OCR
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AS Level Biology A
H020/01 Breadth in biology
Sample Question Paper

Date – Morning/Afternoon
Version 2.2

Time allowed: 1 hour 30 minutes

You may use:
- a scientific or graphical calculator

First name										
Last name										
Centre number						**Candidate number**				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **24** pages.

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Section A

You should spend a maximum of 25 minutes on this section.

Answer **all** the questions.

1 Young mammals receive antibodies in their mother's milk.

This is an example of which type of immunity?

A artificial active immunity

B artificial passive immunity

C natural active immunity

D natural passive immunity

Your answer ☐ **[1]**

2 Which of the following descriptions is correct?

A Vaccination gives long-term protection, immunisation gives short-term protection.

B Vaccination involves injection of antigenic material and immunisation is the process of developing immunity.

C Vaccination involves injection of antigenic material, immunisation is injection of antibodies.

D Vaccination and immunisation have the same meaning.

Your answer ☐ **[1]**

3 When you listen to a human heartbeat through a stethoscope you can hear a two stage 'lub–dub' sound.

Which of the following causes the first 'lub' component?

A closing of the atrioventricular valves

B sound of blood rushing into the atria

C sound of blood rushing into the ventricles

D closing of semilunar valves

Your answer ☐ **[1]**

4 Zinc ions are necessary for the enzyme carbonic anhydrase to work.

Which statement correctly describes the nature and function of zinc ions in their interaction with carbonic anhydrase?

A inorganic ions and coenzymes

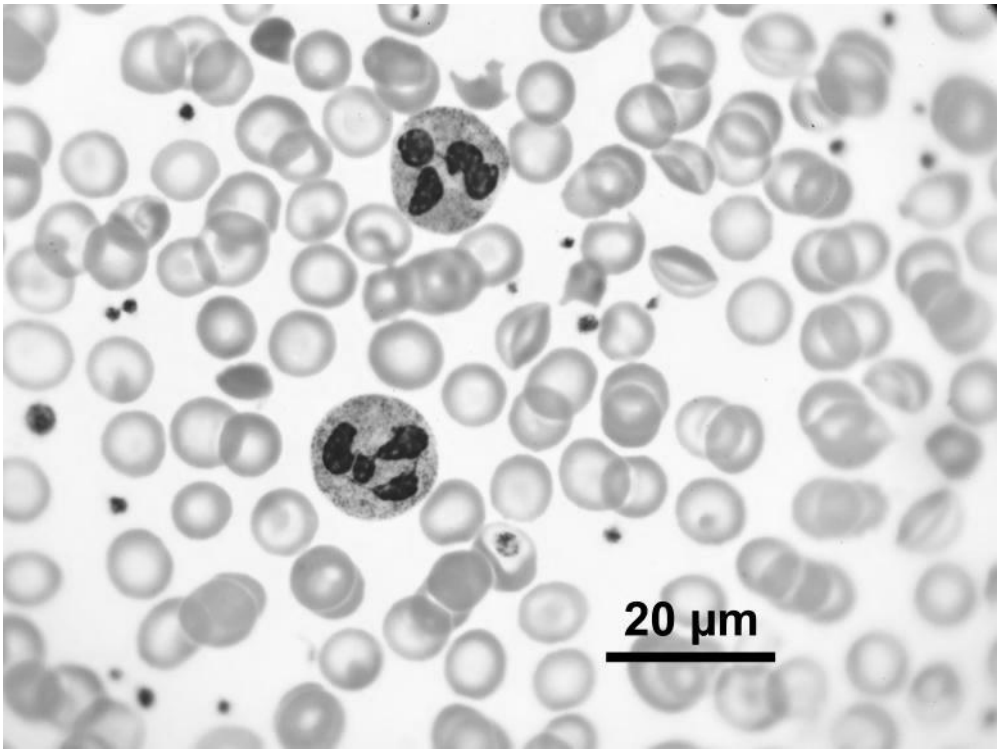
B vitamins and prosthetic groups

C inorganic ions and prosthetic groups

D vitamins and coenzymes

Your answer ☐ **[1]**

5 Using the light micrograph below and the formula $\frac{4}{3}\pi r^3$ what is the volume of a neutrophil?



A 2 μm^3

B 20 μm^3

C 200 μm^3

D 2000 μm^3

Your answer ☐ **[1]**

6 Three types of microscope are listed below.

Select the row that shows the correct use for each type of microscope.

	Type of microscope and what it is used to observe		
	Light microscope	**Transmission electron microscope**	**Laser scanning confocal microscope**
A	an object at a certain depth within a cell	cell surfaces	organelles
B	an object at a certain depth within a cell	cell surfaces	whole cells and tissues
C	whole cells and tissues	organelles	cell surfaces
D	whole cells and tissues	organelles	an object at a certain depth within a cell

Your answer ☐ **[1]**

7 Cyanobacteria are photoautotrophs and fossil records confirm their existence 3.5 billion years ago.

Which row describes the structure of cyanobacteria?

	Feature					
	Nucleus	**Circular DNA**	**Mitochondria**	**Ribosomes**	**Chloroplast**	**Cell wall**
A	✓		✓		✓	
B			✓		✓	✓
C	✓	✓		✓		
D		✓		✓		✓

Your answer ☐ **[1]**

8 **Fig. 8.1** shows an animal cell.

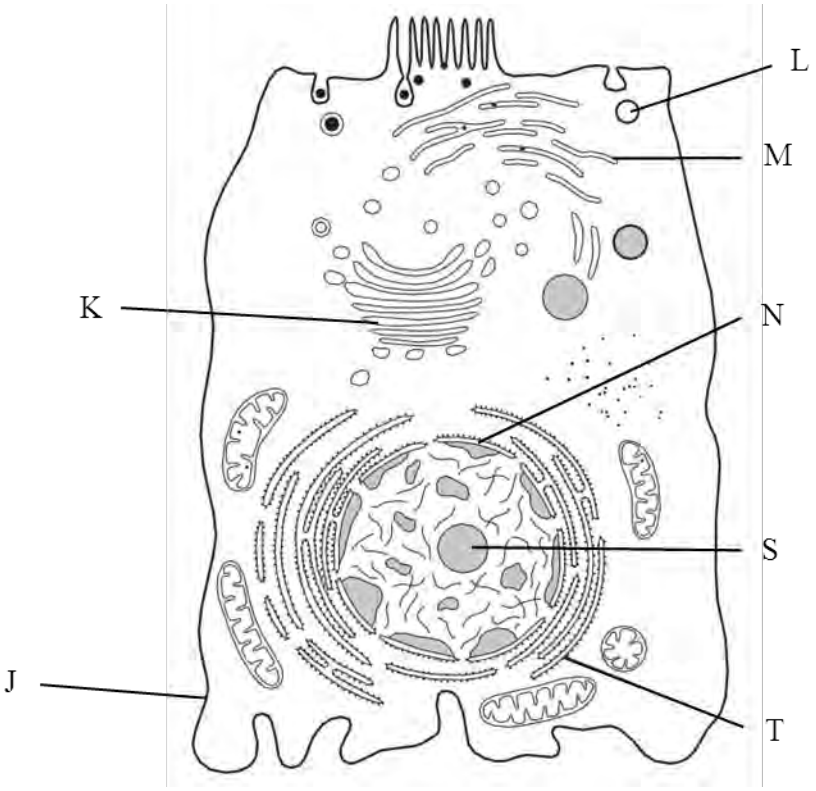


Fig. 8.1

Which option describes the correct sequence of organelles involved during the production and secretion of a protein from this cell?

A S, K, L, J **B** T, K, L, J **C** T, M, L, J **D** S, T, K, L

Your answer ☐ **[1]**

9 A length of DNA has the base sequence AATCGCGGTCGCTCA.

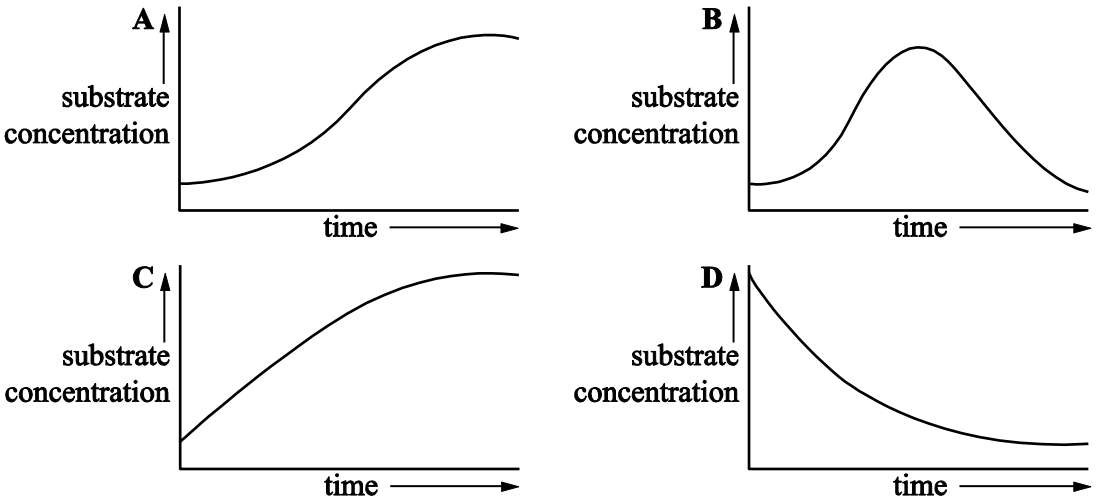
Select the row that shows the correct complementary DNA strand and the sequence of mRNA made during transcription of the DNA sequence above.

	Complementary DNA sequence	**mRNA sequence**
A	AATCGCGGTCGCTCA	UUAGCGCCAGCGAGU
B	TTAGCGCCAGCGAGT	UUAGCGCCAGCGAGU
C	TTAGCGCCAGCGAGT	TTAGCGCCAGCGAGT
D	TTAGCGCCAGCGAGT	AAUCGCGGUCGCUCA

Your answer ☐ **[1]**

10 A group of students monitored the **substrate** concentration during an enzyme-controlled reaction.

Select the graph that correctly shows how the substrate concentration changes during the course of the reaction.



Your answer ☐ **[1]**

11 There are two types of nuclear division, mitosis and meiosis. Meiosis incorporates two divisions of the nucleus.

Which table shows the correct results of nuclear division?

A

	Genetic variation	Reduction division
Mitosis	×	×
Meiosis 1	✓	✓
Meiosis 2	×	×

B

	Genetic variation	Reduction division
Mitosis	×	×
Meiosis 1	✓	✓
Meiosis 2	✓	×

C

	Genetic variation	Reduction division
Mitosis	×	✓
Meiosis 1	✓	×
Meiosis 2	✓	✓

D

	Genetic variation	Reduction division
Mitosis	×	×
Meiosis 1	✓	✓
Meiosis 2	×	✓

Your answer ☐ **[1]**

12 The following events occur when carbon dioxide enters an erythrocyte in a capillary.

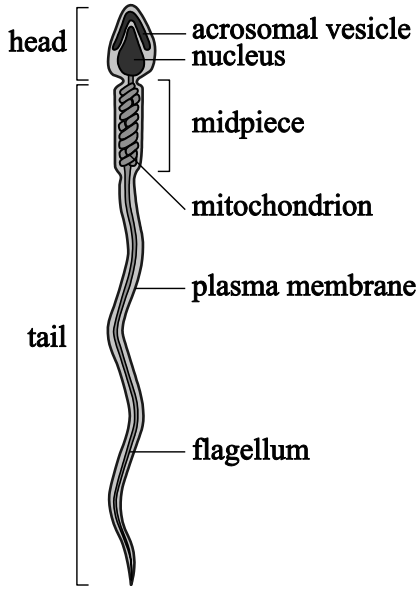
1. Hydrogencarbonate ions diffuse into the plasma from the erythrocyte.
2. Dissociation of carbonic acid.
3. Carbon dioxide reacts with water forming carbonic acid.
4. Chloride ions diffuse into erythrocyte from plasma.

In which sequence do they occur?

	First step →			**Final step**
A	2	4	1	3
B	3	2	1	4
C	3	1	4	2
D	2	3	4	1

Your answer ☐ **[1]**

13 Sperm cells are an example of a specialised cell.



Which statement correctly describes one specialisation of a sperm cell?

A tail contains flagellum which generates ATP

B head contains chromosomes in homologous pairs

C acrosome contains enzymes to digest outer portion of egg

D midpiece contains mitochondria which enter egg

Your answer ☐ **[1]**

14 Which of the following statements correctly describes the mechanism behind water movement between plasma and tissue fluid at the venule end of a capillary?

A The hydrostatic pressure is greater than the oncotic pressure so water moves out of the capillary.

B The hydrostatic pressure is greater than the oncotic pressure so water moves into the capillary.

C The oncotic pressure is greater than the hydrostatic pressure so water moves out of the capillary.

D The oncotic pressure is greater than the hydrostatic pressure so water moves into the capillary.

Your answer ☐ **[1]**

15 Emphysema is a chronic respiratory disease where elastase is produced by phagocytes in the lungs, which breaks down lung tissue. This means that a person with emphysema cannot fully exhale.

Fig. 15.1 is a diagram of a small section of a healthy lung.

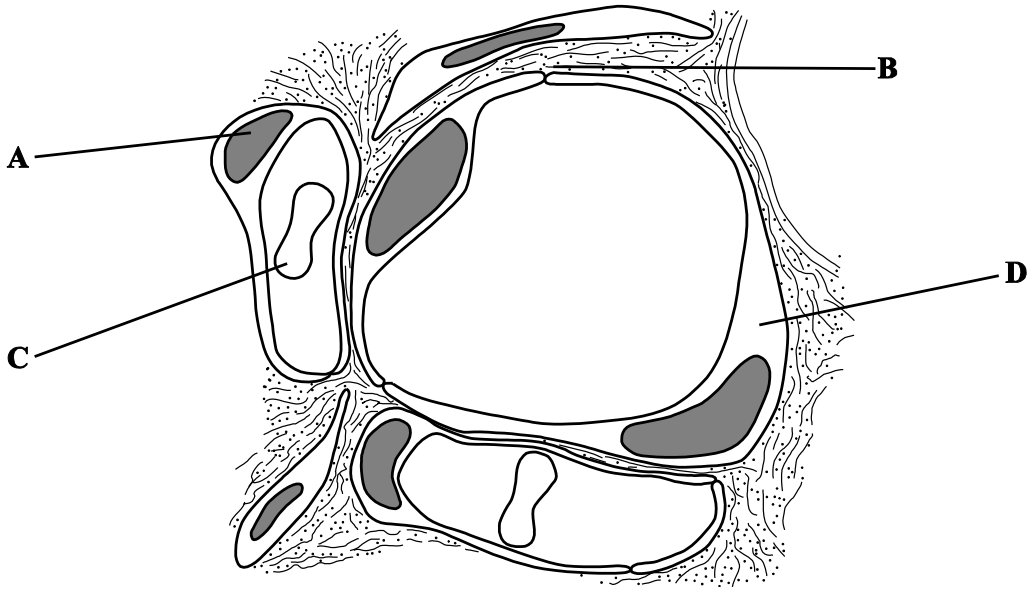
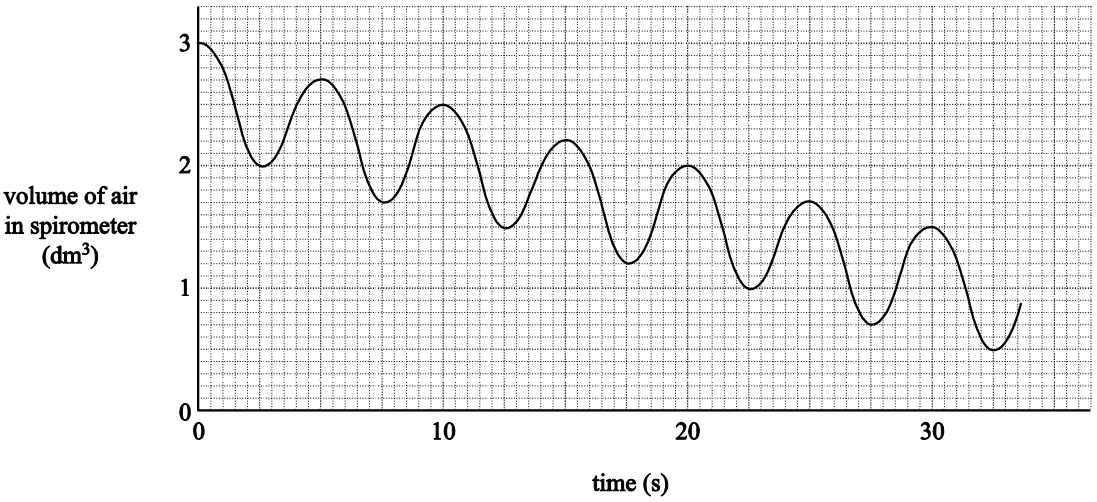


Fig. 15.1

Which label shows the area of lung tissue that is broken down by elastase?

Your answer ☐ **[1]**

16 The following spirometer trace shows the results of an experiment. Soda lime was used to extract carbon dioxide from exhaled air.



What is the rate of oxygen consumption in the experiment?

A 1.0 dm^3 **B** 3.0 $dm^3\ min^{-1}$ **C** 5.0 $dm^3\ min^{-1}$ **D** 12 breaths min^{-1}

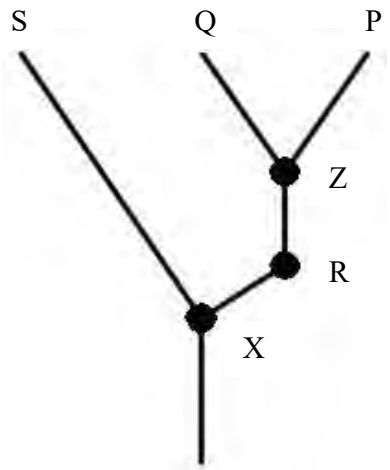
Your answer ☐ **[1]**

17 Q, P, R and S are related species of organisms.

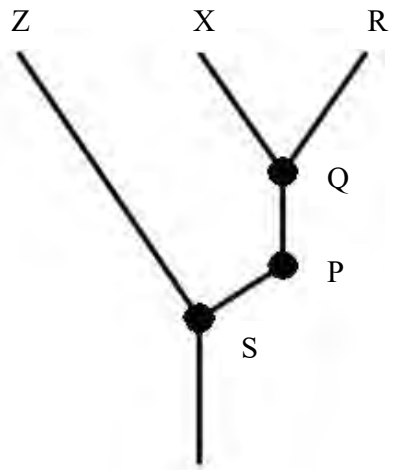
Species X is an extinct recent common ancestor of species Q and R.
X, Q and R all evolved from species P.
Species S is the least related to the others, with extinct species Z being its most recent phylogenetic link to the other species.

Which of the following phylogenetic trees correctly represents the relationships described above?

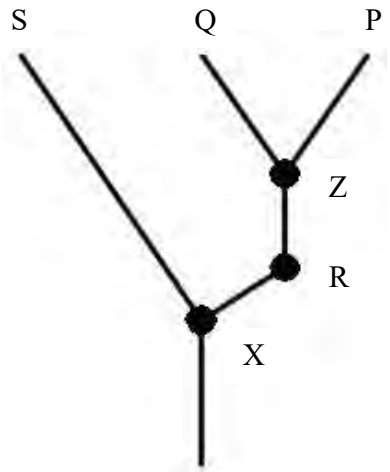
A



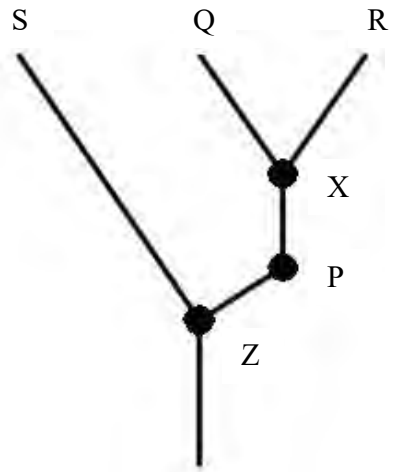
B



C



D



Your answer ☐ **[1]**

18 Which of the following formulae of fatty acids represents a saturated fatty acid?

Statement 1: Palmitic acid, $C_{15}H_{31}COOH$

Statement 2: Oleic acid, $C_{17}H_{33}COOH$

Statement 3: Linoleic acid, $C_{17}H_{31}COOH$

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐ **[1]**

19 A chemical produced by a metabolic pathway binds to the initial enzyme in the pathway. The chemical binds to the enzyme at a site away from the active site and inhibits the enzyme action.

Which of the following statements about the mode of action of the chemical is/are correct?

Statement 1: It is an end product inhibitor.

Statement 2: It is a competitive inhibitor.

Statement 3: It binds to the allosteric site of the enzyme.

A 1, 2 and 3

B Only 1 and 2

C Only 1 and 3

D Only 1

Your answer ☐ **[1]**

20 The following statements refer to the movement of water from the cortex of the root into the xylem.

Which of the following statements is/are true?

Statement 1: Most of the water moves across the root cortex by the apoplast pathway.

Statement 2: At the endodermis water has to enter the symplast pathway.

Statement 3: Casparian strips in the endodermis contain the chemical callose.

A 1, 2 and 3

B Only 1 and 2

C Only 1 and 3

D Only 1

Your answer ☐ **[1]**

Section B

Answer **all** the questions.

21 Transmembrane proteins are involved in the transport of sugars across the plasma membrane.

(a) Glucose can be moved into cells by facilitated diffusion using proteins called GLUT proteins. These proteins expose a single binding site on one side of the membrane. Glucose binds to this site and causes a change in the shape of the protein. This change moves the glucose across the membrane and releases it on the other side.

(i) Explain why facilitated diffusion via GLUT proteins requires no metabolic energy.

……...

……...

……...

…… **[2]**

(ii) Glucose can also be absorbed by an active process which requires metabolic energy. What is the immediate source of this energy in cells?

…… **[1]**

(iii) Explain why glucose cannot pass through a cell membrane by simple diffusion.

……...

……...

……...

…… **[2]**

(b) A student investigated the effect of alcohol on the permeability of membranes in plant cells. The student wanted to find the minimum concentration of alcohol at which all the cells became permeable to the stain Evans Blue. Evans Blue stains the nucleus of the cell.

The student followed this method:

- The student placed samples of onion epidermis into different concentrations of ethanol.
- After five minutes a few drops of Evans Blue stain was added to each sample.
- After a further five minutes, the samples were viewed using a light microscope.
- The student observed 20 cells and recorded how many contained a blue nucleus.

Table 21.1 shows the student's results.

Concentration of ethanol (%)	Number of cells with a blue nucleus	% cells with blue nucleus
0	1	5
10	4	20
20	16	80
30	20	100
40	20	100

Table 21.1

(i) Identify **one** limitation of the method the student followed.

……...

……. **[1]**

(ii) On evaluating the results the student decided to use a narrower range of ethanol concentrations.

Suggest what range of ethanol concentrations the student should use and give a reason for your choice.

……...

……...

……...

……. **[2]**

(iii) How would using a narrower range of alcohol concentrations improve the investigation?

……...

……. **[1]**

22 **Fig. 22.1** shows a transverse section of the stem of a typical pondweed viewed using a ×10 objective lens. Part of a graticule is shown below the stem. The markings on the graticule are 0.1 mm apart.

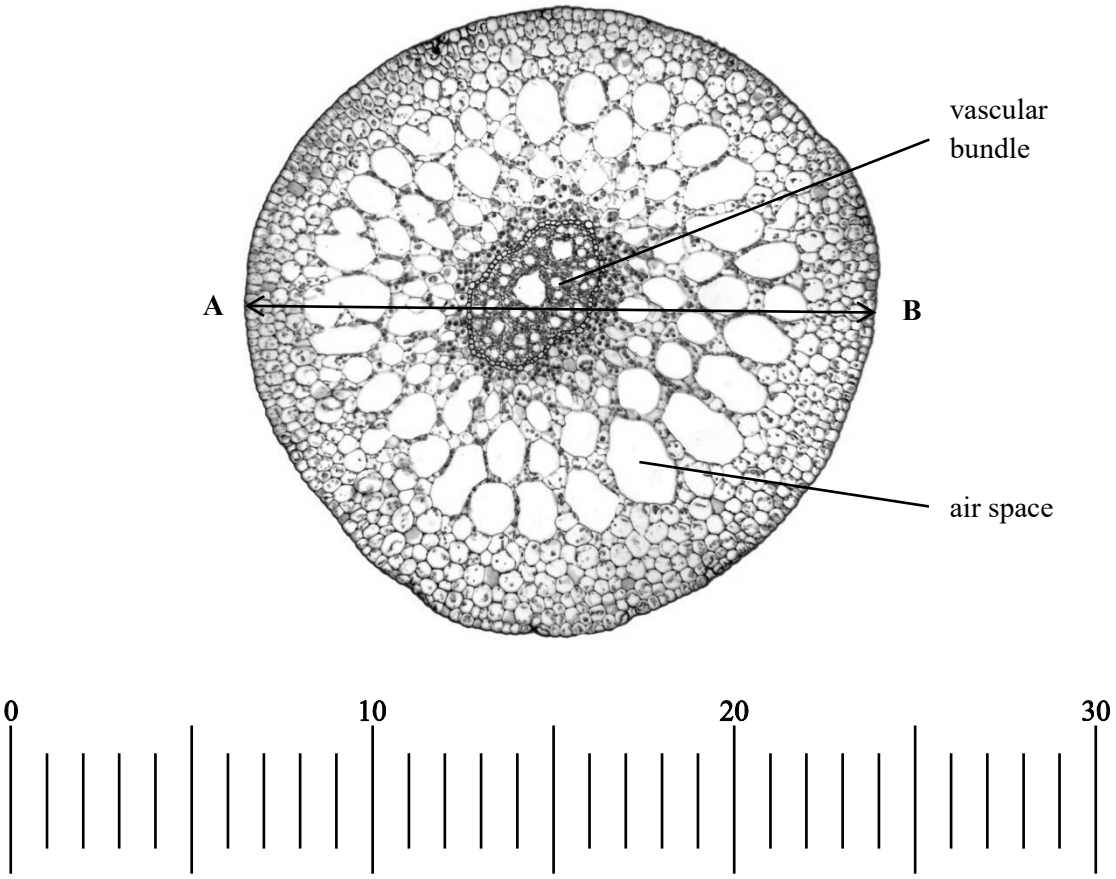


Fig. 22.1

(a) **(i)** Measure the width of the stem between points **A** and **B**.
Give your answer to the nearest 0.1 mm.

Answer..... **[1]**

(ii) Calculate the magnification of the image in **Fig. 22.1**.

Answer..... **[2]**

(iii) The thin stem and thin cell walls do not provide much support for the leaf. Suggest how the leaf is supported.

.....

.....

..... **[2]**

(b) A student was asked to view cells from the phloem in transverse section using a high power objective lens. **Fig. 22.2** shows two diagrams of phloem tissue.

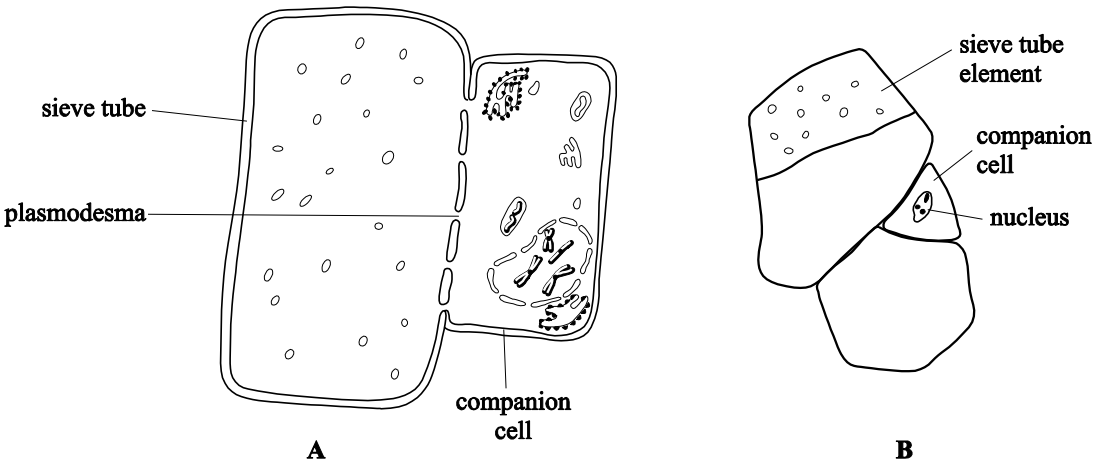


Fig. 22.2

(i) Which diagram is the more accurate representation of what the student could see? Justify your decision using **two** separate features of the diagrams.

.....

.....

.....

..... **[2]**

(ii) State what is meant by the *resolution* of a microscope.

.....

..... **[1]**

(iii) The slide viewed to draw the diagrams in **Fig. 22.2** had been stained.

Table 22.1 shows a list of stains and the cell feature that can be stained.

Stain	Cell feature stained
Nile blue	nuclei
eosin	cytoplasm
Sudan red	cell membrane
iodine	starch

Table 22.1

Which stain had the student used? Explain your answer.

……...

……...

……...

…… **[2]**

23 The concept of molecules with complementary shapes can be used to explain many processes in living things.

(a) Complete the following passage about the mechanism of enzyme action.

Enzymes are proteins which speed up the rate of biological reactions. They form an

..... by binding to their substrate at a site known as the

..... . This site has a specific shape created by the

..... structure of the protein molecule. This means that

each enzyme can bind to only one type of substrate molecule.

This is explained by the lock and key hypothesis. In an alternative hypothesis, the binding site

changes shape to fit more closely around the substrate molecule. This is called the

..... hypothesis. This hypothesis can help to explain

how enzymes enable reactions to occur at lower temperatures by reducing the

..... required for the reaction to occur.

[5]

(b) Another molecule that relies on a specific shape to bind to a specific compound is an antibody. **Fig. 23.1** shows the generalised structure of an antibody.

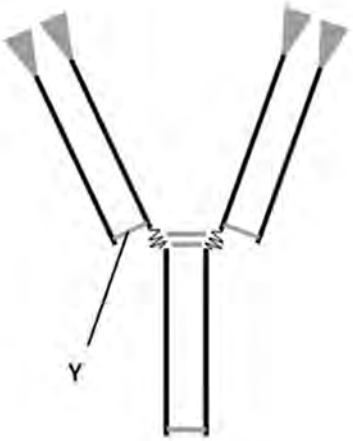


Fig. 23.1

(i) Draw a ring on **Fig. 23.1** to show a part of the molecule that has a shape complementary to the shape of an antigen.

[1]

(ii) The component labelled **Y** on the antibody is a bond.

State what type of bond is found here and give its function.

……...

…… [2]

(c) Lupus is an autoimmune disease. Lupus occurs when nuclear proteins are exposed and the immune system makes antibodies against these proteins. As a result the proteins clump together. These clumps stick to surfaces such as the blood vessel walls and cause fatigue, joint pain and skin rashes.

(i) What is meant by the term *autoimmune disease*?

……...

……...

……...

……. **[2]**

(ii) Suggest why antibodies specific to nuclear proteins are not normally made.

……...

……. **[1]**

(d) Scientists often use natural substances to help them develop specific new medicines.

State two possible sources of such natural substances.

…….....

…….. **[2]**

24 **(a)** The cassowary is a large, flightless bird found in the rainforest in parts of Australia. It feeds mainly on fruit. The seeds of the fruit are deposited on the rainforest floor.

(i) The cassowary is known as a *keystone species*. This means it is important for the survival of other species.

Suggest what role the cassowary plays in the survival of other species.

……...

……. **[1]**

(ii) The cassowary needs to be conserved for ecological reasons.

State **two** other reasons for maintaining biodiversity.

1…….

2…….

[2]

(b) The mountain gorilla is an endangered species with as few as 880 individuals surviving in the wild. Many of the animals have been 'habituated' to human contact. The health of these animals is monitored and medical assistance is given when necessary. Animals that are not habituated are rarely visited.

(i) Suggest one advantage **and** one disadvantage of keeping some gorilla families that have not been habituated.

……...

……...

……...

……. **[2]**

(ii) The gorilla population in one area, Virunga, has been regularly monitored (**Table 24.1**). The data have been collected by indirect methods such as collecting dung samples at nest sites. However, DNA analysis of another gorilla population suggests that estimates made by these indirect methods may be up to 6% inaccurate.

Year	Population in Virunga
1981	254
1989	320
2003	380
2010	480

Table 24.1

Calculate the mean annual percentage rate of growth of the gorilla population in Virunga between 1981 and 2010.

Answer……% **[2]**

(iii) In 1993 the Rio Convention on Biodiversity came into force. In 2010, one conservationist commented that the Rio Convention had had a real effect on the gorilla population.

Use the information above to evaluate the effect that the Rio Convention on Biodiversity has had on the gorillas in Virunga.

……...

……...

……...

……...

……...

…… **[3]**

25 **Fig. 25.1** shows a potometer.

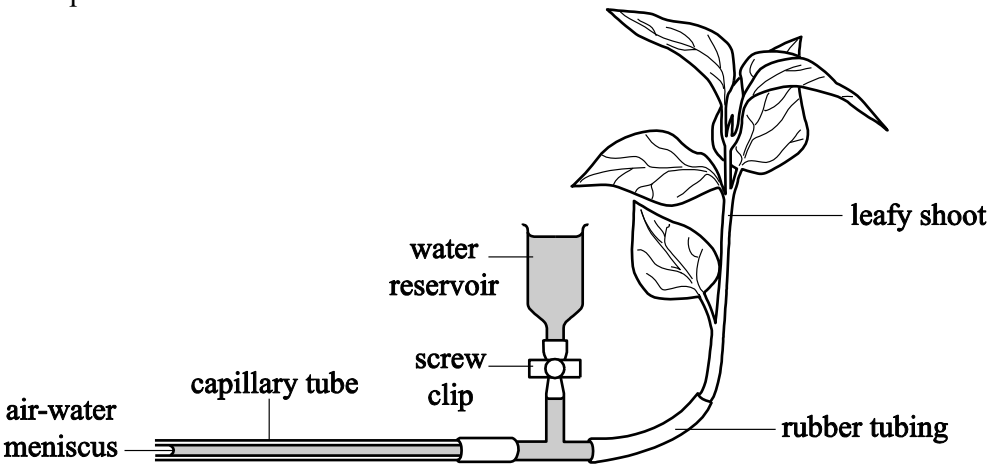


Fig. 25.1

(a) A student used this apparatus to investigate the role of stomata in transpiration. The student noted the position of the air–water meniscus each minute for five minutes.

The student then covered the underside of one of the leaves in petroleum jelly before repeating the measurements. This was continued until the undersides of all the leaves had been covered.
Table 25.1 shows the results.

Number of leaves with undersides covered in petroleum jelly	**Position of meniscus (mm) at**					
	0 min	**1 min**	**2 min**	**3 min**	**4 min**	**5 min**
0	0	23	44	65	84	102
1	0	20	40	58	77	95
2	0	16	31	47	61	76
3	0	11	23	37	50	62
4	0	9	17	24	32	40
5	0	6	11	16	22	28

Table 25.1

The student presented these results as a graph. **Fig. 25.2** shows the graph.

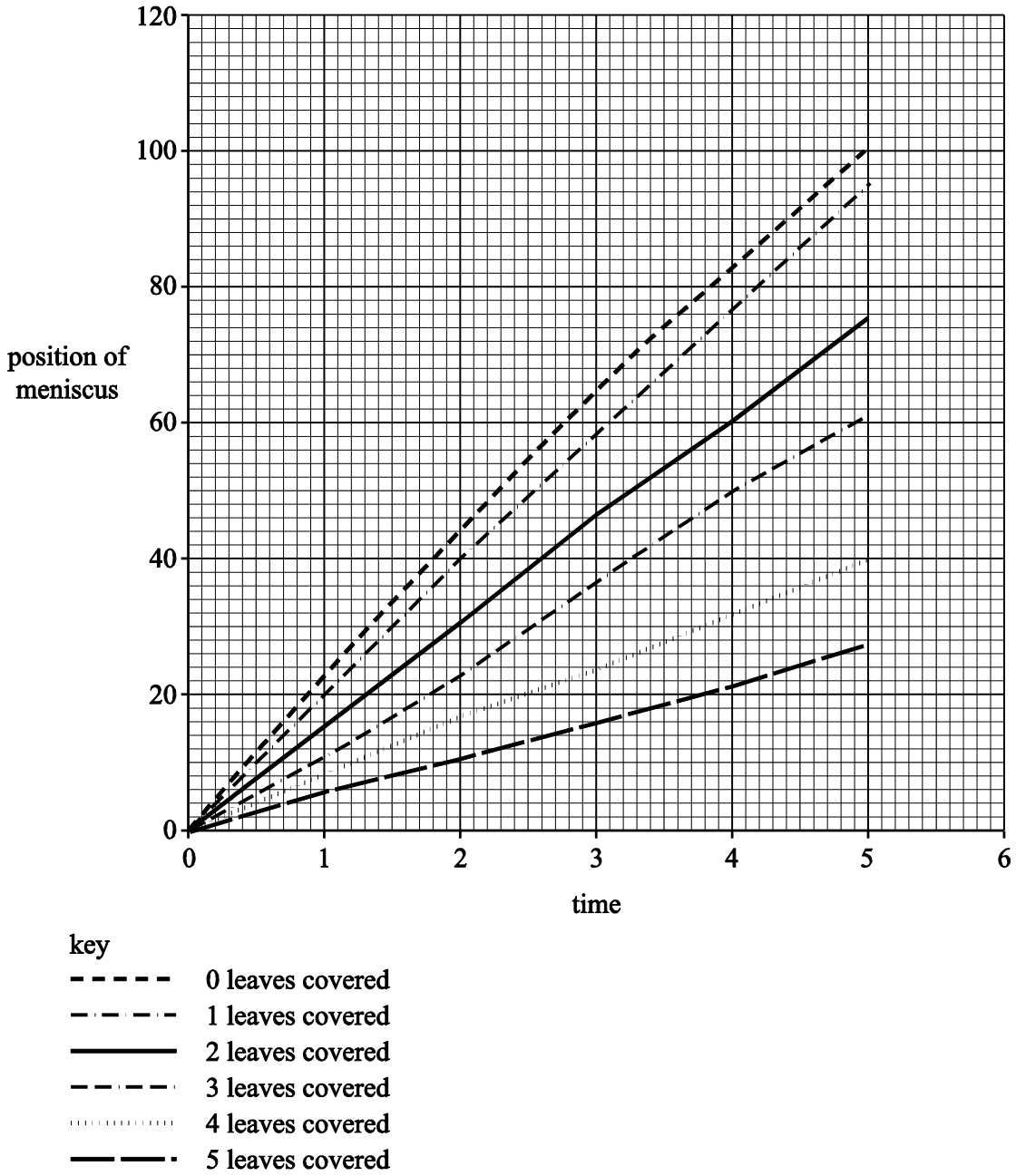


Fig. 25.2

(i) State two different types of information the student has missed from the graph.

……...

……. **[2]**

(ii) Use the graph to calculate the minimum rate of transpiration.

Answer……mm min^{-1} **[2]**

(b) Suggest how water is being lost from the cut stem when all the leaves have been treated with petroleum jelly.

……

…… **[2]**

(c) Suggest **two** possible sources of error in this investigation.

……

…… **[2]**

END OF QUESTION PAPER

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