OCR
Oxford Cambridge and RSA

Monday 12 October 2020 – Morning

AS Level Biology A

H020/01 Breadth in biology

Time allowed: 1 hour 30 minutes

You can use:
- a scientific or graphical calculator
- a ruler (cm/mm)

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

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 **[ ]**.
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

SECTION A

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

Write your answer for each question in the box provided.

Answer **all** the questions.

1 Which of the following stages, **A** to **D**, of the cell cycle, would DNA polymerase be most active?

A G_1

B G_2

C mitosis

D S

Your answer ☐ **[1]**

2 Which statement, **A** to **D**, describes the function of DNA polymerase?

A break the hydrogen bonds between complementary bases

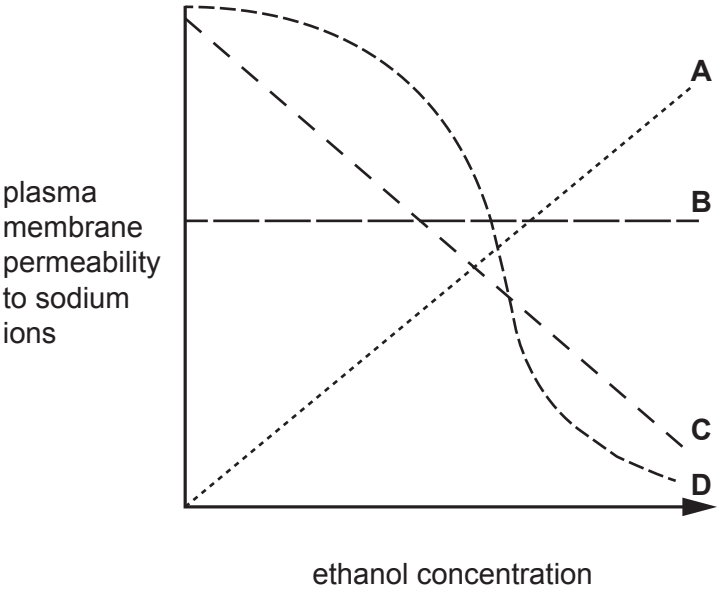
B make phosphodiester bonds between adjacent nucleotides

C make phosphodiester bonds between polynucleotides

D make the hydrogen bonds between complementary bases

Your answer ☐ **[1]**

3 Which of the lines, **A** to **D**, in the graph below, represents the effect of increasing ethanol concentration on the permeability of the plasma membrane to sodium ions?



Your answer ☐ **[1]**

4 Which of the rows, **A** to **D**, in the table below shows the correct order of increasing complexity of organisation within an organism?

A	epithelium	goblet cell	lung	respiratory system
B	epithelium	respiratory system	goblet cell	lung
C	goblet cell	epithelium	lung	respiratory system
D	goblet cell	lung	respiratory system	epithelium

Your answer ☐ **[1]**

5 The image below shows Dawlish Warren, which is a conservation area in the UK.

Which of the following is an aesthetic reason for maintaining biodiversity in Dawlish Warren?

A maintaining the 200 different animal species

B maintaining the area as a tourist destination to support local businesses

C preventing the disappearance of the coastal landscape

D protecting the sparrowhawk, which is a keystone species

Your answer ☐ **[1]**

6 Antifreeze proteins are a group of globular proteins that prevent ice crystal formation in living cells. These proteins are found in four different kingdoms and have evolved independently of each other.

Which of the following phrases explains why this convergent evolution has occurred?

A adaptation to fill a similar niche

B continuous variation of these species

C interspecific variation

D the same gene occurs in these species

Your answer ☐ **[1]**

7 The table below shows the different percentages of three different components of blood vessels.

	elastin (%)	**smooth muscle (%)**	**collagen (%)**
A	8	33	58
B	17	39	43
C	56	11	33
D	56	45	10

Which of the rows, **A** to **D**, shows the relative proportions of the components of the aorta?

Your answer ☐ **[1]**

8 Which of the following, **A** to **D**, is an example of disease transmitted by a vector?

A athlete's foot from a shower

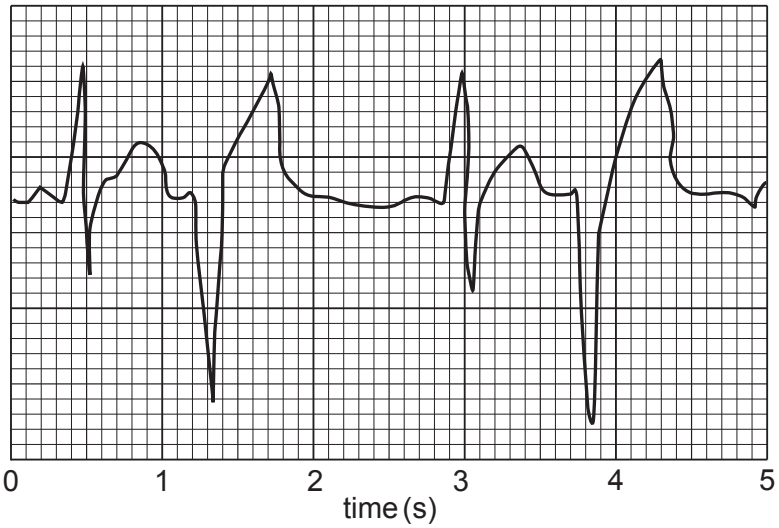
B bubonic plague from rat fleas

C catching bird flu from inhaling water droplets

D salmonella from undercooked chicken

Your answer ☐ **[1]**

9 The trace below is an electrocardiogram (ECG) of an abnormal heart activity.



What is the name for this abnormal heart activity?

A bradycardia

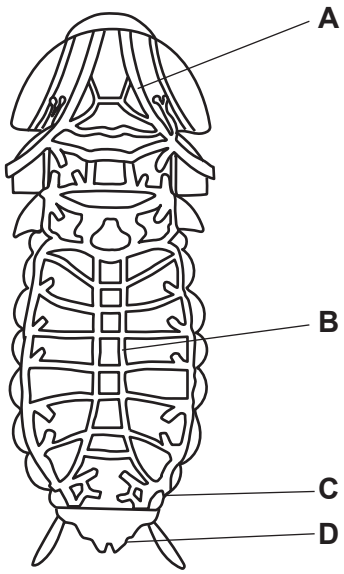
B ectopic heartbeat

C fibrillation

D tachycardia

Your answer ☐ **[1]**

10 The drawing below shows the respiratory system of an insect.



Which of the letters, **A** to **D**, shows a spiracle?

Your answer [ ] **[1]**

11 Which of the following muscles in the mammalian ventilation system contract to force air out of the lungs?

A all of the muscles in the mammalian ventilation system

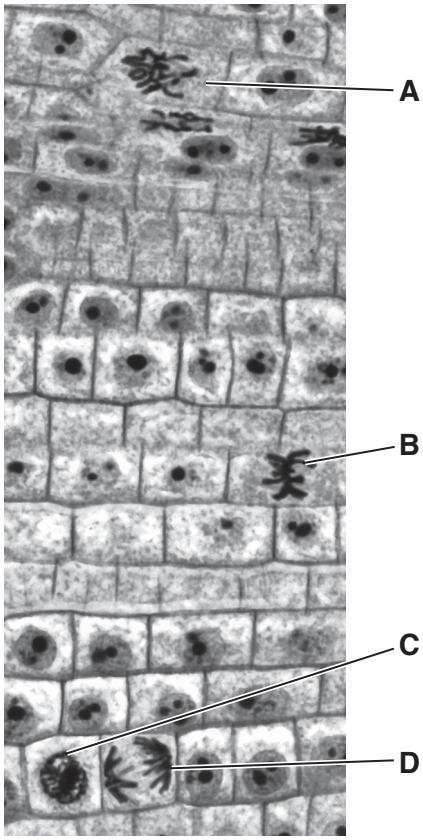
B the external intercostal muscles

C the diaphragm

D the internal intercostal muscles

Your answer [ ] **[1]**

12 The image below shows onion root tissue. Some of the cells in the tissue are undergoing mitosis.



Which of the label lines, **A** to **D**, shows a cell that is in anaphase?

Your answer ☐ **[1]**

13 A student is investigating species richness of plants along a sand dune from the sea edge moving inland. They are testing the hypothesis that 'species richness increases with distance from the sea'.

Which of the sampling methods, **A** to **D**, would the student use?

A opportunistic

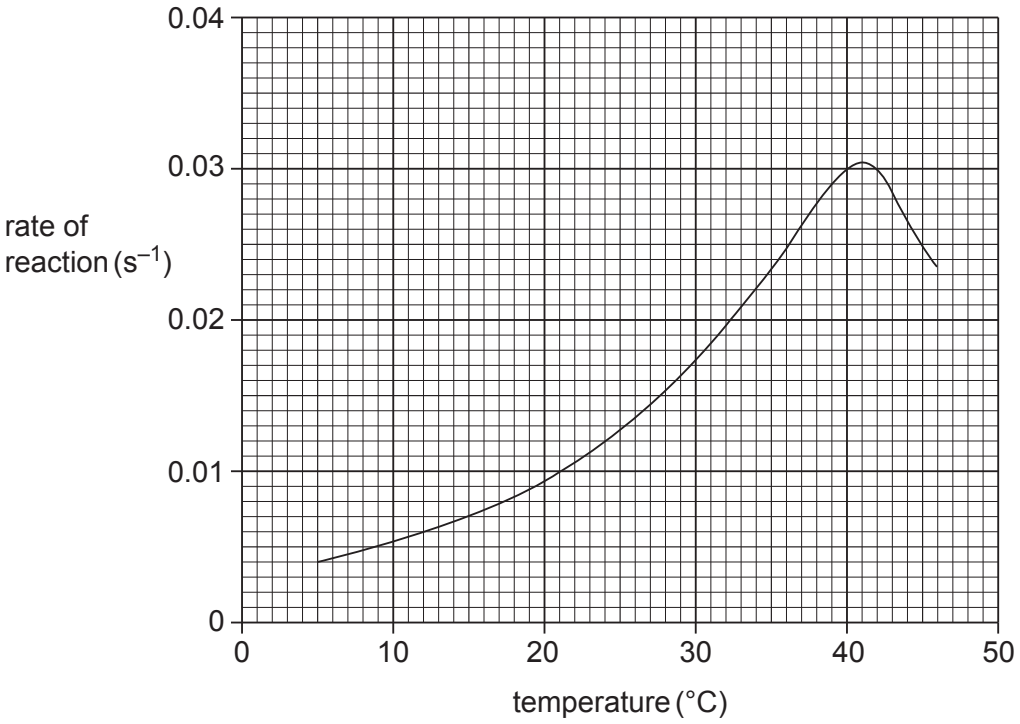
B random

C stratified

D systematic

Your answer ☐ **[1]**

14 The graph below shows how the rate of reaction of the enzyme pepsin changes with temperature.



What is the temperature coefficient, Q_{10}, of this reaction before the enzyme denatures?

A 0.06

B 0.35

C 1.80

D 3.98

Your answer ☐ **[1]**

15 Which of the rows, **A** to **D**, contains the correct elements that are found in proteins?

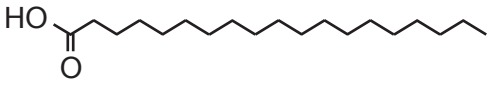
	carbon	**hydrogen**	**oxygen**	**phosphorus**	**nitrogen**	**sulphur**
A	✓	✓	✓			
B	✓	✓	✓	✓	✓	
C	✓	✓	✓		✓	✓
D	✓	✓	✓	✓	✓	✓

Your answer ☐ **[1]**

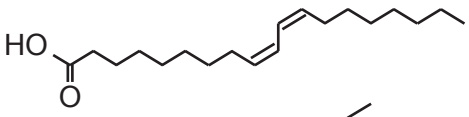
16 Oleic acid is a monounsaturated fatty acid found in vegetable oil.

Which of the following, **A** to **D**, is the correct structure for oleic acid?

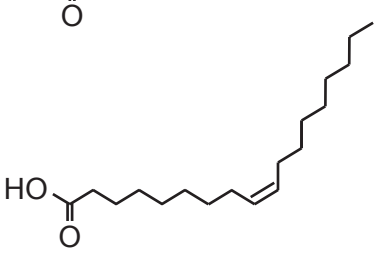
A



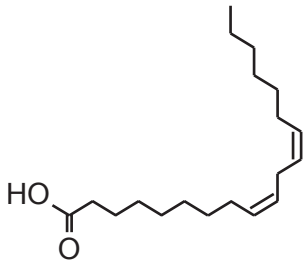
B



C

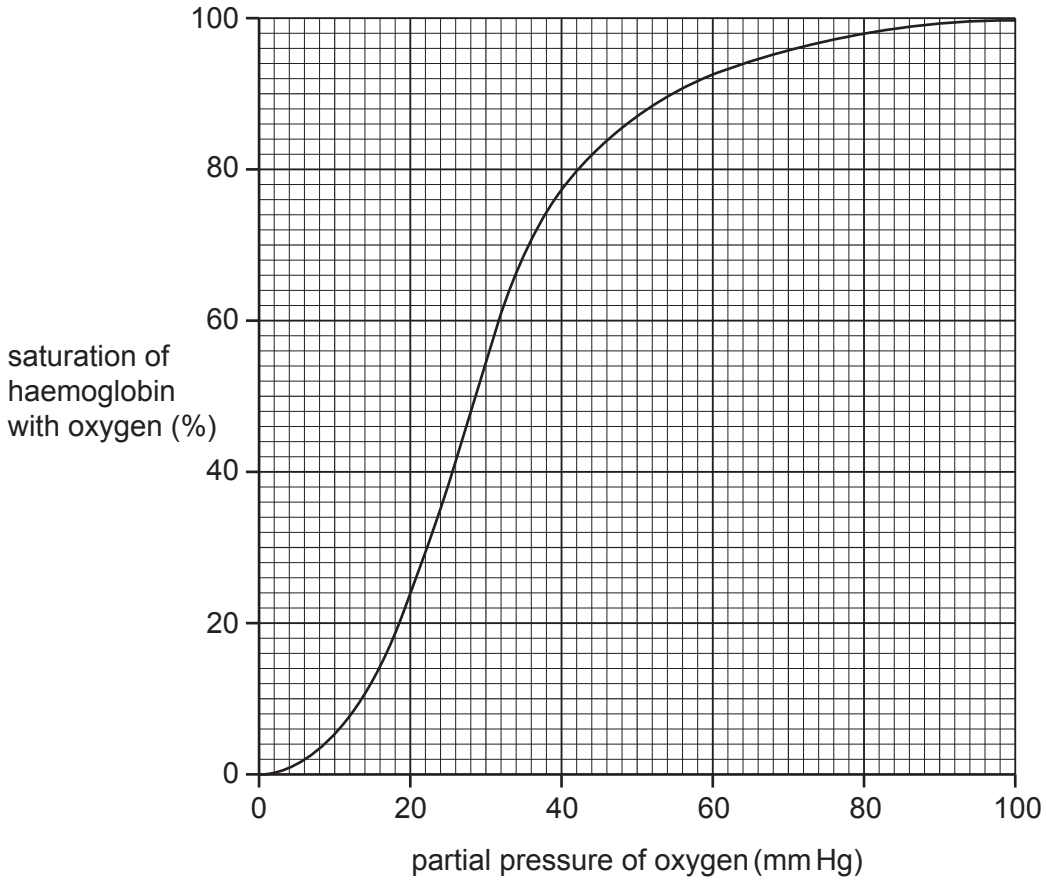


D



Your answer ☐ **[1]**

17 The graph below shows the oxygen dissociation curve for adult human haemoglobin.



What is the proportion of oxygen molecules released by haemoglobin between 40 mm Hg and 20 mm Hg?

A 0.31

B 0.69

C 2.21

D 3.21

Your answer ☐ **[1]**

18 Human pancreatic lipase breaks the bonds between fatty acids and glycerol.

What name is given to this reaction?

A condensation

B esterification

C hydration

D hydrolysis

Your answer ☐ **[1]**

19 A conjugated protein is held together by many different types of bond.

Which bond is **not** formed when a conjugated protein folds into its quaternary structure?

A disulphide

B hydrogen

C ionic

D peptide

Your answer ☐ **[1]**

20 There are four different human blood groups: A, B, AB and O.

This is because there are three different alleles coding for different proteins in red blood cells.

Which of the letters, **A** to **D**, describes this form of variation?

A continuous and intraspecific

B continuous and interspecific

C discontinuous and intraspecific

D discontinuous and interspecific

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

21 A zygote undergoes rapid cell division.

(a) Explain why the type of nuclear division in a zygote is mitosis and not meiosis.

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

(b) After many rounds of cell division, the zygote forms a blastula. A blastula is an animal embryo at an early stage of development. As the blastula develops, it becomes a hollow ball of cells with an inner cell mass. The inner cell mass is a source of embryonic stem cells.

(i) Explain the role of embryonic stem cells in the development of the embryo.

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(ii) Explain why the cells of the inner cell mass are **not** totipotent stem cells.

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22 Collagen is a protein found in arterial walls. A collagen molecule has three polypeptide chains, each with 1050 amino acids, wrapped into a triple helix. A repeating sequence of the amino acids glycine and proline occur in each polypeptide chain. These amino acids have non-polar side chains.

(a) (i) Describe and explain why collagen is a fibrous protein.

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(ii) Suggest why collagen is such a strong molecule.

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(b) Outline the method of chromatography that will separate the main amino acids in collagen.

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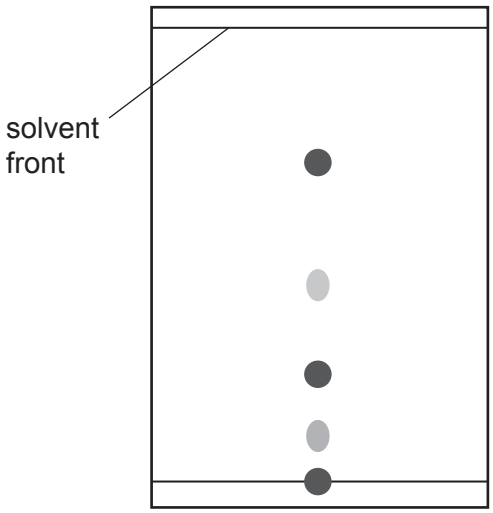
(c) A student carried out the method of chromatography on a sample labelled 'collagen'. The results can be seen on the chromatogram below.

On a chromatogram, the darker the spot, the higher the concentration of that amino acid.



(i) Calculate Rf values for the two highest concentration amino acids.

Rf value 1 = ...

Rf value 2 = ...

[2]

(ii) The table shows the Rf values of a range of amino acids.

amino acid	Rf value
glutamine	0.13
glycine	0.27
isoleucine	0.72
leucine	0.73
methionine	0.55
phenylalanine	0.68
proline	0.43
tryptophan	0.66
tyrosine	0.45
valine	0.61

The student thought that they may have made an error and **not** used a sample of collagen.

Use the information in the table to conclude whether the chromatogram shows that the protein analysed is collagen.

Explain your answer.

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23 The rough endoplasmic reticulum is where translation of some proteins takes place in a eukaryotic cell.

(a) Describe the structure of the rough endoplasmic reticulum.

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(b) Explain the role of the membrane in the rough endoplasmic reticulum.

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24 A student was comparing transpiration rates in tomato leaves and watermelon leaves. They selected eight separate leaves on different tomato plants and sealed a plastic bag over each leaf. They repeated this process for the watermelon plants. The plastic bags were left for six hours then they used a syringe to collect any water inside the plastic bag. The volume of water was recorded.

An example of their method can be seen in Fig. 24.1.

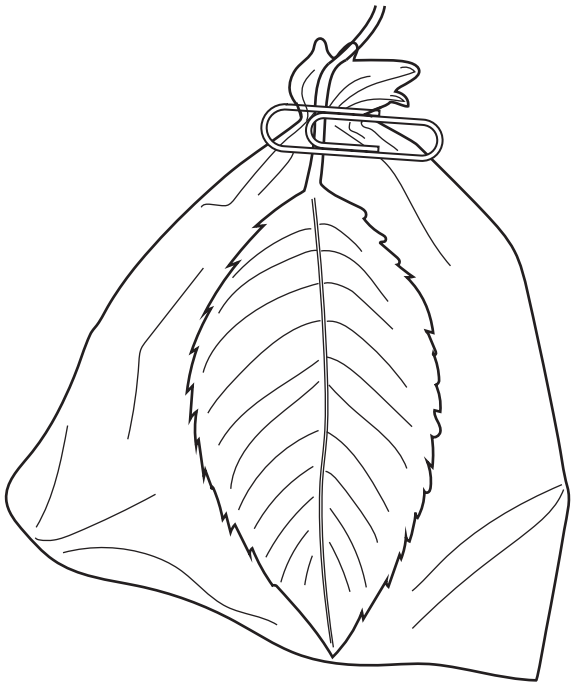

Fig. 24.1

(a) Identify **two** problems with this method and **for each** problem suggest how the method can be improved.

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[4]

(b) The results of the experiment are shown in Fig. 24.2.

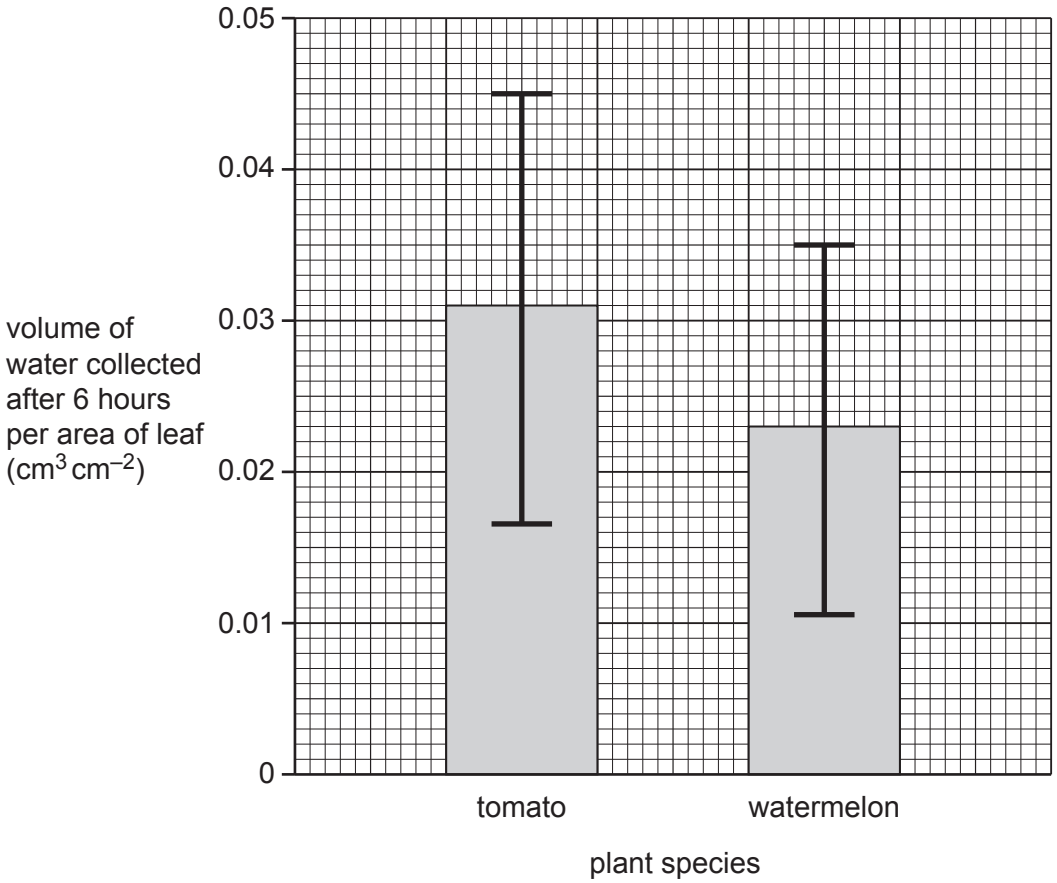

Fig. 24.2

What conclusion can be drawn from this graph? Justify your answer.

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(c) Describe how a potometer can be used to calculate a more accurate rate of transpiration.

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(d) Name **and** describe **two** pathways that water takes to reach the xylem vessels at the base of the stem.

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25 **(a)** Explain how the nucleotides in a DNA molecule are arranged as two polynucleotide strands.

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(b) **(i)** The human genome contains 3.0×10^9 nucleotides. The replication of DNA takes six hours in some cells.

One eukaryotic enzyme complex can replicate DNA at a rate of 50 nucleotides added per second on each complementary strand.

Calculate the number of eukaryotic enzyme complexes needed to replicate the DNA in the human genome in six hours.

Give your answer in standard form.

number of enzyme complexes = ... **[3]**

(ii) Name **two** enzymes involved in DNA replication.

1 .....

2 .....

[2]

(iii) Explain why enzymes are essential to all organisms.

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

26 The table shows the characteristics of five species from the five different kingdoms.

species	organisation	nucleus	cell wall	nutrient source
Solanum tuberosum	multicellular	yes	yes	autotroph
Yersinia pestis	unicellular	no	yes	heterotroph
Cantharellus pallens	unicellular	yes	yes	saprotroph
Ministeria vibrans	unicellular	yes	no	heterotroph
Ailuropoda melanoleuca	multicellular	yes	no	heterotroph

(a) (i) Name the genus of the protoctist in the table.

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

(ii) Use the information in the table to determine the kingdom and cell wall molecule for *S. tuberosum* and *C. pallens*. Write your answers in the table below.

species	kingdom	cell wall molecule
S. tuberosum		
C. pallens		

[2]

(iii) Describe how the genetic material is arranged in organisms in the same kingdom as *Y. pestis*.

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(b) Explain how a specific molecule is used to show that two different species have evolved from a recent common ancestor.

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

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).