STEMpathy: OCR Biology A Style Practice Paper

Assessment Content: Modules 1, 2, 3 and 4

Time allowed: 1 hour 30 minutes

INFORMATION

• Total marks: 70

• Questions assessing the quality of an extended response are indicated with an asterisk (*).

INSTRUCTIONS

• Use a black pen for writing to ensure clarity. Use an HB pencil 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 document and number the question clearly at the start of your extended response.

• Answer all questions to the best of your ability. You may leave a comment to explain why you cannot answer the question if you like.

• Show your working, so that your approach can be analysed. Marks might also be given, even if your answer is wrong.

SECTION A

You should spend a maximum of 15 minutes on this section.
Write your answer for each question in the box provided.
Answer all the questions.

Question 1

Which row correctly matches each organelle to its function?

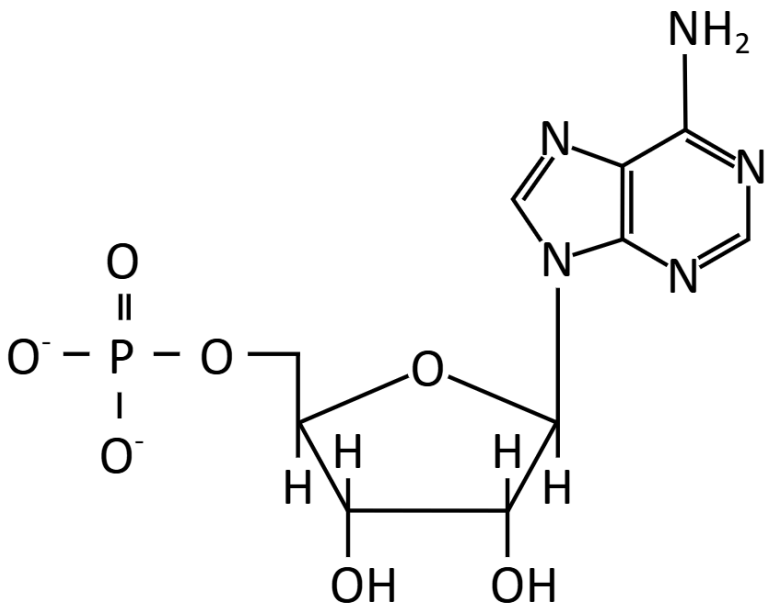
	Rough endoplasmic reticulum	Golgi apparatus	Lysosome
A	Synthesis of proteins	Modification of proteins	Digestion of worn-out organelles
B	Synthesis of lipids	Modification of proteins	Storage of digestive enzymes
C	Synthesis of proteins	Production of ATP	Digestion of worn-out organelles
D	Synthesis of lipids	Production of ATP	Storage of digestive enzymes

Your answer	

[1]

Question 2

The diagram below shows the structure of a nucleotide.



Which statement about this nucleotide is correct?

Statement

A This nucleotide contains deoxyribose and could be found in DNA.

B This nucleotide contains ribose and could be found in RNA.

C The nucleotide has a pyrimidine base.

D The base would form covalent bonds with a complementary base.

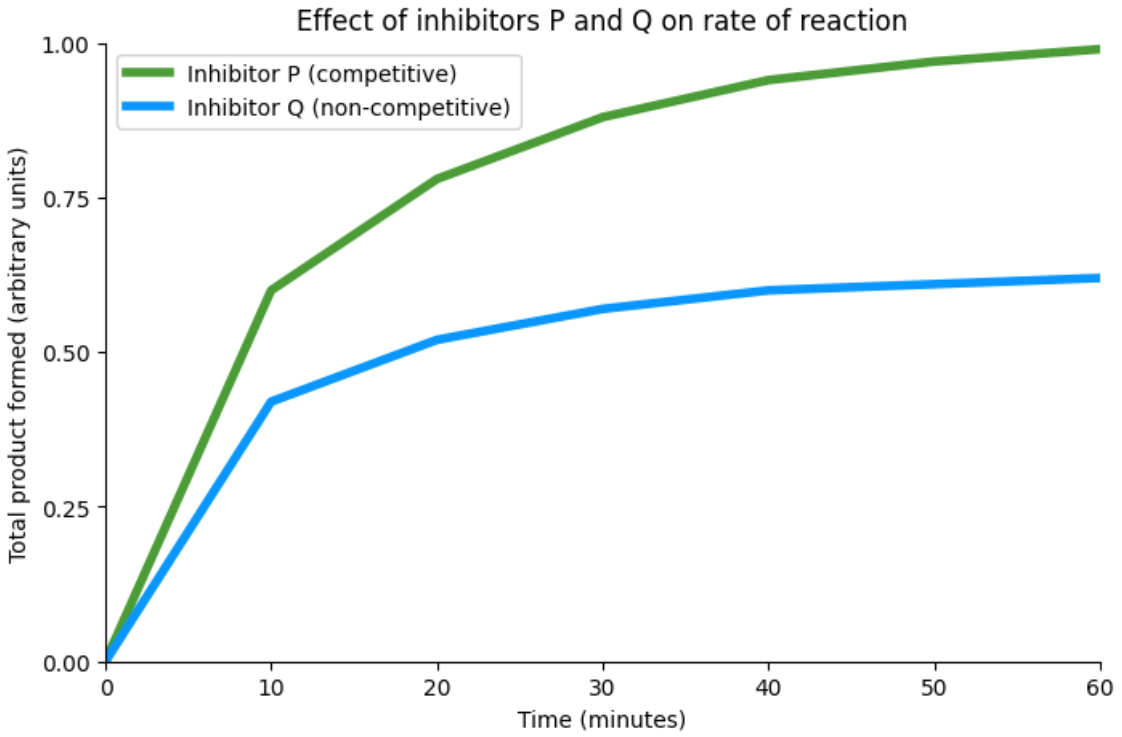
Your answer	

[1]

Question 3

A student investigated the effect of two different inhibitors on the rate of an enzyme-controlled reaction.

The below graph shows the results.



Which statement correctly describes the type of inhibition caused by inhibitor P and inhibitor Q?

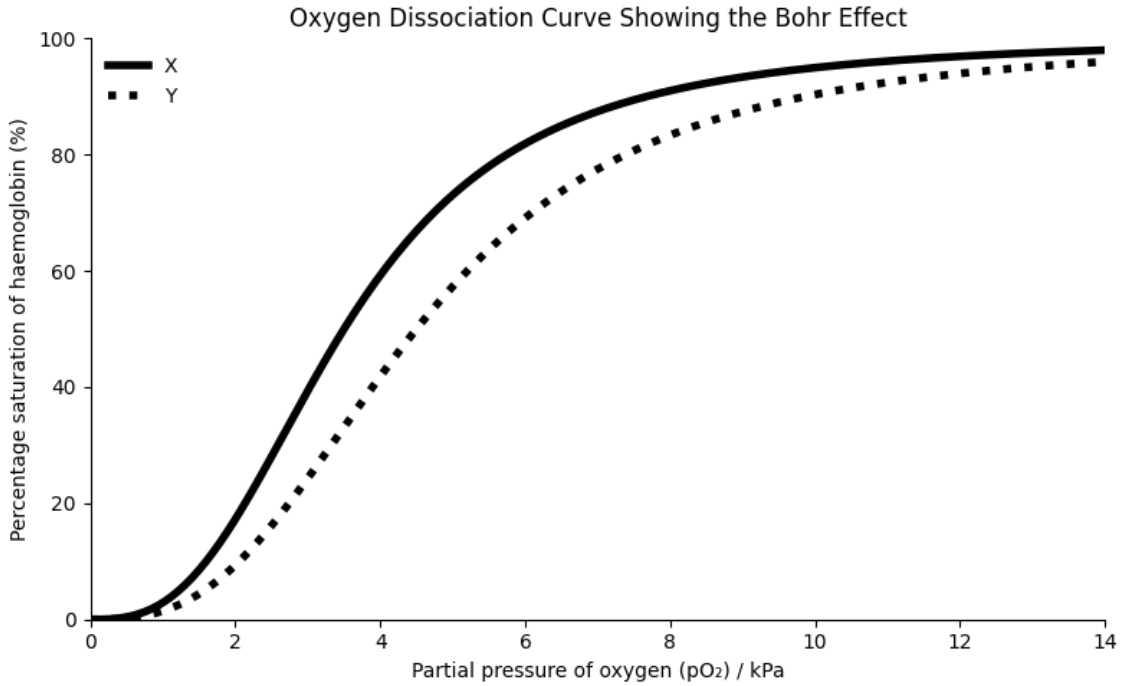
	Inhibitor P	**Inhibitor Q**
A	Competitive inhibitor that binds to the active site	Non-competitive inhibitor that binds to an allosteric site
B	Competitive inhibitor that binds to an allosteric site	Non-competitive inhibitor that binds to the active site
C	Non-competitive inhibitor that binds to the active site	Competitive inhibitor that binds to an allosteric site
D	Non-competitive inhibitor that binds to an allosteric site	Competitive inhibitor that binds to the active site

Your answer	

[1]

Question 4

The graph shows oxygen dissociation curves for adult haemoglobin at two different concentrations of carbon dioxide.



Which statement correctly describes the curves in this graph?

Statement

A Curve Y shows that haemoglobin has a lower affinity for oxygen at low carbon dioxide concentrations.

B At 4 kPa, haemoglobin releases more oxygen in the presence of high carbon dioxide concentrations.

C The shift from curve X to curve Y is called the Bohr effect and occurs in the lungs.

D Curve X shows that carbon dioxide increases the affinity of haemoglobin for oxygen.

Your answer	

[1]

Question 5

Which row correctly matches each type of pathogen to a disease it causes?

	Bacterium	**Virus**	**Protoctist**
A	Tuberculosis	Influenza	Malaria
B	Malaria	Tuberculosis	Influenza
C	Influenza	Malaria	Tuberculosis
D	Tuberculosis	Malaria	Influenza

Your answer	

[1]

Question 6

A newborn baby receives antibodies from its mother through breast milk.

What type of immunity does this provide to the baby?

	Type of immunity
A	Artificial active immunity
B	Artificial passive immunity
C	Natural active immunity
D	Natural passive immunity

Your answer	

[1]

Question 7

A student viewed a cell using a light microscope.

The image of the cell measured 30 mm in length.

The student calculated that the magnification of the microscope was ×500.

What is the actual length of the cell?

A 0.06 µm

B 0.6 µm

C 60 µm

D 600 µm

Your answer	

[1]

Question 8

Which statement about biological classification is correct?

Statement

A The domain Archaea contains organisms from the kingdom Protoctista.

B The domain Eukarya contains organisms from four different kingdoms.

C The domain Bacteria contains organisms with membrane-bound organelles.

D The three domains were established based on observable physical features.

Your answer	

[1]

Question 9

A student used a potometer to investigate transpiration in a leafy shoot and recorded the following measurements:

- Distance moved by air bubble in 5 minutes = 35 mm
- Diameter of capillary tube = 1 mm

What is the rate of water uptake?

Use the formula:
Volume of cylinder = $\pi r^2 l$

A $5.5\ mm^3\ min^{-1}$

B $7.0\ mm^3\ min^{-1}$

C $22.0\ mm^3\ min^{-1}$

D $27.5\ mm^3\ min^{-1}$

Your answer	

[1]

Question 10

Scientists calculated Simpson's Index of Diversity (D) for two habitats.

- Habitat 1: D = 0.85
- Habitat 2: D = 0.32

Which statement correctly interprets these results?

Statement

A Habitat 1 has lower biodiversity because D is closer to 1.

B Habitat 2 has higher biodiversity because D is closer to 0.

C Habitat 1 has higher biodiversity because D is closer to 1.

D Both habitats have similar biodiversity because both values are less than 1.

Your answer	

[1]

[TOTAL FOR SECTION A: 10 MARKS]

SECTION B

Answer all the questions.

If you need extra space, use the lined pages at the end of this document and number the question clearly at the start of your extended response.

Question 11

Fig. 11.1 is a photomicrograph showing animal cells in various stages of the cell cycle.

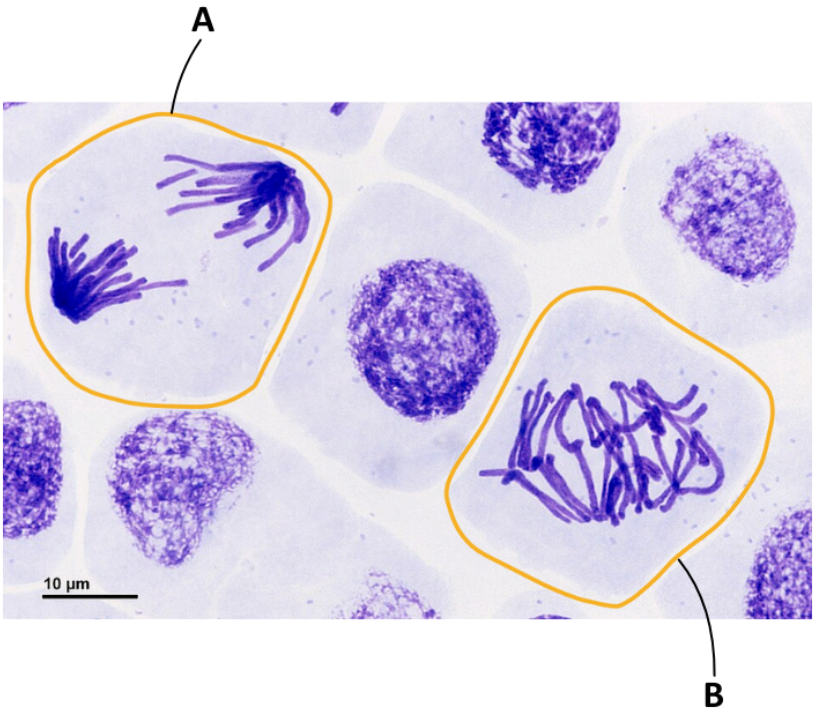


Figure 11.1

(a) (i) Calculate the magnification of Fig. 11.1.

Show your working.

Magnification = ...

[2]

(a) (ii) Compared to using a transmission electron microscope to view these cells, the useful level of maximum magnification is limited.

State one other advantage of using a transmission electron microscope, rather than a light microscope, to produce this image.

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[1]

(b) For a cell to complete the cell cycle, it must begin the process with sufficient numbers of mitochondria.

Outline the importance of the mitochondria.

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[2]

(c) (i) Cell A in Fig. 11.1 is undergoing mitosis.

Describe what is happening to the chromosomes at the stage of mitosis shown in cell A in Fig. 11.1.

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[2]

(c) (ii) State one reason why mitosis is important for this organism.

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[1]

[Total for question 11: 8 Marks]

Question 12

Potatoes are storage organs that contain starch and other biological molecules.

A student investigated the biological molecules present in potato tissue.

(a) Fig. 12.1 shows two α-glucose molecules.

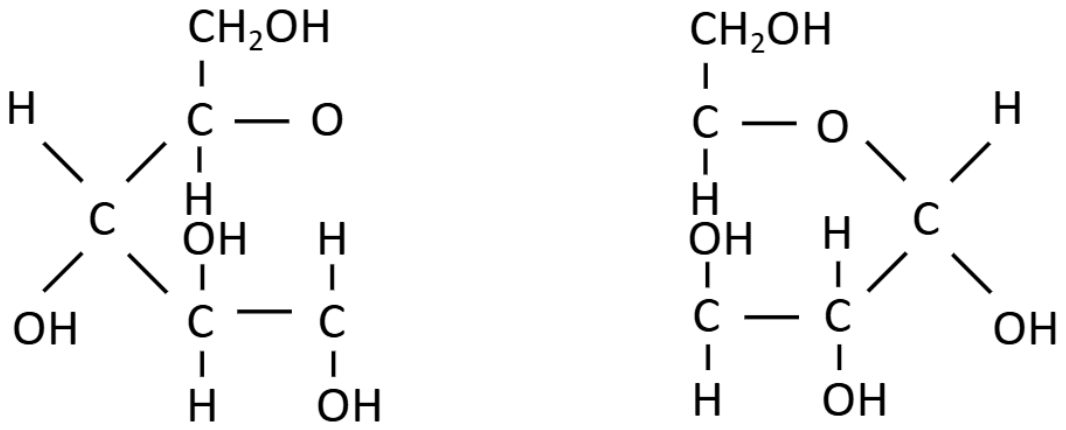

Figure 12.1

Complete Fig. 12.1 to show the disaccharide formed from these two α-glucose molecules, and label the bond that is formed between them.

[2]

(b) The student carried out biochemical tests on an extract from the potato tissue.

(b) (i) Name the reagent used to test for the presence of starch.

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[1]

(b) (ii) Describe how you would test for the presence of reducing sugars in the potato extract.

Include the expected result if reducing sugars are present.

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[2]

(c) The student also separated amino acids from the potato tissue using thin-layer chromatography.

The results are shown in Fig. 12.2.

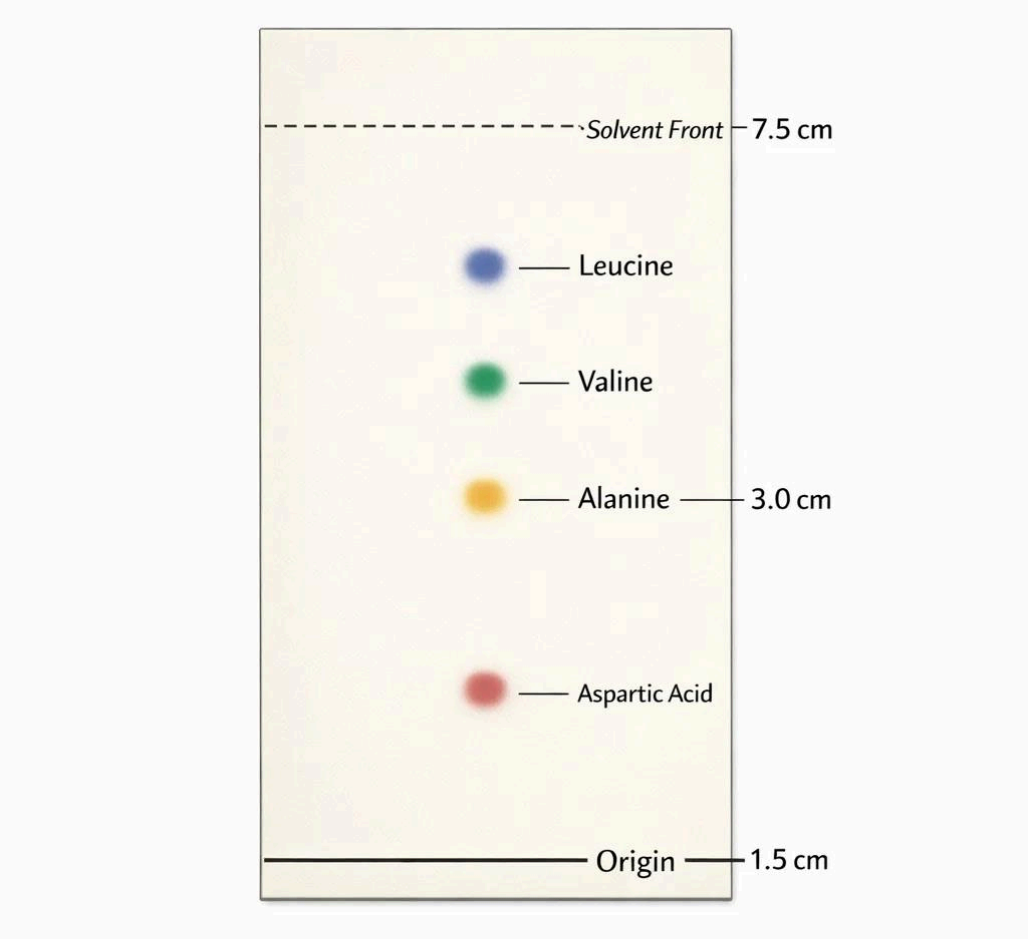

Figure 12.2

Calculate the Rf value of alanine.

Show your working.

Rf = ... [2]

(d) Explain why starch is a suitable molecule for energy storage in plants.

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[1]

[Total for question 12: 8 Marks]

Question 13

Cystic fibrosis is a genetic condition caused by a mutation in the gene that codes for a protein called CFTR. The CFTR protein is a channel protein found in cell surface membranes.

(a) Fig. 13.1 shows part of a DNA molecule.

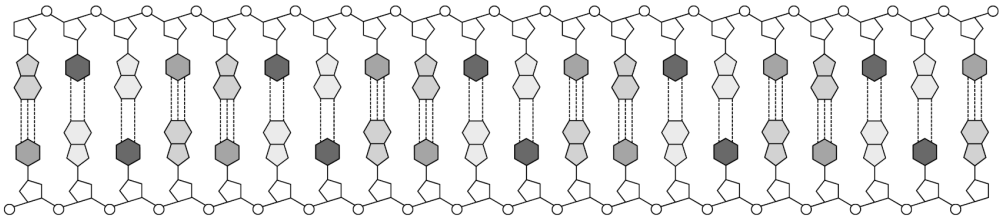

Figure 13.1

On Fig. 13.1:

- Label and circle one phosphodiester bond with the letter P
- Label and circle one hydrogen bond with the letter H

[2]

(b) Before a cell divides, the DNA must be replicated.

Describe and explain the role of DNA helicase and DNA polymerase in semi-conservative replication.

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[2]

(c) (i) The genetic code is described as 'degenerate'.

State what is meant by the term 'degenerate' when describing the genetic code.

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[1]

(c) (ii) The CFTR protein is synthesised at ribosomes in the cytoplasm.

Outline how the information encoded by the gene for CFTR is transmitted to the ribosome.

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[3]

[Total for question 13: 8 Marks]

Question 14

The efficiency of gas exchange in organisms depends on several factors, such as the surface area to volume ratio.

(a) A student modelled a small organism as a cube with sides of 2 mm.

(a) (i) Calculate the surface area to volume ratio of this cube.
Show your working.

Surface area to volume ratio = ... [2]

(a) (ii) Explain why large, active organisms require specialised gas exchange surfaces.

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[2]

(b) Fish have evolved specialised structures for gas exchange called gills.

Fig. 14.1 shows the structure of a fish gill.

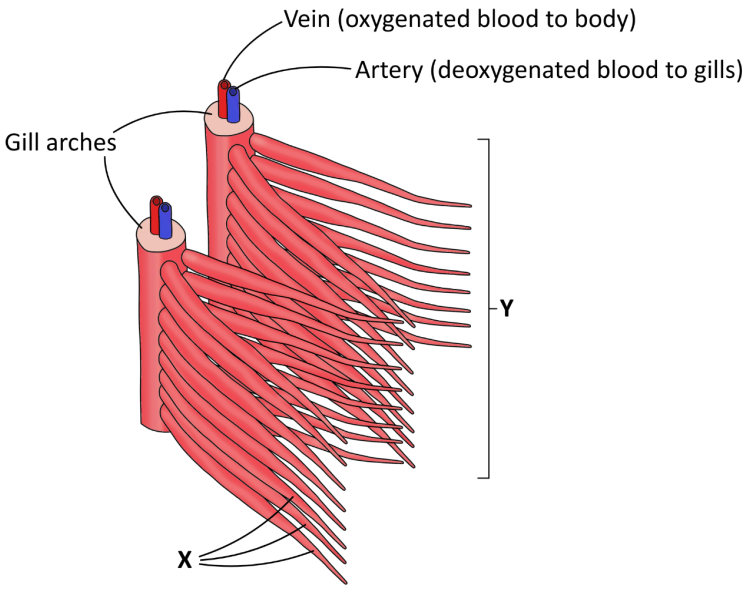

Figure 14.1

Name the structures labelled X and Y in Fig. 14.1.

X: .....

Y: .....

[1]

(c) Describe how counter-current flow increases the efficiency of gas exchange in fish gills.

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[2]

(d) In mammals, blood transports oxygen from the lungs to respiring tissues. Tissue fluid is formed as blood passes through capillary beds in the tissues.

Explain how tissue fluid is formed at the arterial end of a capillary bed.

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[3]

[Total for question 14: 10 Marks]

Question 15

A group of students investigated the effect of light intensity on the rate of transpiration using a potometer.

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

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[1]

(a) (ii) The students' results are shown in Table 15.1.

Table 15.1

Light intensity (a.u)	Trial 1	Trial 2	Trial 3	Mean distance (mm)	Rate of water uptake (mm min^{-1})
0	3	4	2	3.0	0.6
100	12	14	13	13.0	2.6
200	24	22	26	24.0	4.8
300	35	38	32	35.0	7.0
400	41	43	40	41.3	8.3
500	44	45	43	44.0	8.8
600	45	44	46	45.0	9.0

Describe the pattern shown in the results in Table 15.1.

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[2]

(b) Suggest two improvements the students could make to their investigation to increase the reliability of their results.

Improvement 1: .....

Improvement 2: .....

[2]

(c) Explain how water moves up the stem of a plant.

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[3]

[Total for question 15: 8 Marks]

Question 16

(a) Pathogens are organisms that cause disease.

Complete the table below to give an example of a disease caused by each type of microorganism, with an appropriately matched method of transmission.

Microorganism	Transmission	Disease
Bacteria		Tuberculosis
Virus	Direct contact	
Protoctist		Malaria
Fungus	Spores	

[2]

(b) White blood cells play an important role in protecting the body from pathogens.

(i) Describe the process of phagocytosis.

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[2]

(ii) Explain the role of T helper cells in the specific immune response.

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[2]

(c) Fig. 16.1 shows data on the effectiveness of a vaccination programme for a disease between 2000 and 2020.

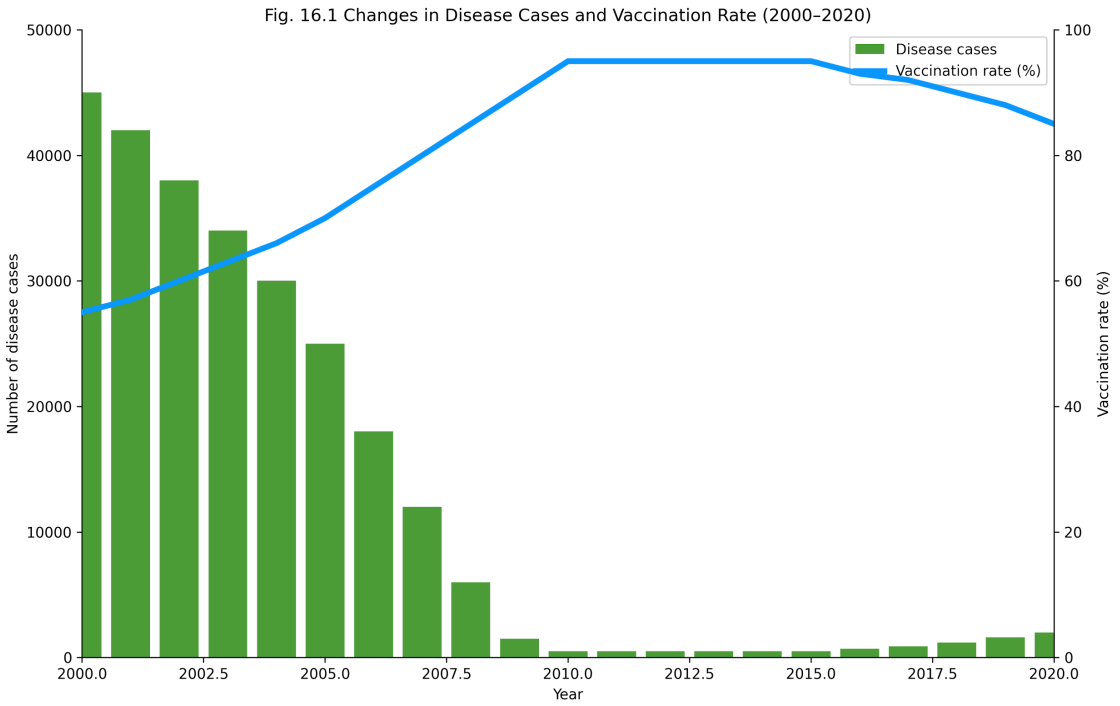

Figure 16.1

Explain what the data can tell us about the effectiveness of the vaccination programme.

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[3]

(d) The treatment for bacterial infections is to give antibiotics. Some bacterial populations have become resistant to specific antibiotics.

Explain the implications of increasing antibiotic resistance.

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[3]

[Total for question 16: 12 Marks]

Question 17*

Scientists investigated a population of ground beetles living in an area that has experienced climate change over the past 50 years. The area has become significantly drier, with reduced rainfall and higher temperatures.

Field observations showed that modern beetles in this area have thicker cuticles (outer protective layer) compared to beetles collected from the same area 50 years ago. A thicker cuticle helps to reduce water loss in dry conditions.

Describe how the scientists could reliably estimate the beetle population in this area.

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[Total for question 17: 6 Marks]

Extra Space

If you need extra space for your answers, use this page and clearly show the question number.