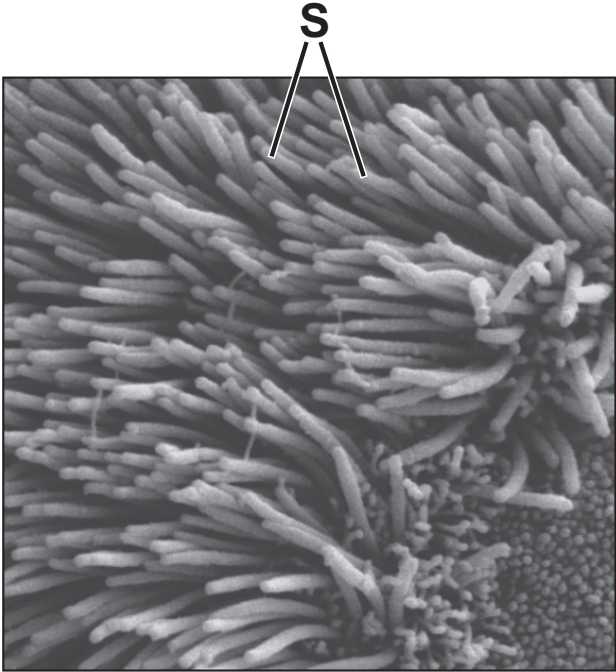
**The assessment of the quality of extended response (QER) will take place in question 7.**

**The quality of written communication will affect the awarding of marks.**

**Image 1**



**Image 2**



**Answer ALL questions.**

**1. The images opposite show a longitudinal section through a tissue found lining the trachea of humans and a highly magnified image of the surface of this tissue.**

**(a) (i) Name the structures labelled **S** and suggest their function in the human respiratory system. [2]**

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**1(a) (ii) Explain why Image 1 is referred to as a tissue rather than an organ. [1]**

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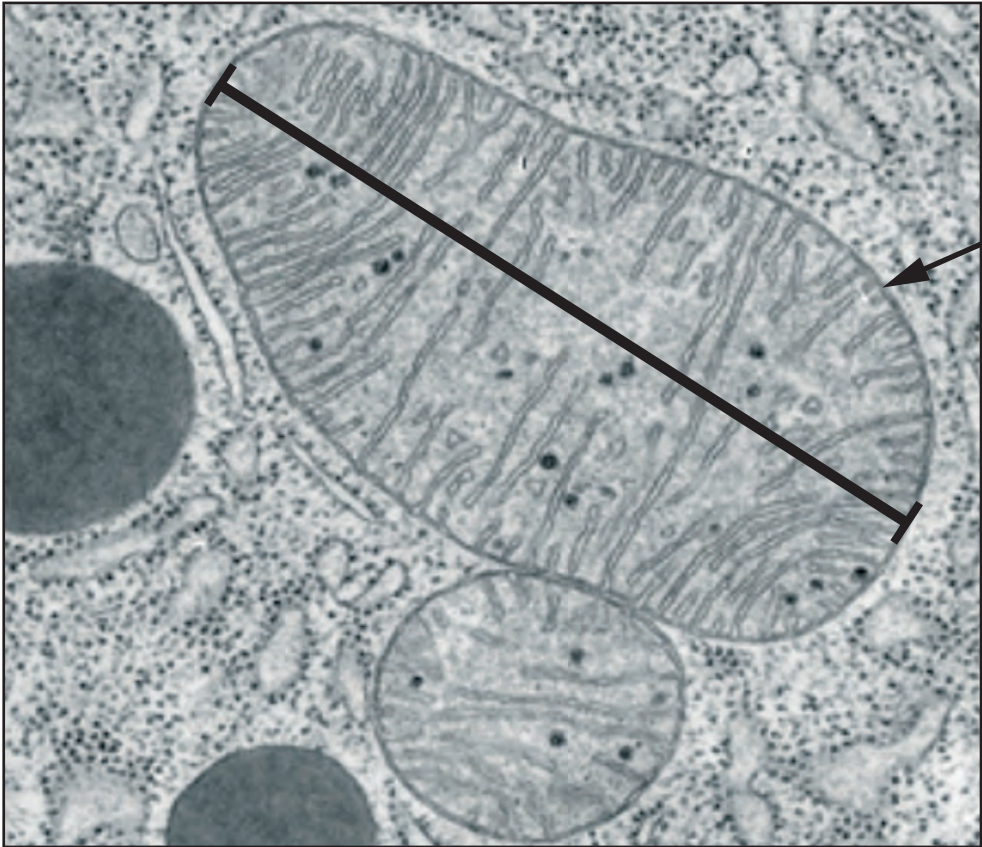
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T

250 nm

The photo electron micrograph opposite shows two mitochondria found in this tissue.

- 1(b) (i) One reason for the different appearance of the mitochondria is that they have been cut in different planes. Suggest **ONE OTHER** reason that could account for the difference in their appearance. [1]

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- 1(b) (ii) Calculate the actual size of mitochondrion T along the line shown on the image. Give your answer in micrometres. [3]

Length of organelle = \_\_\_\_\_  $\mu\text{m}$

**1(b) (iii) State and explain ONE way in which mitochondria are adapted to perform their function. [2]**

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<b>9</b>

2. Meselson and Stahl investigated the replication of DNA prior to cell division.

In their experiments, bacteria were cultured in a medium containing only the  $^{15}\text{N}$  isotope (heavy nitrogen). The bacteria were then transferred to  $^{14}\text{N}$  (light nitrogen) culture medium and allowed to divide. Following each generation, samples of DNA were taken, separated using an ultracentrifuge and analysed.

(a) Identify THREE variables which would need to be controlled during centrifugation of the samples.

[2]

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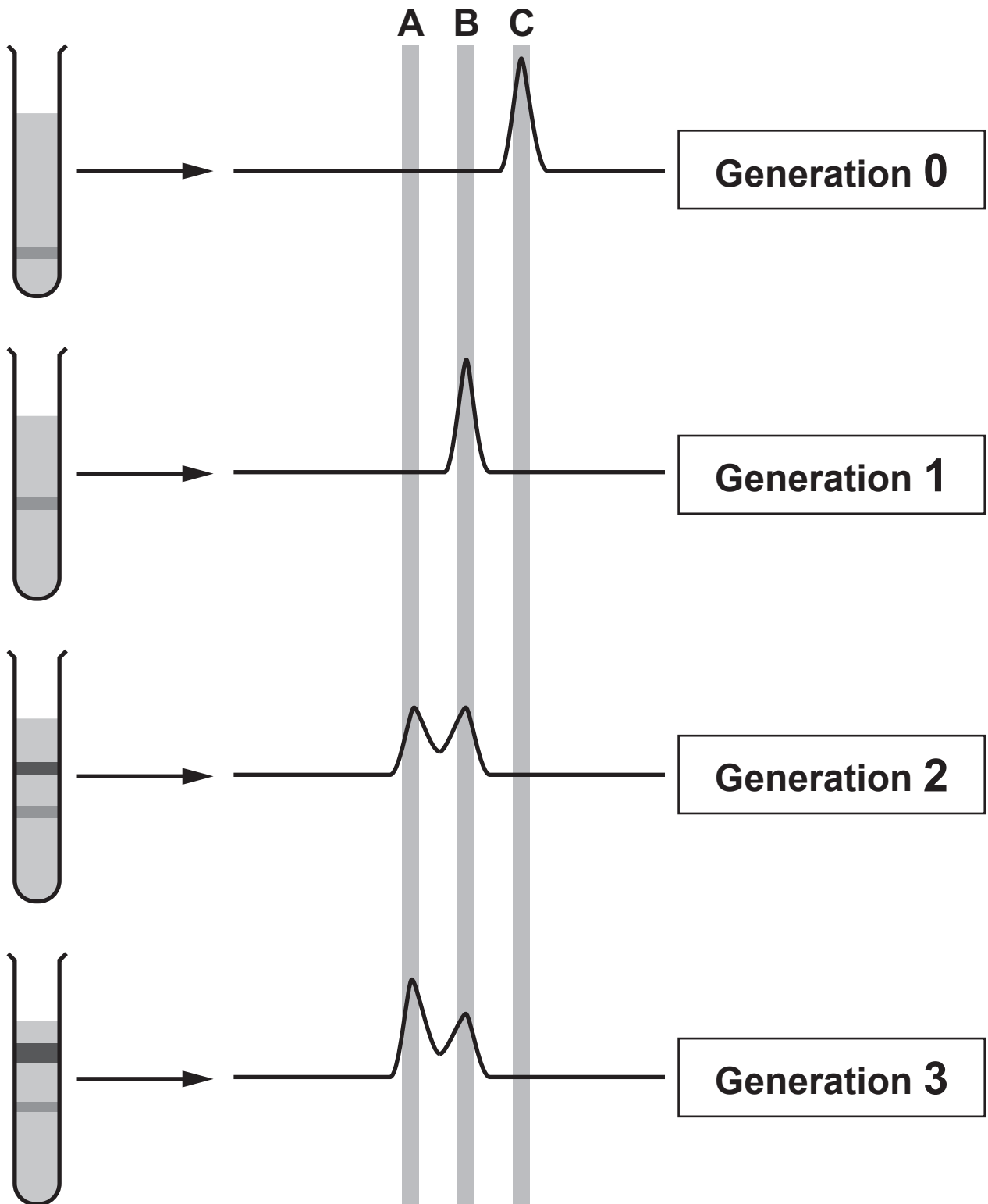
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Relative density of DNA



Photographs were taken of the extracted bands of DNA. The relative density of each band was scanned and measured; the more dense the DNA, the higher the reading. Shown opposite are some of their experimental results.

2(b) (i) State which isotopes of nitrogen would be found in the DNA at **A**, **B** and **C** in the scans. [1]

**A** \_\_\_\_\_

**B** \_\_\_\_\_

**C** \_\_\_\_\_





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**2(b) (iv) Name TWO enzymes now known to be involved in DNA replication and explain their functions. [3]**

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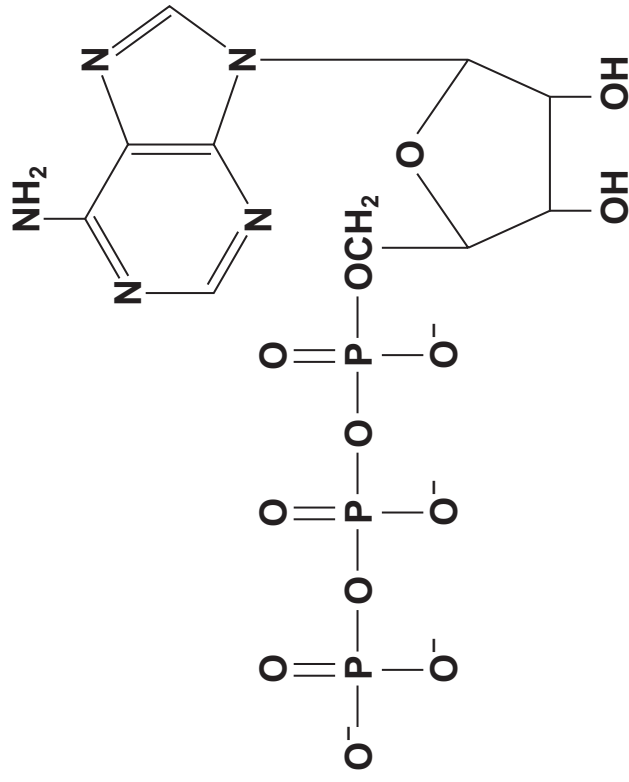
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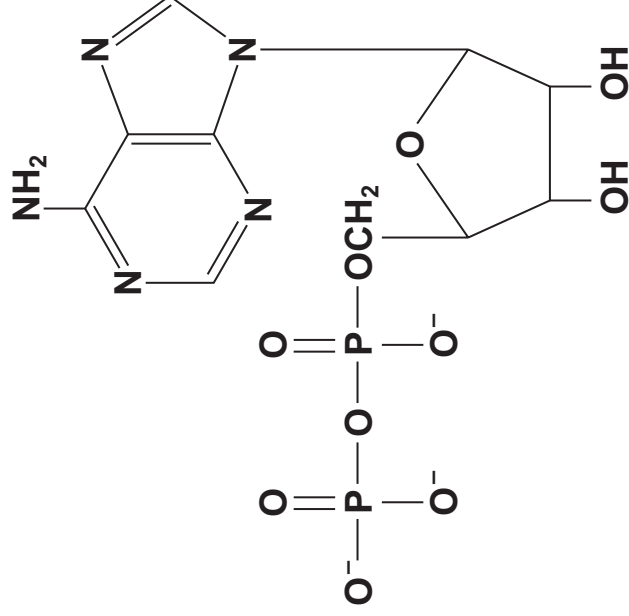
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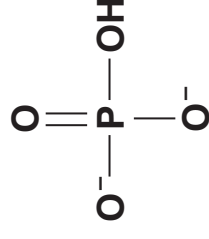
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**Adenosine triphosphate (ATP)**



**Adenosine diphosphate (ADP)**



**Phosphate ion**

**3. Adenosine triphosphate (ATP) belongs to a group of molecules that are made from nucleotides. ATP is an unstable molecule which possesses two high energy phosphate bonds and is often referred to as the universal energy currency. The diagram opposite shows the conversion of ATP into ADP.**

**(a) (i) State the parts of the molecule that are common to DNA, RNA and ATP nucleotides. [1]**

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**3(a) (ii) State what is meant by the term UNIVERSAL ENERGY CURRENCY. [1]**

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**(iii) State whether the reaction shown opposite page 15 is exergonic or endergonic. Explain your answer. [2]**

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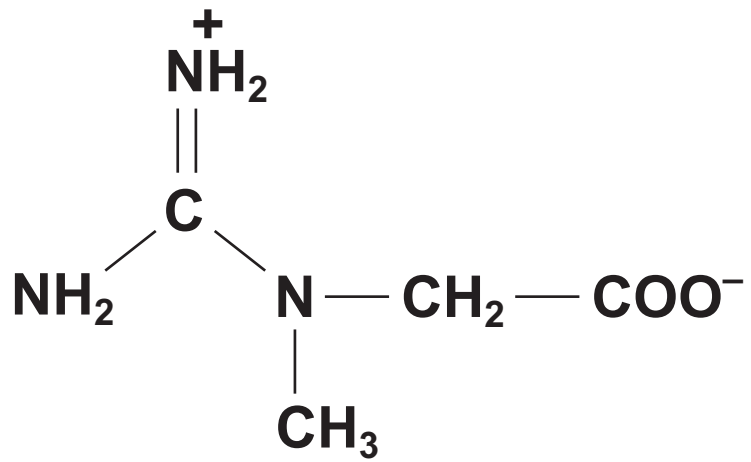
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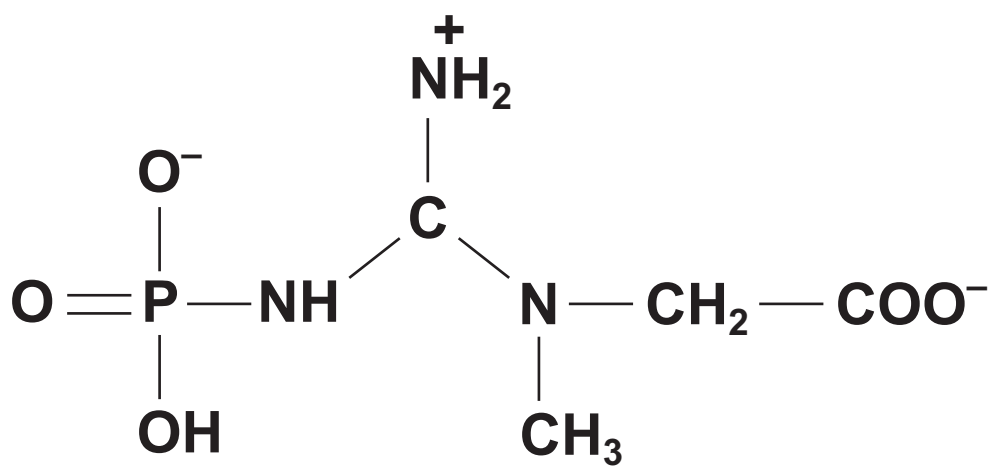
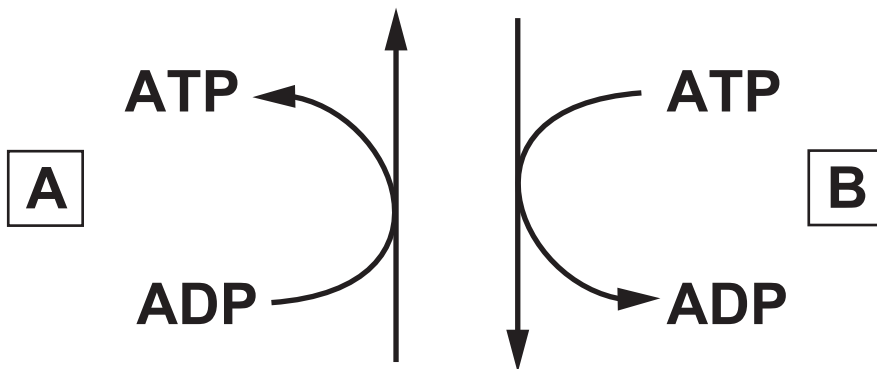
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- 3(b) It is estimated that the mass of ATP that is found within a resting human at any one time is approximately 5 g, yet a human uses an estimated 50 kg of ATP each day. Calculate the percentage of the total ATP used per day that is available at any one time. [2]**

**Percentage of the total ATP available = \_\_\_\_\_ %**



CREATINE



CREATINE PHOSPHATE



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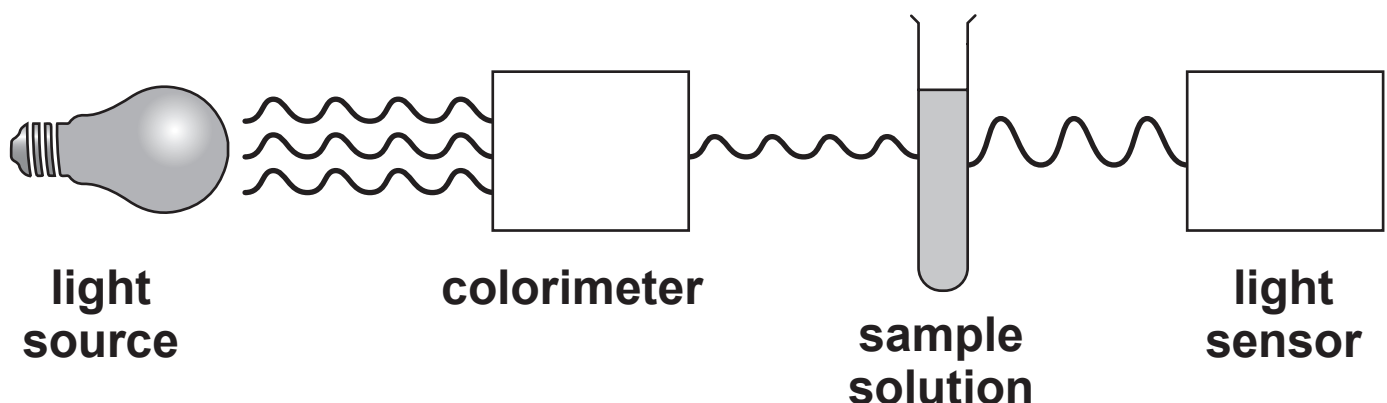
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4. Lipases are involved in diverse biological processes, including the hydrolysis of triglycerides. Some lipases act in specific compartments inside cells, while others work in extracellular spaces.
- (a) State the term given to enzymes which work within specific compartments inside cells. [1]
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Triacetin is a colourless triglyceride and can be hydrolysed by bacterial lipase. When an indicator is added to alkaline triacetin solution a coloured solution is produced. A colorimeter can then be used to monitor the progress of the reaction. When the triacetin is completely digested, the solution will change from coloured to colourless, allowing more light to pass through, and produce an absorbance reading of zero.



The effect of temperature on the hydrolysis of triacetin was investigated.

The experiment was performed as follows:

1.  $2\text{ cm}^3$  of triacetin was mixed with  $3\text{ cm}^3$  of sodium hydrogen carbonate (pH10) in a test tube and 5 drops of indicator added.
2.  $1\text{ cm}^3$  of lipase was placed in a separate test tube.
3. Both test tubes were placed in a water bath ( $20^\circ\text{C}$ ) for 5 minutes.
4. The contents of the tubes were combined, mixed thoroughly and  $2\text{ cm}^3$  transferred to a cuvette.
5. The time taken for the absorbance to reach zero was measured.
6. The experiment was repeated to give a total of three readings.
7. Steps 1-6 were repeated at 25, 35, 45, and  $50^\circ\text{C}$ .

**4(b) (i) Identify the independent and dependent variables in this investigation. [2]**

**independent**

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**dependent**

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**(ii) Explain why the solutions were left in the water bath for 5 minutes before combining and mixing. [1]**

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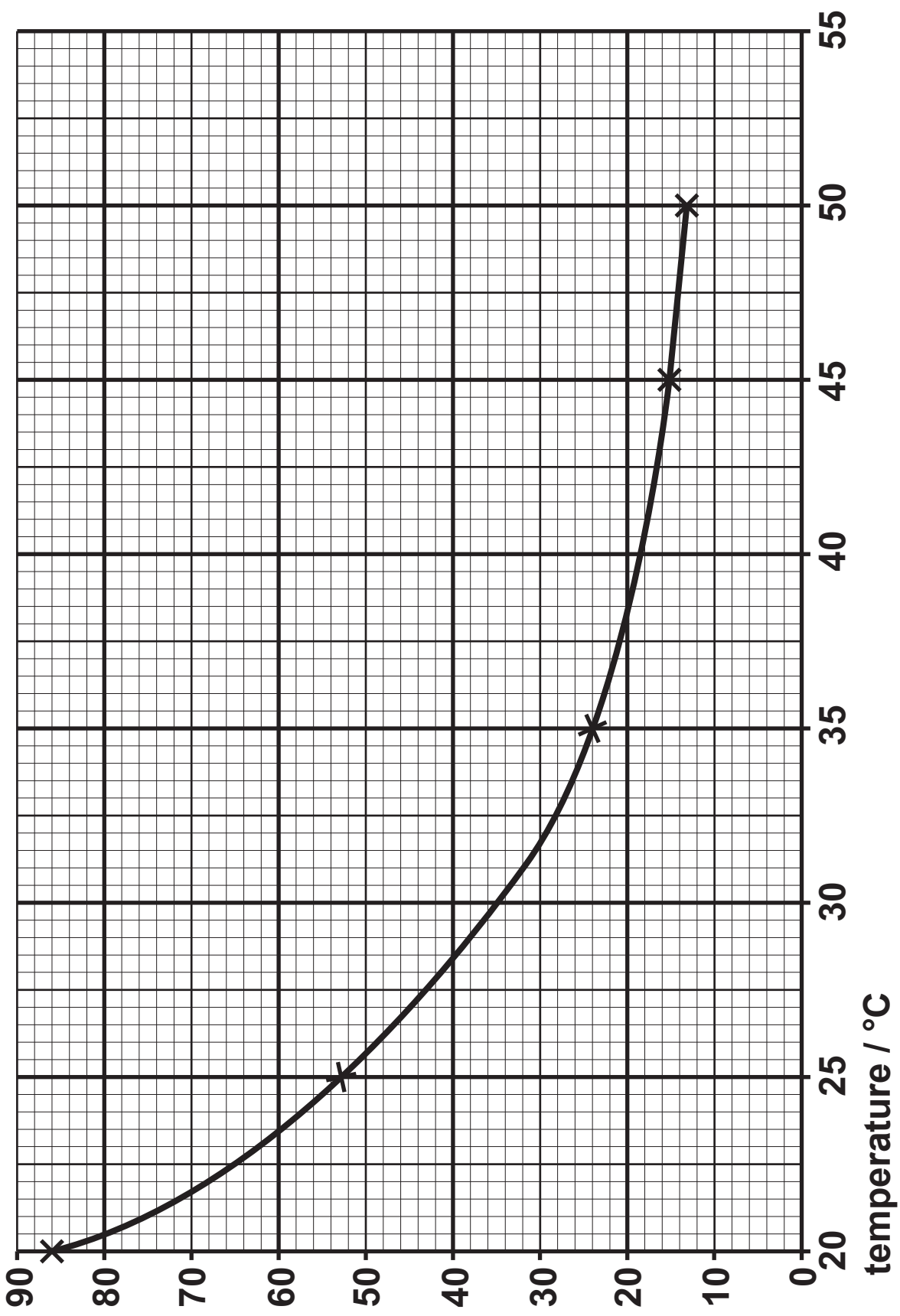
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mean time taken to reach zero  
absorbance / seconds



The results of the investigation are shown opposite.

- 4(c) (i) In this experiment,  $2 \text{ cm}^3$  of  $0.25 \text{ g cm}^{-3}$  triacetin was used. Calculate the rate of digestion per second at  $40^\circ\text{C}$ .

Give your answer in standard form. [3]

Rate = \_\_\_\_\_  $\text{g s}^{-1}$

**4(c) (ii) Suggest ONE source of inaccuracy in this experimental method. [1]**

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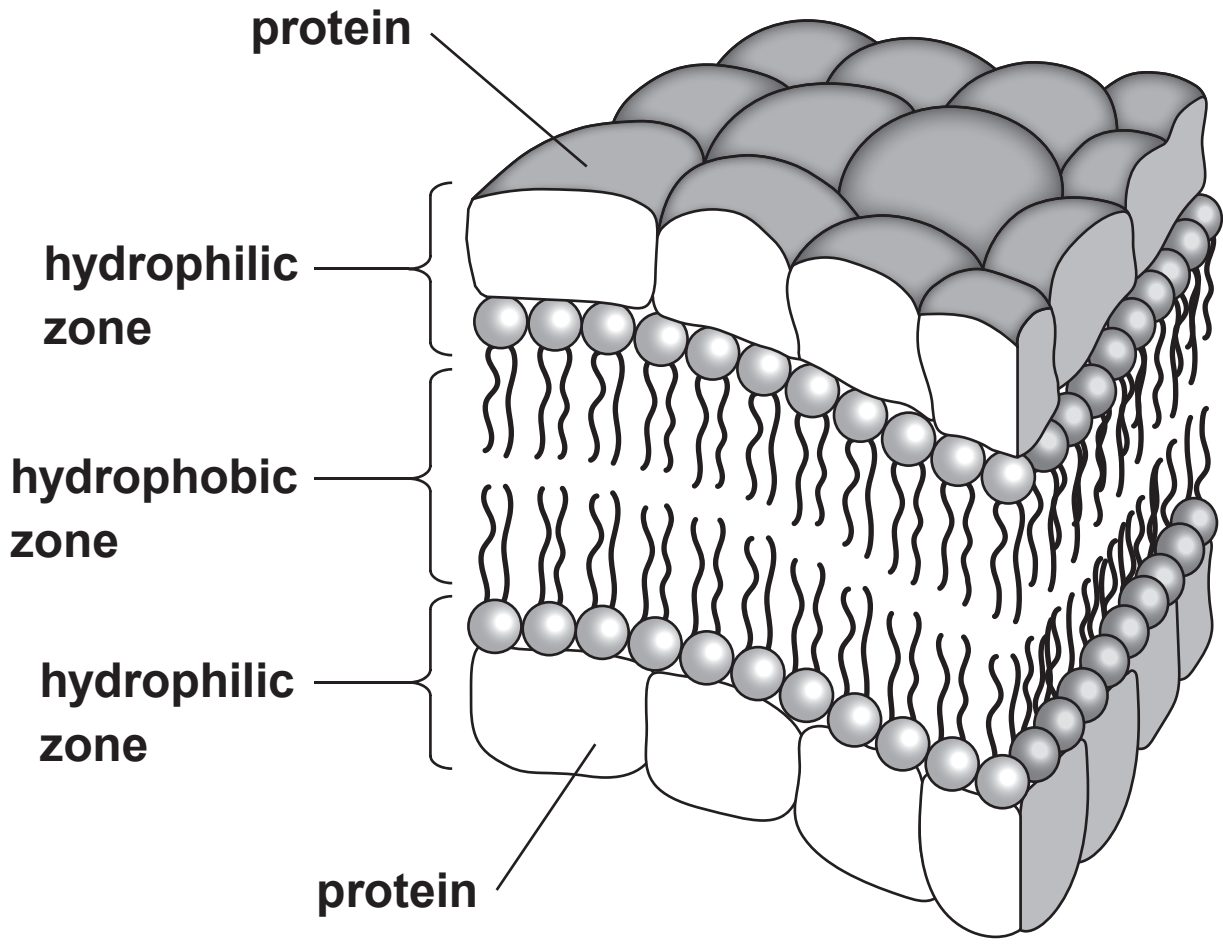
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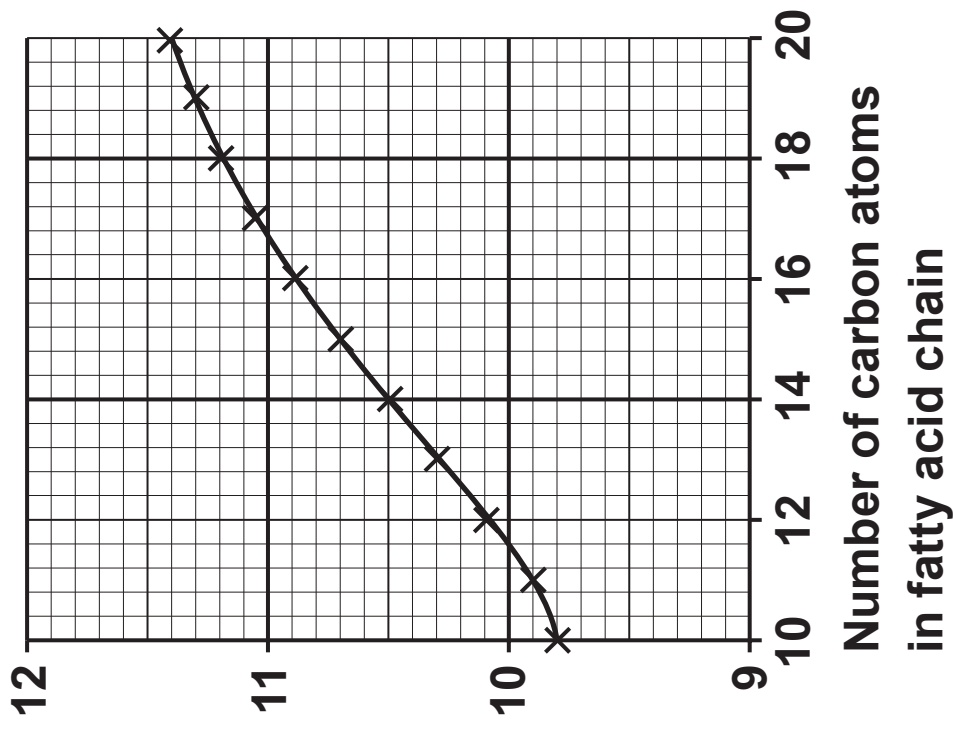
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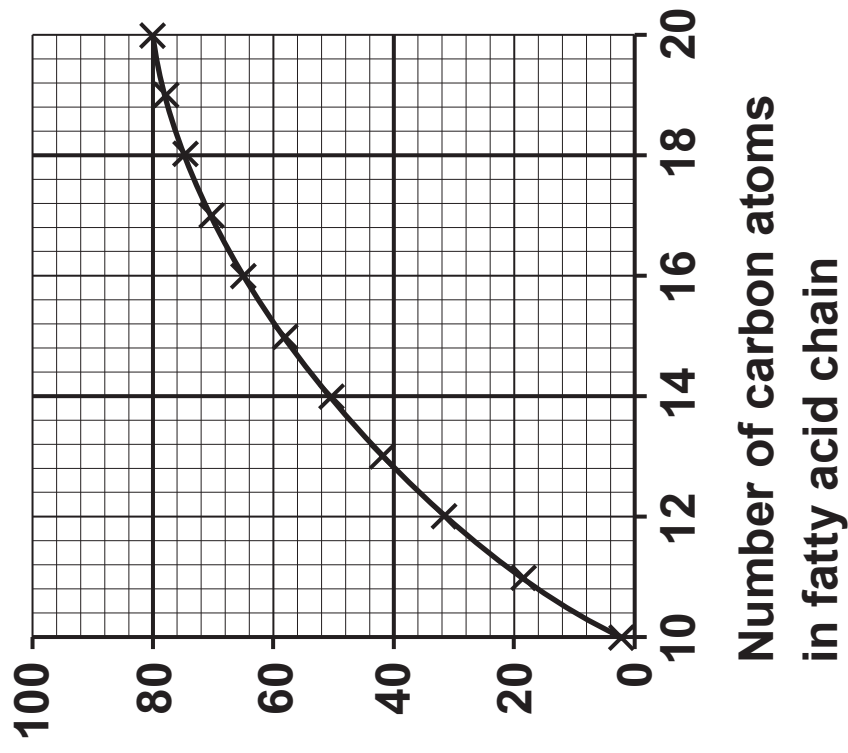




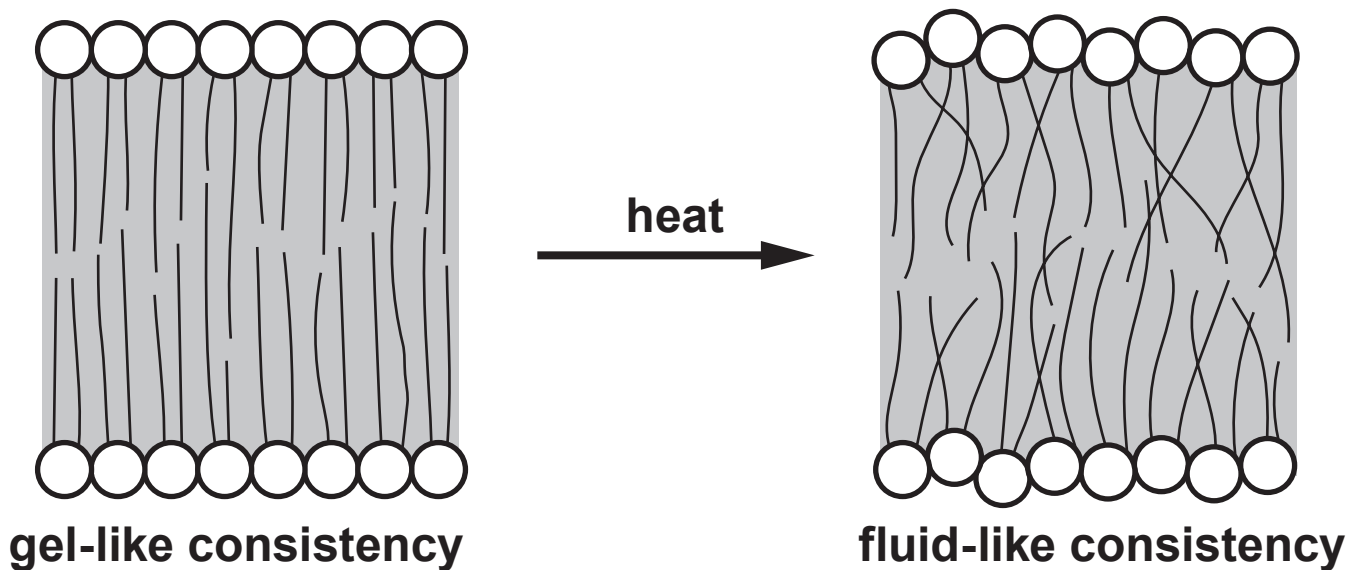
Intermolecular force / a.u.



Transition temperature / °C



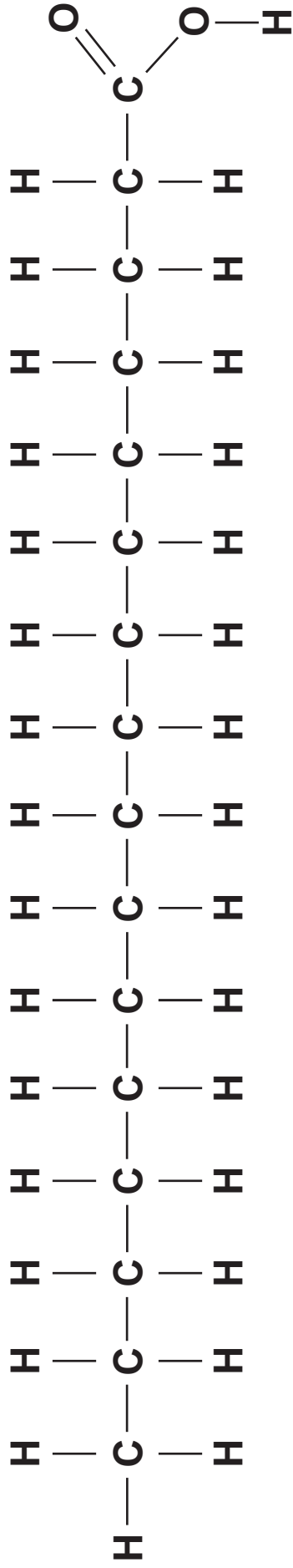
**Fluidity of the plasma membrane is due to the lateral movement of phospholipids. Increased fluidity occurs when the phospholipid bilayer changes from a more fixed gel-like consistency to a fluid-like consistency. Heating the molecules can result in increased fluidity.**



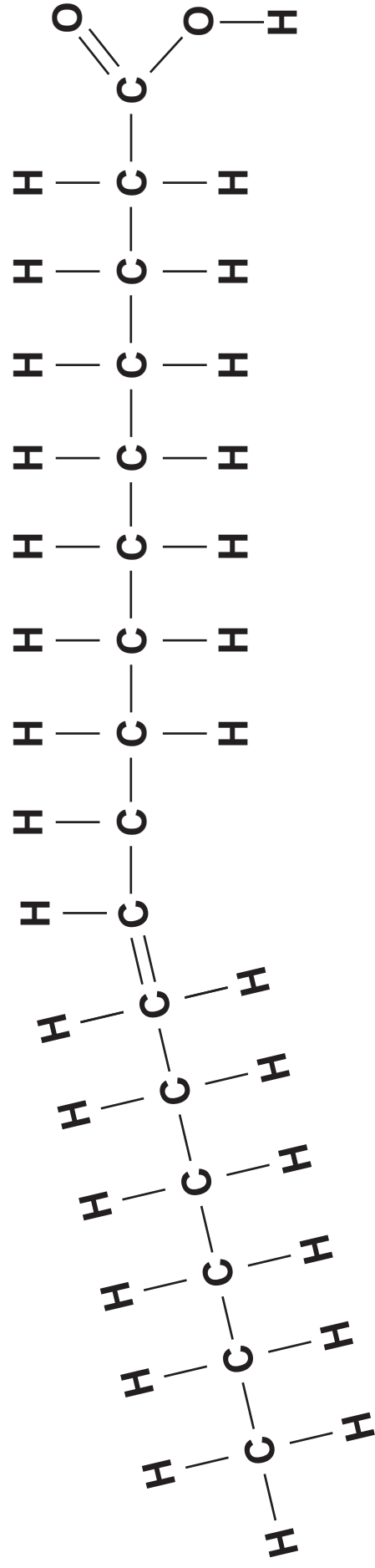
**The transition temperature, is the temperature at which the phospholipid bilayer changes from a gel like consistency to a fluid like consistency. This can also be affected by the length of the fatty acid chains which affect the strength of the intermolecular forces. These relationships are shown in the graphs opposite.**



### Saturated Fatty Acid



### Unsaturated Fatty Acid





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**Cholesterol is a non-polar substance that is produced in the body and obtained from foods that come from animals (particularly egg yolks, meat, poultry, fish, and dairy products). The body needs this substance to build cell membranes. However, too much cholesterol increases a person's risk of developing heart disease.**

**5(b) (iii) Suggest the position of cholesterol molecules within the plasma membrane. [1]**

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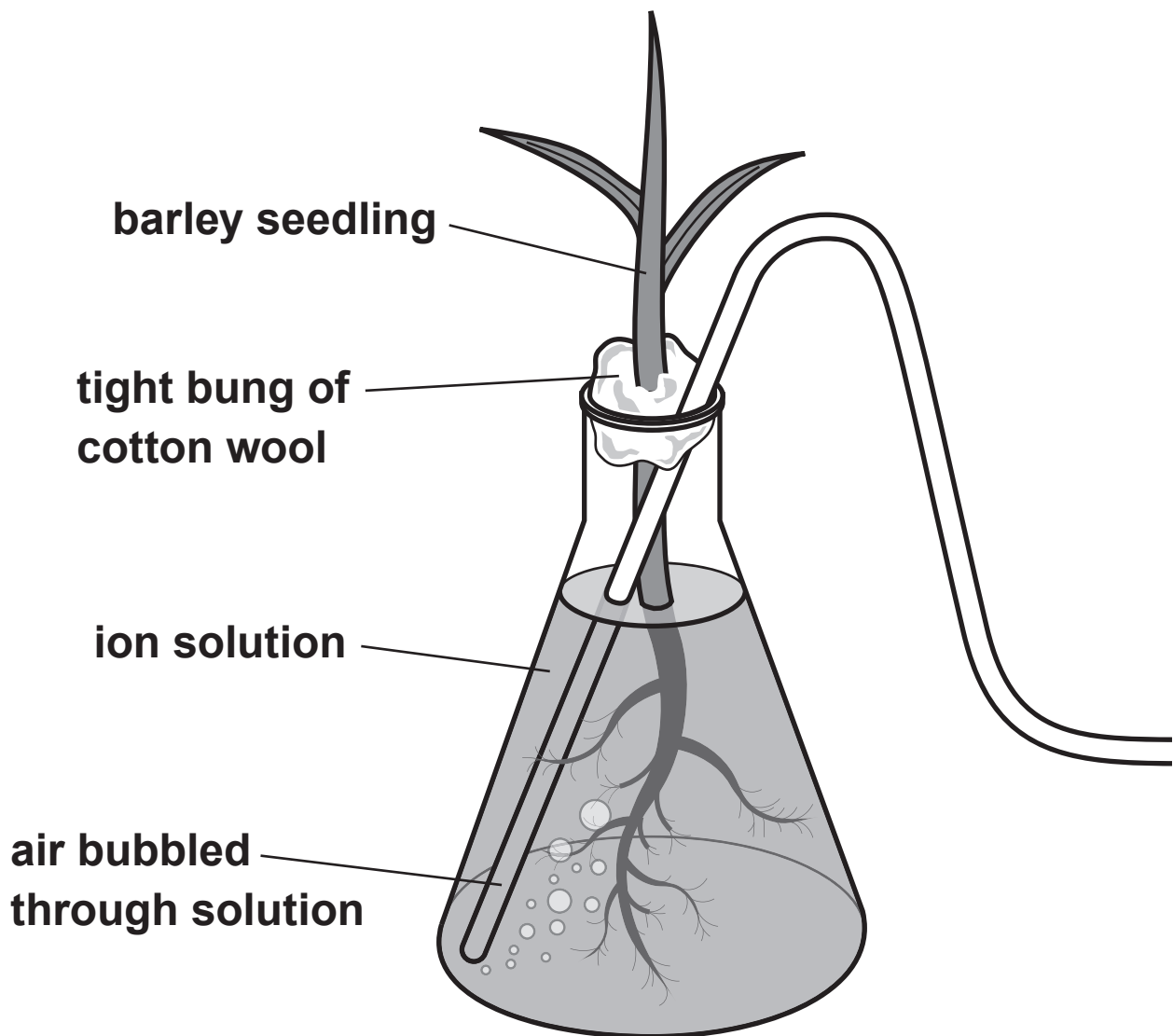
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ION	ION CONCENTRATION / $\text{mmol dm}^{-3}$	
	SURROUNDING SOLUTION	ROOT TISSUE
calcium ( $\text{Ca}^{2+}$ )	1.0	57.0
magnesium ( $\text{Mg}^{2+}$ )	0.3	33.0
phosphate ( $\text{PO}_4^{3-}$ )	0.9	1.6





