

1(a). Plant hormones control many processes in plants.

Complete these sentences by writing the correct plant hormones in the gaps.

Each hormone can be used more than once.

Flowers are sometimes sprayed with to produce fruits without seeds.

After fruits are picked, they can be exposed to to make them ripen.

Flowers are stimulated to open, and seeds made to break dormancy by the hormone

Selective weedkillers and rooting powders usually contain

[4]

(b). Plant hormones have a variety of effects on plants.

Fig. 20.1 shows buds growing on a plant.

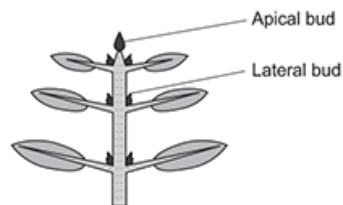


Fig. 20.1

The apical bud affects the growth of the lateral buds. This effect is called apical dominance.

A scientist investigates how auxin produced in the apical bud prevents the growth of the lateral buds.

The results of the experiment are shown in **Fig. 20.2** and **Fig. 20.3**.



The apical bud is cut off and the plant is left to grow for two weeks.

Fig. 20.2



The apical bud is cut off and auxin is applied to the top. The plant is left to grow for two weeks.

Fig. 20.3

Explain how the results of the experiment support the theory that auxin from the apical bud prevents the growth of lateral buds.

[2]

2. What is the correct sequence of events in one cell cycle?

- A** Growth of the cell, DNA replication, movement of the chromosomes
- B** Growth of the cell, movement of the chromosomes, DNA replication
- C** Movement of the chromosomes, DNA replication, growth of the cell
- D** Movement of the chromosomes, growth of the cell, DNA replication

Your answer

[1]

3. Beta thalassaemia is a genetic disorder caused by a mutation in DNA.

Beta thalassaemia can be treated with stem cells.

Stem cells are taken from a donor and placed in the vein of the patient.

Explain why using stem cells from a donor can be used as a treatment for this disease.

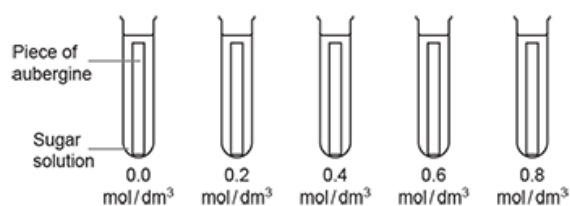
[2]

4(a). An aubergine is a fruit with a thick, shiny skin.

A student does an experiment to find the solute concentration in the cells of an aubergine.

They follow this method:

- Remove the skin and cut five pieces of aubergine of equal size.
- Weigh each piece before placing into one of 5 different sugar solutions.
- Leave for 4 hours.
- Remove the pieces of aubergine and reweigh.



The table shows their results.

	Concentration of sugar solution				
	0.0 mol / dm ³	0.2 mol / dm ³	0.4 mol / dm ³	0.6 mol / dm ³	0.8 mol / dm ³
Mass before the experiment (g)	5.0	5.2	5.5	5.1	5.3
Mass after the experiment (g)	7.0	6.5	5.8	4.5	3.5
Percentage change in mass (%)	+40.0	+ 25.0	+5.50	−11.8	

Another student evaluates the method used in the experiment. This student finds that two errors were made.

For each error, decide if it is a random error or a systematic error.

Tick (✓) **one** box for each error.

Error	Random error	Systematic error
Excess fluid was left on some aubergine pieces which will affect the mass.		
The scale used to weigh the aubergine pieces was not calibrated correctly.		

[1]

(b). Why did the student remove the skin from the aubergine before placing it in the sugar solution?

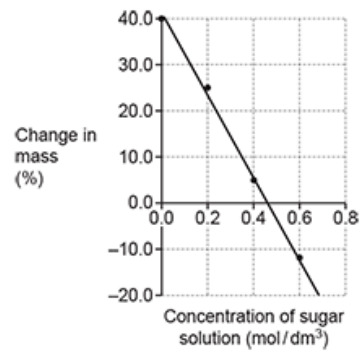
[1]

(c). Calculate the percentage change in mass for the piece of aubergine placed in 0.8 mol / dm³.

Give your answer to **3** significant figures.

Percentage change in mass = % [3]

(d). The student plots a graph to work out the solute concentration of the cells in the aubergine.



The student concludes that the solute concentration of the aubergine cells is 0.46 mol/dm³.

Explain why the student is **correct**.

[1]

(e). Describe how you could improve the method to determine the concentration of the cells in the aubergine with greater accuracy.

[2]

5. Scientists researching how mitochondria produce ATP came up with a theory.

Their theory said:

- Hydrogen ions are transported into the space between the two membranes surrounding the mitochondria, shown in **Fig. 25.1**.
- The ions become concentrated in this space.
- The ions diffuse back into the mitochondria making ATP.

To test this theory the scientists removed the outer membrane of the mitochondria, as shown in **Fig. 25.2**.

Fig. 25.1

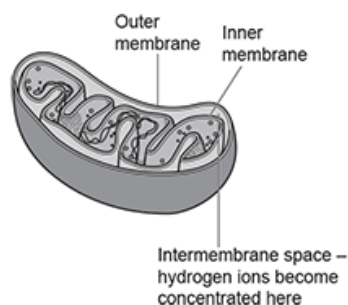
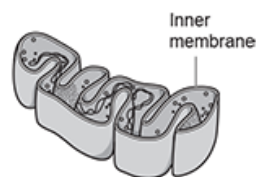


Fig. 25.2



The result of their experiment showed that less ATP is formed.

Explain how this result shows that their theory is correct.

-----[2]

6. A drug is used to treat cancer. The drug stops the formation of microtubules that move chromosomes in cells.

Which statement explains how the drug stops more cancer cells being made?

- A** Chromosomes will be replicated but the chromosomes will not separate in mitosis.
- B** Dividing cells will not replicate their chromosomes.
- C** Four cells will be produced at the end of mitosis.
- D** New cells formed will only have half the number of chromosomes.

Your answer ☐

[1]

7. A cell divides by mitosis every 20 minutes.

How many cells will there be after 3 hours?

- A** 9
- B** 18
- C** 60
- D** 512

Your answer ☐

[1]

8. In an osmosis experiment, a student measures out 45 cm³ of a solution.
They use a beaker to measure out the volume.

Which piece of equipment would make this measurement most accurate?

- A** A 50 cm³ measuring cylinder
- B** A 250 cm³ measuring cylinder
- C** A conical flask
- D** A dropping pipette

Your answer ☐

[1]

9. Mole rats are rodents that live in Africa. Mole rats rarely develop cancer.
One theory to explain this involves two 'over-crowding' genes.
These genes slow down the cell cycle when cells come into contact with each other.

Explain how slowing down the cell cycle can protect mole rats from developing cancer.

[2]

10. Scientists are using stem cells to try and cure cystic fibrosis.

They are trying two methods:

- 1) using stem cells from cloned embryos
- 2) converting skin cells from a donor into adult stem cells.

What is the advantage of the **second** method?

- A Adult stem cells are less likely to be infected by viruses.
- B Adult stem cells can form a wider range of tissues.
- C Embryos will not need to be destroyed.
- D Stem cells produced from donor skin cells are less likely to be rejected.

Your answer

☐

[1]

11. Amyloidosis is a group of inherited conditions that affect people's health.

The most common type of amyloidosis is caused by a dominant allele (**A**) of a gene.

One treatment that doctors use for amyloidosis involves:

- Killing all the plasma cells in the body.
- Then giving the patient healthy stem cells.

Explain how this treatment could help people with amyloidosis.

[2]

12. Fig. 24.1 shows how stem cells in bone marrow differentiate into red blood cells.

Fig. 24.2 shows how the concentration of RNA and haemoglobin changes as the stem cell differentiates and the area of the nucleus changes.

Fig. 24.1

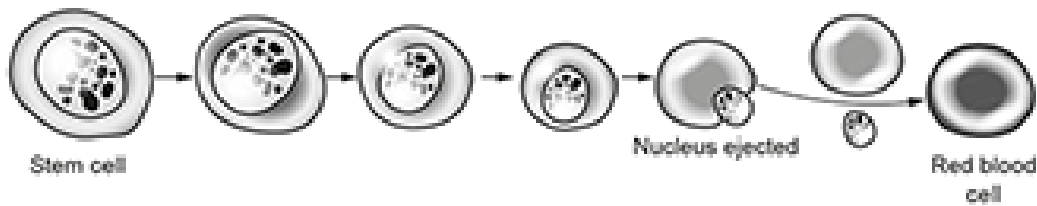
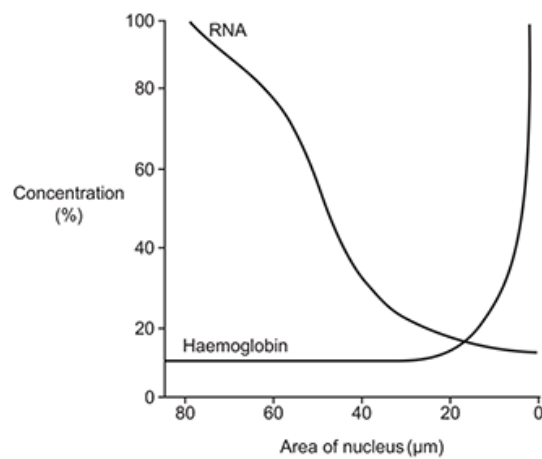


Fig. 24.2

Red blood cell development



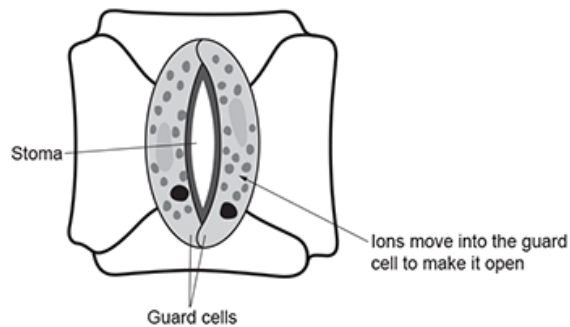
* Use **Fig. 24.1**, **Fig. 24.2** and your knowledge of cell differentiation to describe and explain the formation of red blood cells.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

[6]

13. For gases to enter a leaf, the stomata must be open.

The diagram shows a stoma and two guard cells. When the stomata are open, the guard cells are described as being turgid (full of water).



Explain how the guard cells help control the size of the stoma.
Use information from the diagram.

[4]

14. In 2018, a newspaper headline suggested that a cure for blindness had been found.

The newspaper was reporting on a study looking at operations in patients with age-related macular degeneration (AMD). In AMD, part of the retina is damaged.

During the study, researchers used embryonic stem cells to try to repair the sight of two individuals with wet AMD.

- i. One year later, both patients' eyesight had improved.

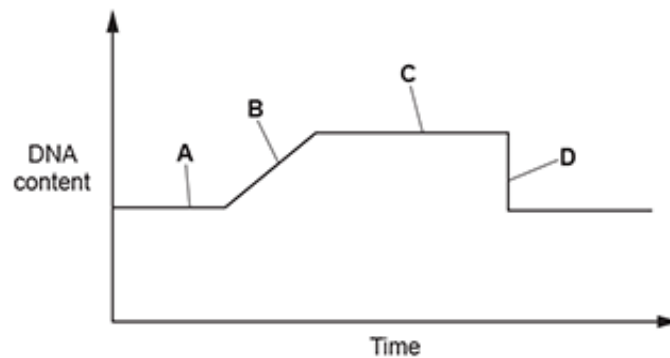
Explain why the newspaper headline claim of a cure may be misleading.

[2]

- ii. Suggest **one other** factor the researchers need to find out before this treatment is made widely available to all people with AMD.

[1]

15. The graph shows how the DNA content of a cell changes during the cell cycle.



Which part of the graph **A**, **B**, **C** or **D** represents DNA replication?

Your answer

[1]

16. The cell cycle consists of the following stages:

1. Cell growth
2. Movement of chromosomes
3. DNA replication

Which is the correct order of the stages in one cell cycle?

- A** 1, 2, 3, 2
B 1, 3, 1, 2
C 2, 1, 3, 1
D 2, 3, 1, 3

Your answer

[1]

17. An elephant has 56 chromosomes in a stomach cell.

How many chromosomes will there be in an elephant's ear cell?

- A** 23
- B** 28
- C** 56
- D** 112

Your answer

[1]

END OF QUESTION PAPER