

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Thursday 25 May 2023 – Morning

AS Level Biology A

H020/02 Depth in biology

**Time allowed: 1 hour 30 minutes
plus your additional time allowance**

YOU CAN USE:
a scientific or graphical calculator
a ruler (cm/mm)

Please write clearly in black ink.

Centre number

Candidate number

First name(s) _____

Last name _____

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS

Use black ink. You can use an HB pencil, but only for graphs and diagrams.

Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.

Answer ALL the questions.

Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION

The total mark for this paper is 70.

The marks for each question are shown in brackets [].

Quality of extended response will be assessed in questions marked with an asterisk (*).

ADVICE

Read each question carefully before you start your answer.

BLANK PAGE

- 1 (a) Two cubes represent a large and a small multicellular plant.

FIG. 1.1

**Large multicellular
plant**

**Small multicellular
plant**

Length = 2 cm

Width = 2 cm

Depth = 2 cm

Surface area : volume

= 6:1

- (i) Using the data provided in FIG. 1.1, calculate the surface area : volume of the large multicellular plant.

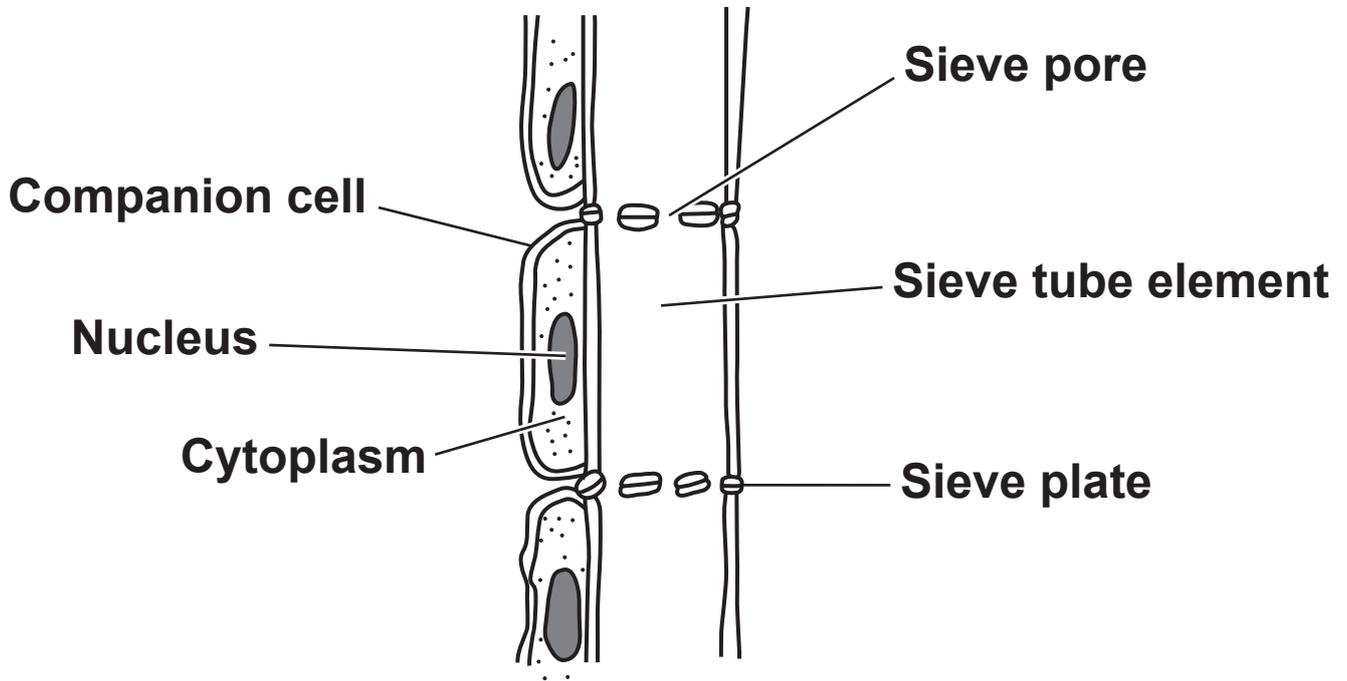
Surface area : volume = _____ [2]

(ii) Explain why a large multicellular plant needs a transport system but a small multicellular plant does not.

[2]

(b)* FIG. 1.2 shows a diagram of phloem tissue in the stem of a herbaceous dicotyledonous plant.

FIG. 1.2



With reference to FIG. 1.2 outline the structure and function of phloem tissue in the stem of a herbaceous dicotyledonous plant. [6]

Additional answer space if required.

BLANK PAGE

2 (a) (i) State the cause of transpiration in plants.

_____ [1]

(ii) Two factors that affect the rate of transpiration in plants are humidity and air movement.

Name ONE other factor that affects the rate of transpiration in plants.

_____ [1]

(b) A class of students investigated the effect of humidity on the rate of transpiration from a leafy shoot.

They made the assumption that the volume of water uptake by a leafy shoot is equivalent to the volume of water lost through transpiration.

This is the method the class followed:

The class was divided into three groups.

Each group had a potometer and a leafy shoot, shown in FIG. 2.1 on the next page.

Each group investigated one humidity level and completed three trials.

They measured the distance moved by the air bubble in a fixed time.

Group A used only the apparatus shown in FIG. 2.1 on the next page.

Groups B and C added to the apparatus. They put a clear plastic dome over the leafy shoot and used a water spray to vary the humidity around the leafy shoot. This is shown in FIG. 2.2 on the next page.

FIG. 2.1

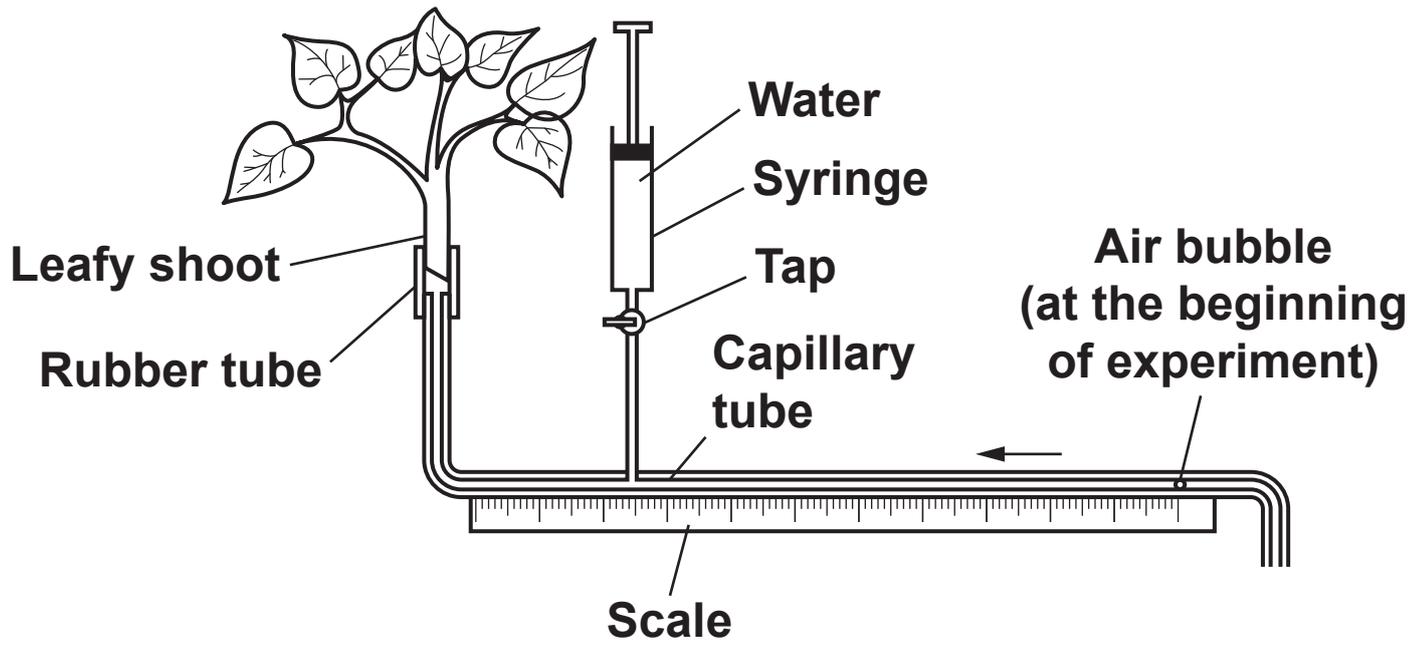
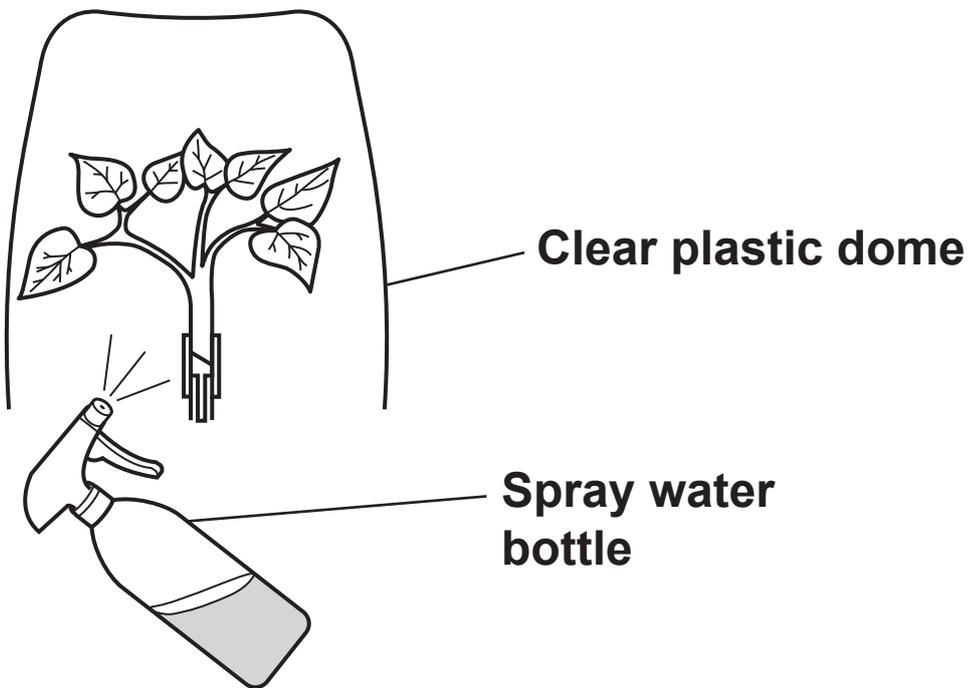


FIG. 2.2



- (i) Suggest **THREE** improvements the students could have made to their investigation.

Improvement 1

Improvement 2

Improvement 3

[3]

The students' results are shown in the tables.

GROUP A. Experiment conducted for 3 minutes.

Number of sprays of water	Distance moved by bubble (mm)				
	Trial 1	Trial 2	Trial 3	Mean	Rate of bubble movement (mm min ⁻¹)
0	34	30	31		

GROUP B. Experiment conducted for 5 minutes.

Number of sprays of water	Distance moved by bubble (mm)				
	Trial 1	Trial 2	Trial 3	Mean	Rate of bubble movement (mm min ⁻¹)
1	31	34	32	32.3	6.5

GROUP C. Experiment conducted for 5 minutes.

Number of sprays of water	Distance moved by bubble (mm)				
	Trial 1	Trial 2	Trial 3	Mean	Rate of bubble movement (mm min ⁻¹)
2	12	10	9	10.3	2.1

- (ii) Complete the table by filling in the missing values for mean AND rate of bubble movement for group A.

Give your answers to 1 decimal place.

Mean = _____ mm

Rate of bubble movement = _____ mm min⁻¹
[2]

- (iii) State the conclusion that can be drawn from the students' results.

_____ [1]

- (c) The students wanted to see how air movement affects rate of transpiration.

Describe how you would **MODIFY** the apparatus shown in FIG. 2.1 and FIG. 2.2 to determine how air movement affects rate of transpiration.

[2]

- 3 (a) A group of students was provided with a sample of an unknown liquid and various chemical reagents. It was suggested that the sample of unknown liquid contained protein.

Here is the chemical test proposed by one of the students to test this suggestion:

Add 3 cm³ of unknown liquid sample to an equal volume of sodium hydroxide solution

Mix

Leave to stand for 5 minutes.

- (i) The above test would not detect the presence of protein in the sample.

State the change that needs to be made to this test to enable protein to be detected.

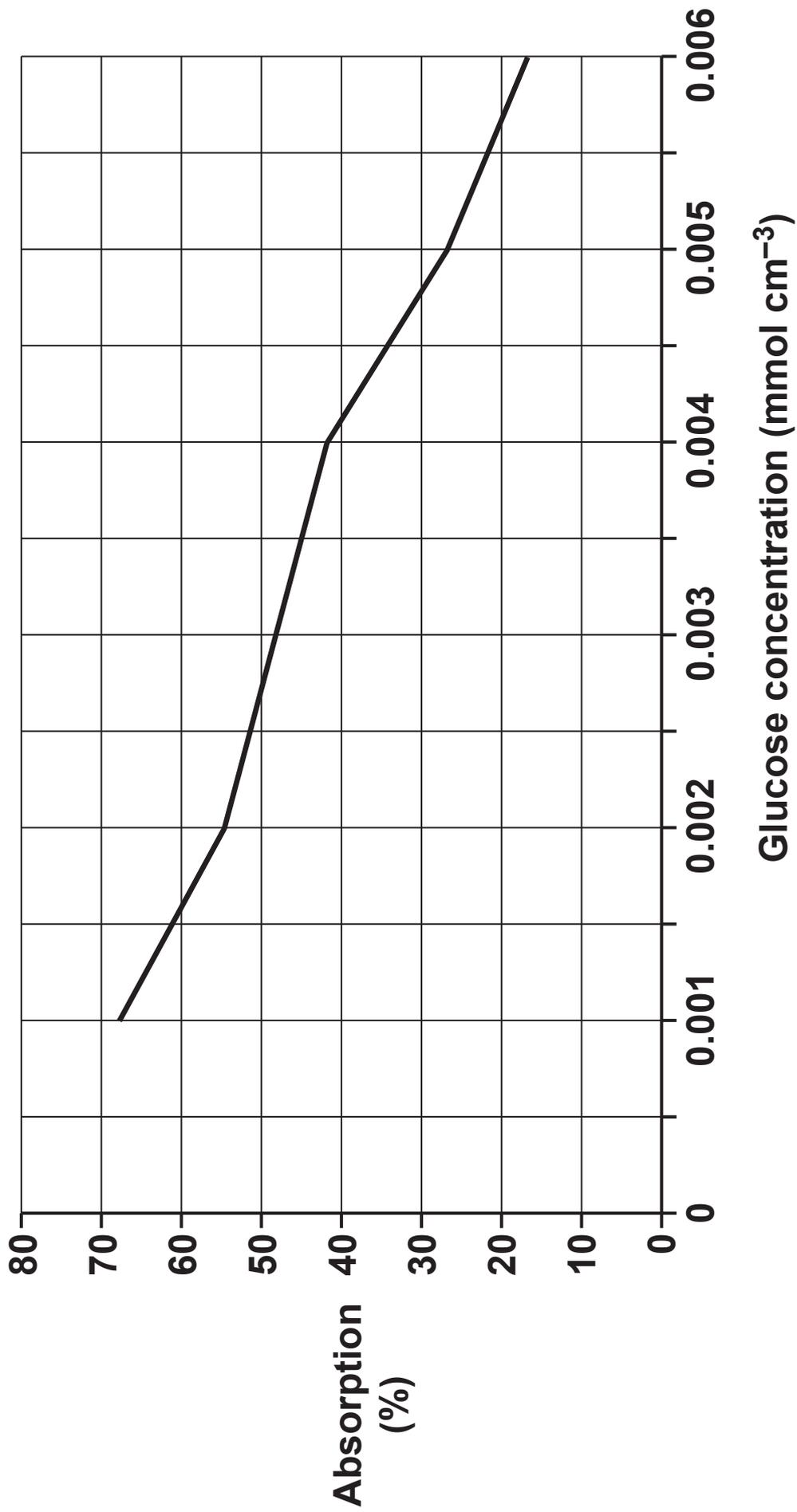
_____ [1]

- (ii) Sodium hydroxide is a white solid ionic compound which is highly soluble in water. It consists of anions and cations.

Complete the table below. [2]

State the chemical symbol of the ANION present in sodium hydroxide.	
State one use of this ANION in a biological process.	

Additional answer space if required.



The students found that the test solution had an absorption value of 45%.

Use the graph to estimate the glucose concentration in the test solution.

Give your answer in mmol dm^{-3} .

Concentration = _____ mmol dm^{-3} [2]

4 (a) The Humboldt penguin is protected by the Convention on International Trade in Endangered Species (CITES).

The Humboldt penguin lives on the Pacific coast of South America.

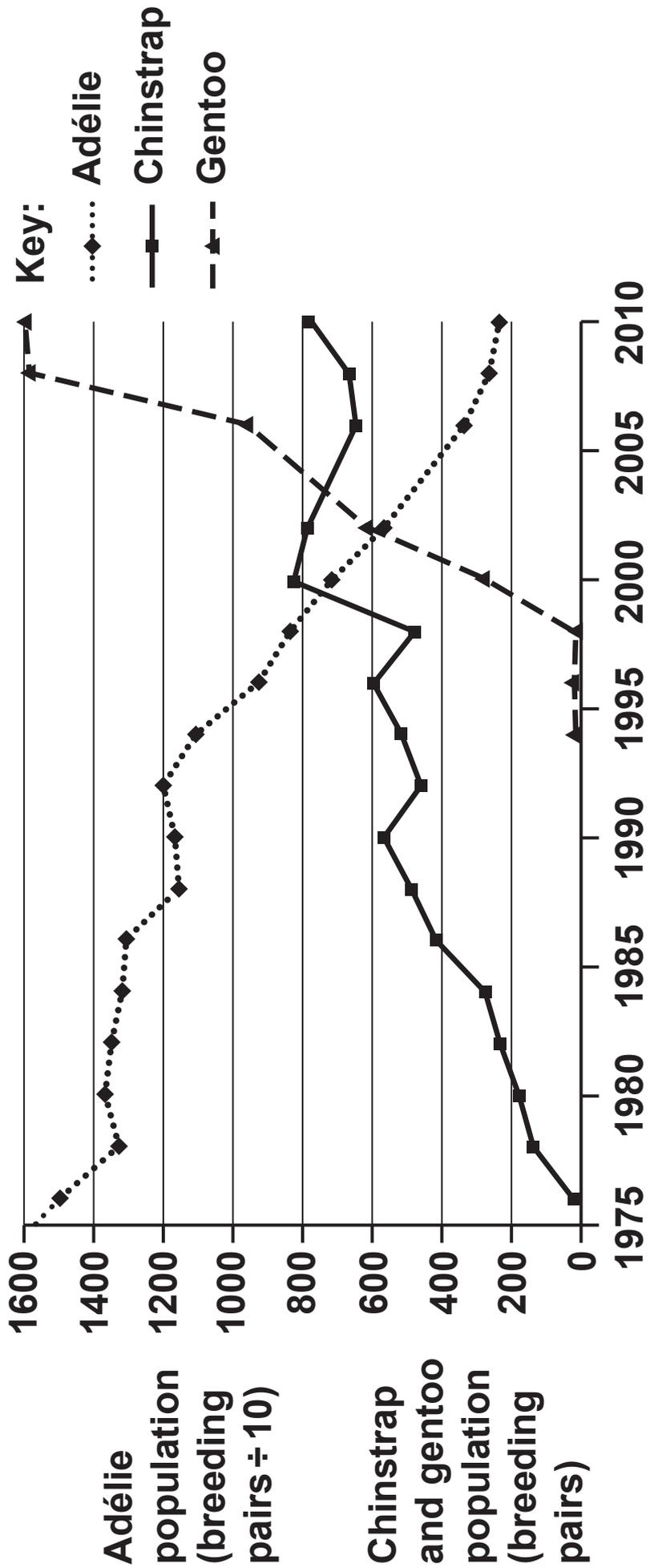
The breeding grounds for the Humboldt Penguin contains layers of guano.

Guano is the accumulated excrement of seabirds. Guano was collected by humans as it is a valuable fertiliser.

Penguins were killed for their oils and skin.

Suggest how CITES can help prevent the decline of the Humboldt penguin.

[2]



- 5 (a) Measles, Mumps and Rubella are communicable diseases. They can be prevented by the use of the MMR vaccine which is administered to children.

The table below shows some data on the number of children given the MMR vaccine and the incidence of measles between 2012 and 2014.

MMR vaccinations		
Date	Country	Number of vaccinations administered
2013 (Oct to Dec)	England	171,855
2014 (Jan to March)	England	162,193
Confirmed cases of measles		
Date	Country	Number of confirmed cases
2012	England and Wales	2,032
2013	England	1,414
2014	England	102

- (i) Using the data provided in the table, calculate the percentage decrease in the number of vaccinations administered in England between 2013 and 2014.

Give your answer to 2 significant figures.

Percentage decrease = _____ [2]

(b) Rheumatoid arthritis is an autoimmune disease that causes pain in skeletal joints.

(i) Explain the meaning of the term AUTOIMMUNE DISEASE.

_____ [1]

(ii) Collagen is a protein found in ligaments. Ligaments attach bone to bone and stabilise joints.

State the properties of collagen that make it suitable for this function.

_____ [2]

(iii) Neutrophils are produced by stem cells.

State where in the body these stem cells are found.

_____ [1]

(iv) A student wrote the following passage about the immune system:

'T helper cells produce cell signalling molecules called perforins. These stimulate the activity of B cells which increase antibody production. Agglutinins cause pathogens with antigen-toxin complexes to clump together.'

Identify TWO errors in the statement and write a correction for each error.

1 _____

2 _____

[2]

(c) Parkinson's disease is a neurological condition which results in problems with co-ordination of body movements.

It can be caused by the death of dopamine producing nerve cells in a part of the midbrain called the substantia nigra.

Body movements become slow and abnormal due to reduction in dopamine.

Drugs are available but they only slow down the progress of Parkinson's disease.

Suggest and explain how stem cells might be used to help treat Parkinson's disease.

[2]

BLANK PAGE

- 6 (a) Here is some information about reproduction in two members of the animal kingdom.**

Komodo dragons are large lizards that usually reproduce sexually, but very rarely females can reproduce asexually.

Starfish can reproduce asexually by a process known as fragmentation. This is when a small piece of the adult starfish breaks off and starts to grow on its own to form a clone of its parent.

- (i) Describe the role of mitosis in fragmentation.**

[2]

- (ii) State ONE other function of mitosis in starfish.**

[1]

- (b) HeLa cells and RPE1 cells are cell lines that are commonly used in research. Scientists can use these cell lines to observe mitosis in human tissues outside the human body.

Scientists use the term mitotic index to describe the proportion of cells in a sample that are undergoing mitosis.

A study was carried out using a chemical CDK1. This chemical increased the mitotic index of HeLa and RPE1 cells so that mitosis could be better observed.

Here are the results from the study:
31 HeLa cells were found to be undergoing mitosis in the field of view through a microscope. The mitotic index for HeLa cells was found to be 0.36.

The mitotic index for RPE1 cells was found to be 0.16.

Total number of RPE1 cells in the field of view were 75.

Calculate the total number of HeLa cells that were in the field of view.

Use the formula:

Mitotic index =

$$\frac{\text{Number of cells in the field of view undergoing mitosis}}{\text{Total number of cells in the field of view}}$$

Give your answer to 2 significant figures.

Total number of HeLa cells = _____ [2]

7 The diagrams below are of two specialised cells.

FIG. 7.1 shows a sperm cell from a mammal. FIG. 7.2 shows a palisade cell from a plant.

FIG. 7.1

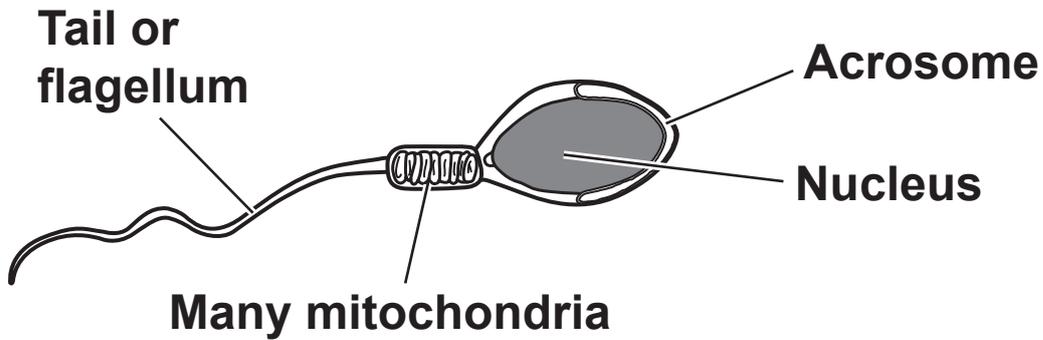
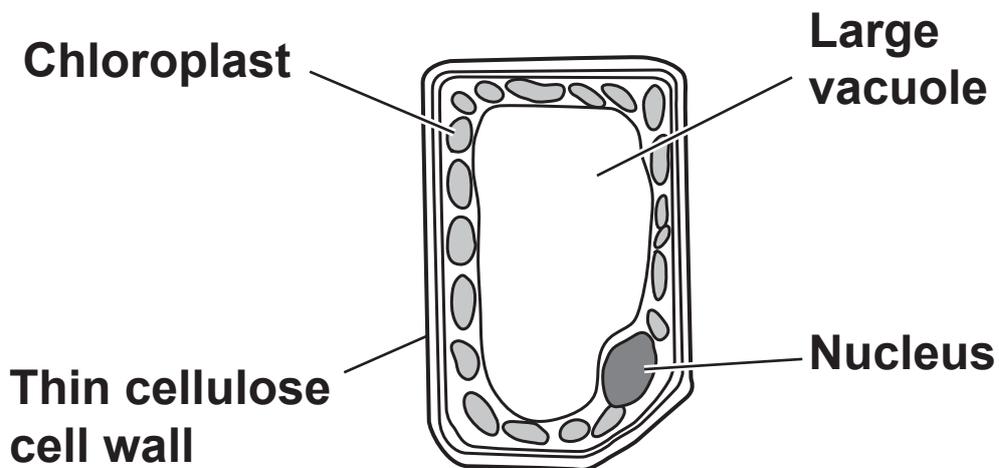


FIG. 7.2



(a) With reference to the features shown in FIG. 7.1, explain how the sperm cell is adapted to its function.

[2]

(b) With reference to the features shown in FIG. 7.2, explain how the palisade cell is adapted to its function.

[2]

END OF QUESTION PAPER

