Cell level systems – 2022 GCSE Gateway Biology Combined Science A

1. May/2022/Paper_J250/07/No.1

Which statement is true of **both** adult and embryonic stem cells?

A They are in all adult and embryonic tissues.

B They are only used to make blood cells.

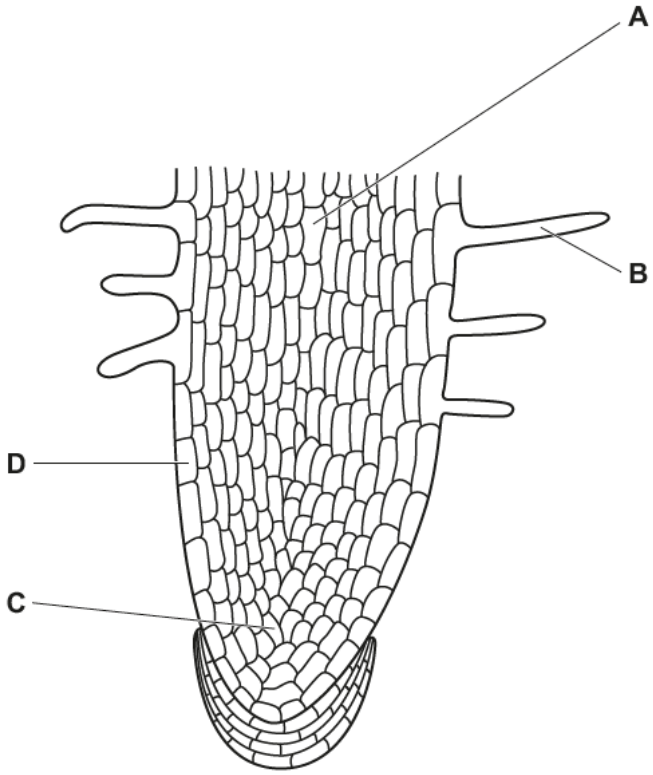
C They can divide by mitosis.

D They cannot differentiate.

Your answer ☐ **[1]**

2. May/2022/Paper_J250/07/No.2

The diagram shows the root tip of a plant.

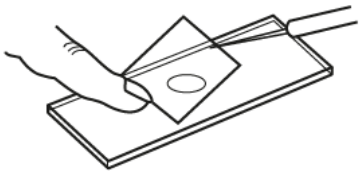


Which label, **A**, **B**, **C** or **D**, identifies the position of stem cells in the root tip?

Your answer ☐ **[1]**

3. May/2022/Paper_J250/07/No.3

The diagram shows a student preparing some cells to view using a light microscope.



What are they lowering into place?

A Cover slip

B Lens

C Slide

D Stain

Your answer ☐ **[1]**

4. May/2022/Paper_J250/07/No.4

Which term describes a cell that contains plasmids but no mitochondria?

A Embryonic

B Meristem

C Prokaryotic

D Specialised

Your answer ☐ **[1]**

5. May/2022/Paper_J250/07/No.10

Photosynthesis is affected by light intensity. The relative light intensity can be calculated using the inverse square law.

$$\text{relative light intensity} = \frac{1}{(\text{distance from light source})^2}$$

What is the distance from the light source when the relative light intensity is 0.04?

A 0.04

B 0.2

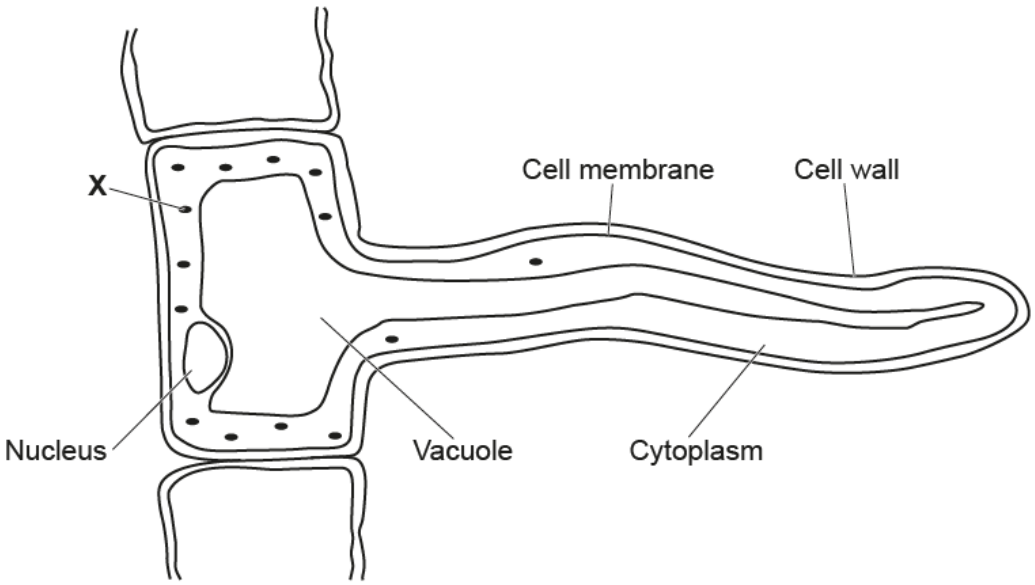
C 5

D 25

Your answer ☐ **[1]**

6. May/2022/Paper_J250/07/No.12

(a) The diagram shows the structure of a root hair cell.



(i) The structure labelled **X** contains enzymes needed for cellular respiration.

Identify the name of structure **X**.

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

(ii) The mineral concentration of soil surrounding the cell is lower than the mineral concentration inside the cell.

Explain how minerals are transported into the cell from the soil.

.....

.....

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

(b) Plants make a range of different molecules. One of these is glycerol.

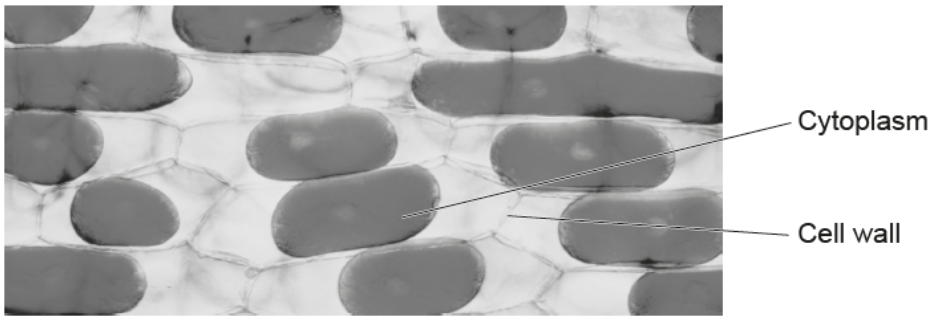
Explain why glycerol is important.

.....

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

(c) A student investigates osmosis using onion cells. When water leaves an onion cell, the cytoplasm shrinks away from the cell wall. The cell is said to be plasmolysed.

The image shows plasmolysed onion cells.



This is the method the student follows:

- Place onion cells into different concentrations of salt solution.
- Observe the onion cells using a microscope after 30 minutes.
- Count the number of cells that can be seen and record how many were plasmolysed.

The table shows their results.

Concentration of salt solution (mol/dm^3)	Number of cells counted	Number of cells plasmolysed	Percentage number of cells plasmolysed
0.0	25	0	0
0.2	25	1	4
0.4	25	2	8
0.6	25	.....	48
0.8	25	19	76
1.0	25	24	96

(i) Calculate the number of plasmolysed cells the student counted in the 0.6 mol/dm^3 salt solution. Write your answer in the table. **[2]**

(ii) Use ideas about osmosis to explain the result for **1.0** mol/dm^3 salt solution.

.....

.....

.....

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

7. May/2022/Paper_J250/07/No.13

(a) Plants photosynthesise to produce sugars.

(i) Describe the process of photosynthesis.

.....

.....

.....

.....

.....

..... **[3]**

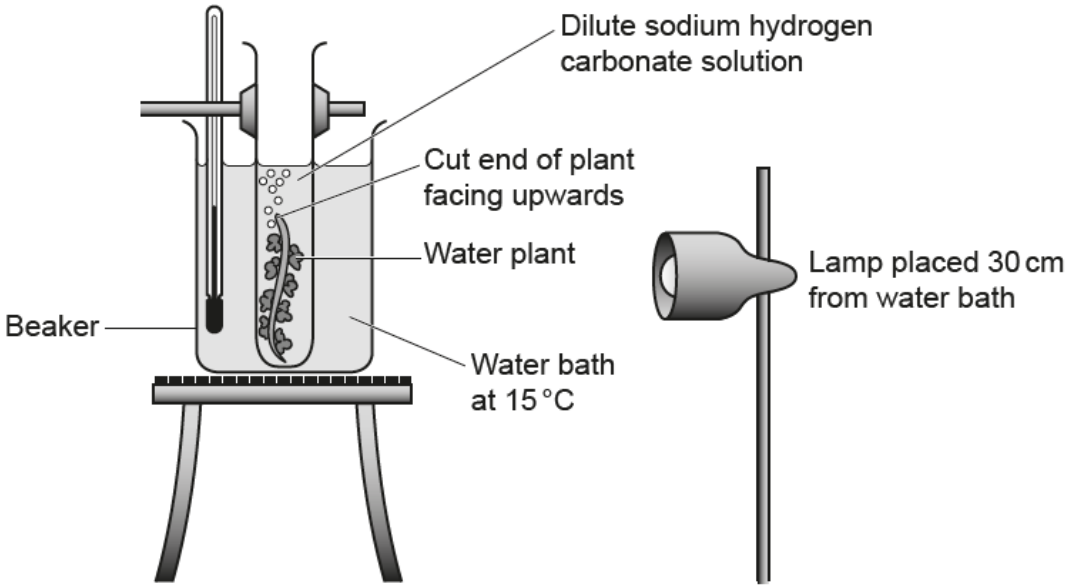
(ii) Explain the importance of sugars in the production of larger carbohydrates such as starch.

.....

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

(b) A student investigates the effect of temperature on the rate of photosynthesis.

The diagram shows the apparatus they use.



This is the method the student follows:

- Count the number of bubbles released by the water plant in 10 minutes.
- Repeat this method with different temperatures of water.
- Count the bubbles three times at each temperature.

The table shows their results.

Temperature (°C)	Number of bubbles			
	Count 1	Count 2	Count 3	Mean
15	22	18	23	21
20	24	26	24	25
25	36	32	35	34
30	26	24	25	25
35	22	19	6	16(21)
40	2	4	1	2

(i) Look at the mean the student has calculated for 35 °C.

Explain why there is a second mean in brackets.

.....

.....

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

*(ii) Photosynthesis is an enzyme-controlled process.

Explain the student's results.

.....

.....

.....

.....

.....

.....

.....

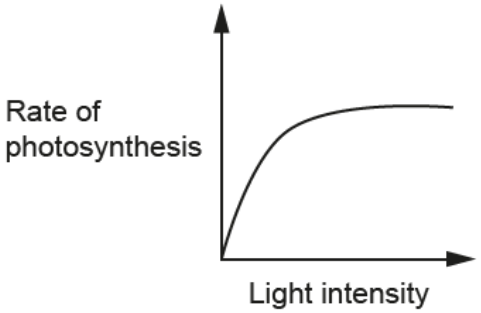
.....

.....

.....

..... [6]

(c) The graph shows the effect of light intensity on the rate of photosynthesis.



Explain why the graph levels off.

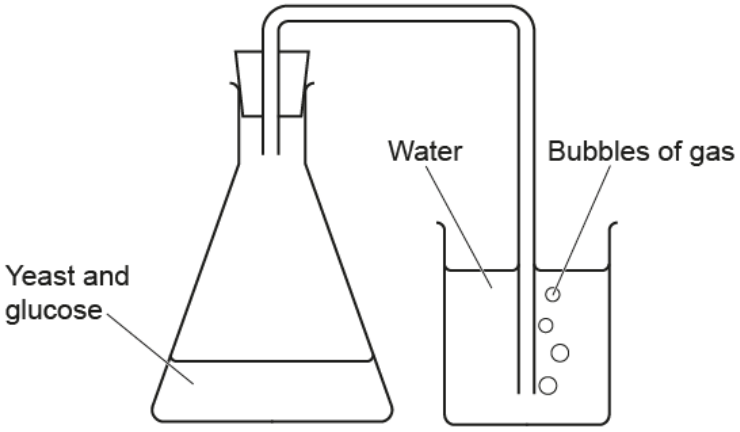
.....

..... [1]

8. May/2022/Paper_J250/07/No.14

(a) A scientist investigates anaerobic respiration in yeast.

The diagram shows the apparatus they use.



This is the method the scientist follows:

- Count the number of bubbles produced in 10 minutes.
- Repeat the same investigation using different types of sugars.
- Use the same mass of yeast and the same volume and concentration of sugar each time the investigation is repeated.

(i) The scientist wants to obtain more accurate results for the rate of **anaerobic** respiration in yeast.

Describe **two** ways the scientist could improve their investigation to obtain more precise and accurate results.

1 .....

.....

2 .....

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

(ii) Describe how the scientist could use the apparatus in the diagram to find the effect of glucose concentration on the rate of anaerobic respiration.

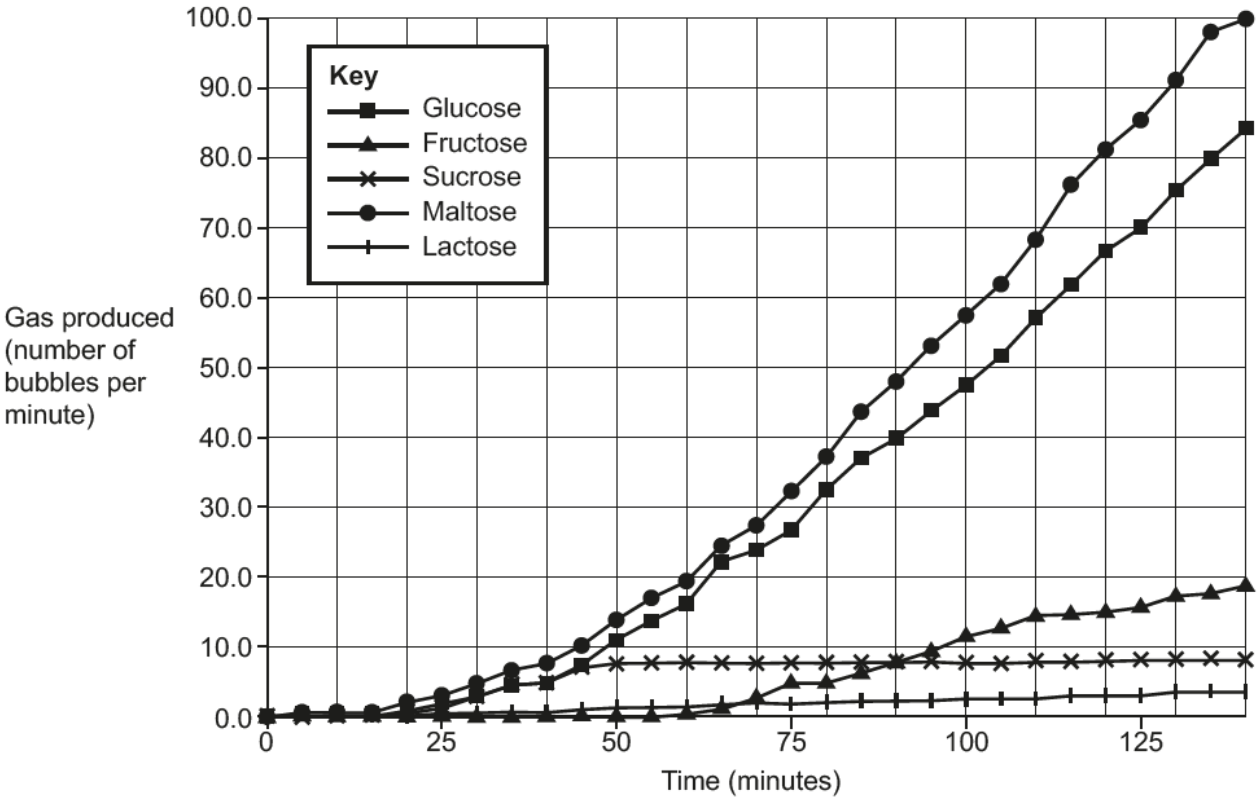
.....

.....

.....

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

(b) The graph shows the number of gas bubbles produced by yeast using different sugars.



(i) Which sugar results in the fastest rate of anaerobic respiration?

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

(ii) Yeast takes time to process fructose before anaerobic respiration can occur.

Explain how the graph shows evidence of this.

.....

.....

.....

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

(c) Compare the **products** of anaerobic respiration in yeast with anaerobic respiration in humans.

.....

.....

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

9. May/2022/Paper_J250/08/No.2

The diameter of a human ovum is 100 000 nm. The diameter of the HIV pathogen is 100 nm.

How many orders of magnitude larger is the diameter of a human ovum compared to an HIV pathogen?

A 3

B 10

C 99

D 1000

Your answer ☐ **[1]**

10. May/2022/Paper_J250/08/No.4

Which number per cell is halved during meiosis?

A Chromosome

B Gamete

C Haploid

D Nucleus

Your answer ☐ **[1]**

11. May/2022/Paper_J250/01/No.1

Which part of the cell provides a selective barrier to molecules entering the cell?

A Cell membrane

B Cell wall

C Cytoplasm

D Plasmid

Your answer ☐ **[1]**

12. May/2022/Paper_J250/01/No.2

A microscope has a ×10 eyepiece lens and a ×40 objective lens.

What is its magnification?

A ×10

B ×40

C ×50

D ×400

Your answer ☐ **[1]**

13. May/2022/Paper_J250/01/No.3

Which two terms describe the structure of DNA?

A Monomer and double helix

B Monomer and triple helix

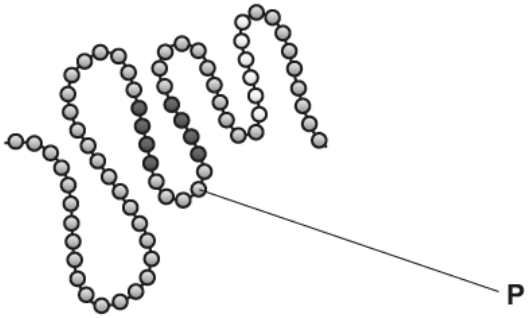
C Polymer and double helix

D Polymer and triple helix

Your answer ☐ **[1]**

14. May/2022/Paper_J250/01/No.4

The diagram shows a model of a protein molecule.



Which substance is labelled **P** in the diagram?

A Amino acid

B Fatty acid

C Glucose

D Glycerol

Your answer ☐ **[1]**

15. May/2022/Paper_J250/01/No.7

Why do root hair cells require large numbers of mitochondria?

A For the uptake of minerals by active transport.

B For the uptake of water by active transport.

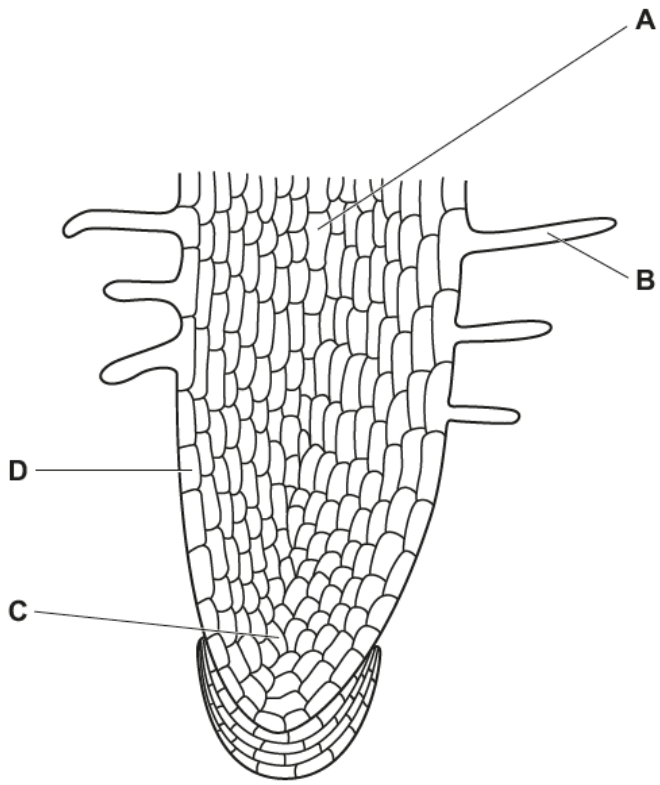
C For the uptake of minerals by osmosis.

D For the uptake of water by osmosis.

Your answer ☐ **[1]**

16. May/2022/Paper_J250/01/No.10

The diagram shows the root tip of a plant.



Which label, **A**, **B**, **C** or **D**, identifies the position of stem cells in the root tip?

Your answer ☐ **[1]**

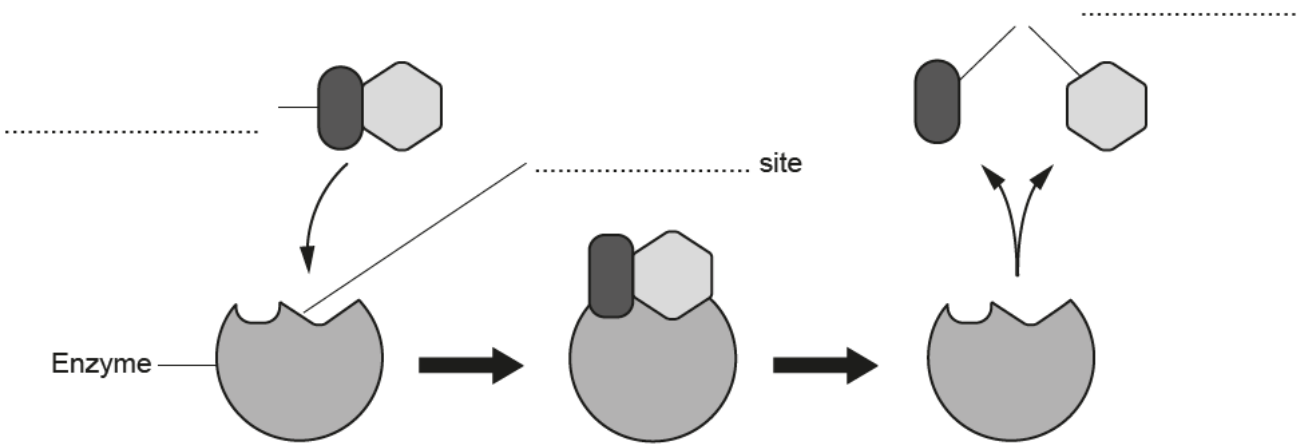
17. May/2022/Paper_J250/01/No.12

(a) **Fig. 12.1** shows a model of the lock and key hypothesis for enzymes.

Label **Fig. 12.1**. Use words in the list.

active	**catalyst**	**helix**	**products**
specific	**substrate**	**yields**	

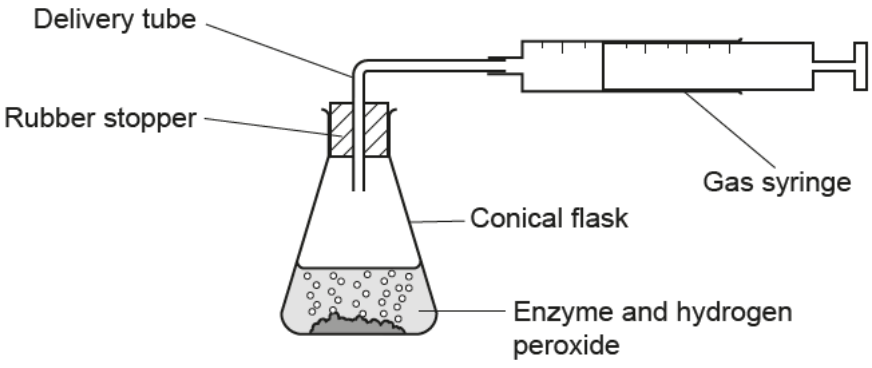
Fig. 12.1



[3]

(b) **Fig. 12.2** shows apparatus that could be used to investigate an enzyme-controlled reaction.

Fig. 12.2



The enzyme breaks down hydrogen peroxide to produce oxygen.

Complete these sentences to describe how to use the apparatus.

Put the enzyme and hydrogen peroxide into the ..... .

Measure the volume of oxygen that collects in the ..... after 5 minutes.

[2]

(c) A student uses the apparatus in **Fig. 12.2** to find the pH at which the enzyme works best (optimum pH).

The table shows the results.

pH	Volume of gas (cm^3)
1	2
6	20
14	1

***(i)** Describe and explain the pattern in the results.

Use ideas about the lock and key hypothesis in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(ii) Describe how the student could improve their investigation to find a more **accurate** optimum pH for the enzyme.

.....

.....

.....

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

18. May/2022/Paper_J250/01/No.13

(a) Plants are important for life on Earth as they photosynthesise and provide oxygen.

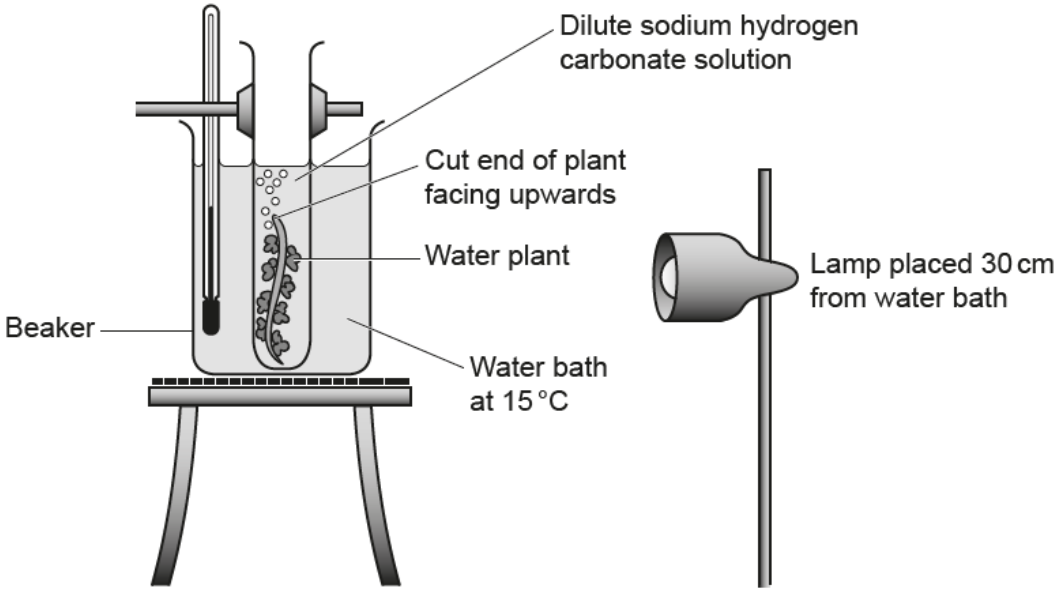
Describe **one other** reason why plants are important to life on Earth.

.....

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

(b) A scientist investigates the effect of temperature on the rate of photosynthesis.

The diagram shows the apparatus they use.



The scientist counts the number of bubbles released by the water plant in 10 minutes.

They repeat this method with different temperatures of water.

The table shows their results.

Temperature (°C)	Number of bubbles
15	22
20	8
25	36
30	26
35	22
40	2

(i) The scientist decides to repeat the investigation for 20 °C.
Suggest why.

.....

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

(ii) When the scientist repeats the investigation at 20 °C the result is 26 bubbles.

Use this result and the results in the table to describe the effect of temperature on the **rate** of photosynthesis.

.....

.....

.....

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

(c) The scientist decides to use the apparatus to investigate the effect of light intensity on photosynthesis.

Describe how they could use the apparatus to change light intensity.

.....

.....

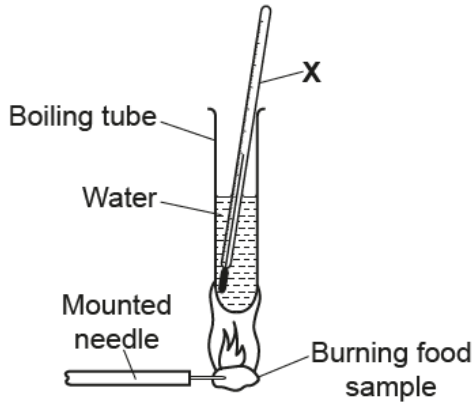
.....

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

19. May/2022/Paper_J250/01/No.14

Respiration releases energy from food. The energy content of food can be measured by burning the food. A student measures the energy content of some different foods.

(a) The diagram shows the apparatus they use.



(i) The student finds the energy content by measuring the change in temperature of the water.

Identify the piece of apparatus labelled **X** in the diagram.

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

(ii) The table shows the change in temperature for one type of food.

Temperature at the start (°C)	Temperature at the end (°C)
20	65

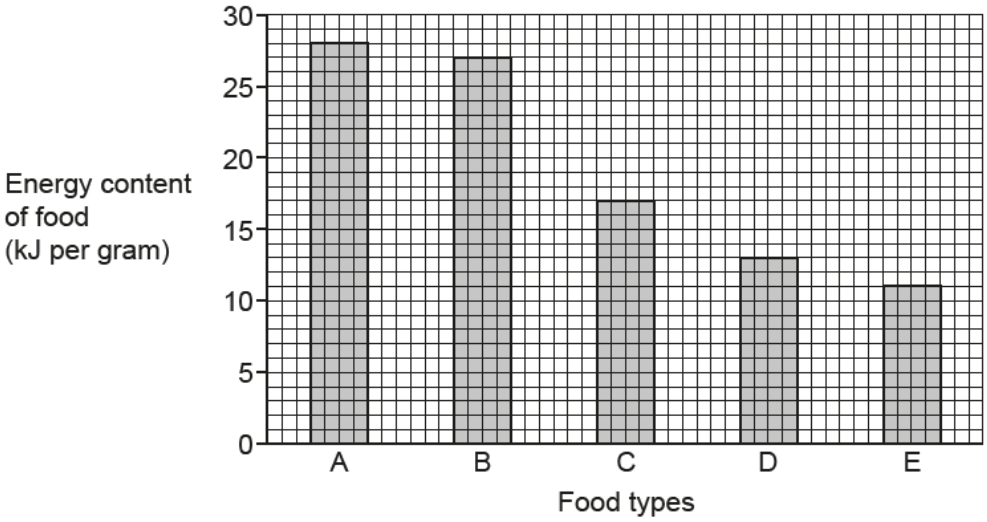
Calculate the energy content of the food using this formula.

Energy content = 20 × 4.2 × change in temperature

Energy content = ... J **[2]**

(b) The student converted all their results to find the energy content in kJ per gram of food.

The graph shows the results.



(i) What is the energy content of food type **D**? ..... kJ per gram **[1]**

(ii) Eating food type **B** provides the body with **more** ATP molecules than eating the same mass of food type **E**.

Use your knowledge of cellular respiration to explain why.

.....

.....

.....

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

20. May/2022/Paper_J250/02/No.1

What is the function of platelets in blood?

A They destroy pathogens.

B They help clot the blood.

C They produce antibodies.

D They transport oxygen around the body.

Your answer ☐ **[1]**

21. May/2022/Paper_J250/02/No.6

Which term is used to describe a pair of alleles that control a characteristic?

A Gamete

B Genome

C Genotype

D Phenotype

Your answer ☐ **[1]**

22. May/2022/Paper_J250/02/No.7

The kangaroo **diploid** chromosome number is 16.

Which row shows the number of chromosomes found in each type of cell?

	Kangaroo cells		
	Skin	**Sperm**	**Egg**
A	8	8	16
B	8	16	16
C	16	8	8
D	16	16	8

Your answer ☐ **[1]**

23. May/2022/Paper_J250/02/No.10

The diameter of a human ovum is 100 000 nm. The diameter of the HIV pathogen is 100 nm.

How many orders of magnitude larger is the diameter of a human ovum compared to an HIV pathogen?

A 3

B 10

C 99

D 1000

Your answer ☐ **[1]**