Foundations in biology

(Cell structure)

Total mark – 22

Question: 1

5. 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.

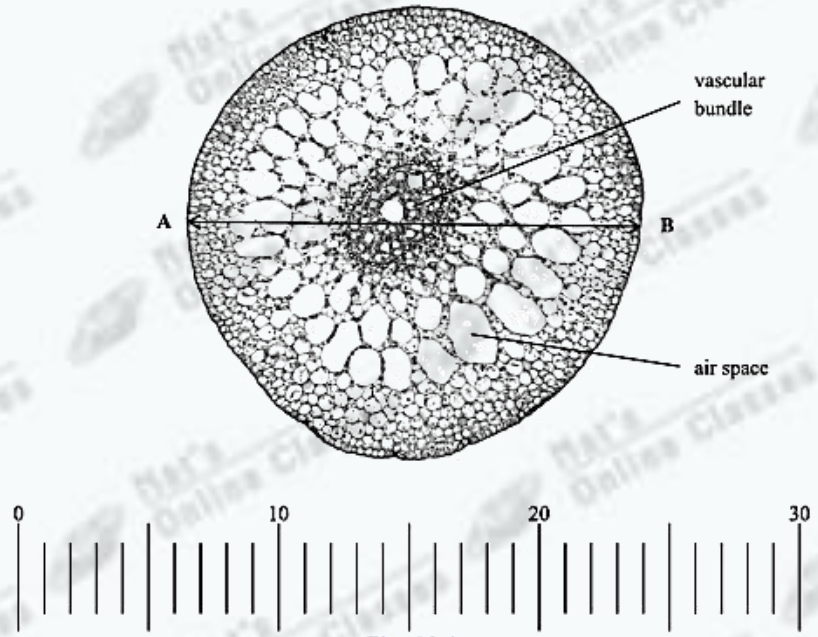


Fig. 22.1

A 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.

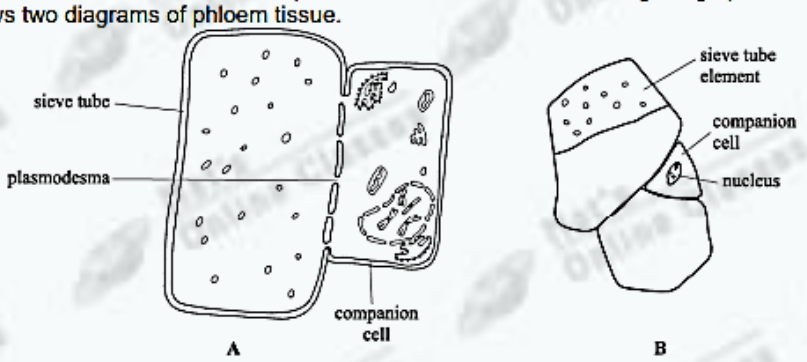


Fig. 22.2

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

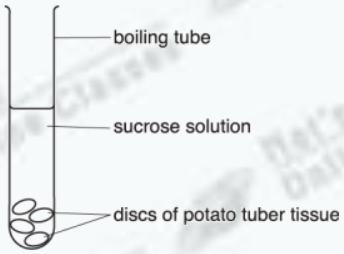
Table 22.1

Which stain had the student used? Explain your answer.

---[2]

Question: 2

6. The figure shows some of the apparatus used in an experiment investigating water potential in potato tuber tissue.

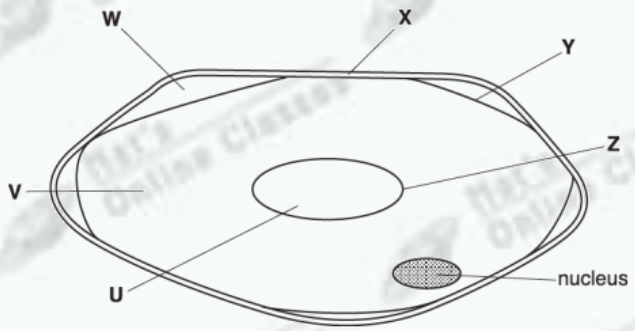


The discs were placed in boiling tubes containing sucrose solutions of different concentrations for four hours. The percentage change of mass was then calculated.

The results are shown in the table.

Concentration of sucrose solution (mol dm^{-3})	Change in mass of potato discs (%)
0.00	+18.00
0.10	+12.50
0.20	+2.50
0.30	− 3.00
0.40	− 8.00
0.45	−11.50

The figure shows a diagram of a cell from a potato tuber disc that was placed in 0.45 mol dm^{-3} sucrose solution.



i. Identify the parts of the cell labelled **X**, **Y** and **Z**.

X .....

Y .....

Z .....

[3]

ii. What will be found at **W** in the immersed cell?

.....

[1]

Question: 3

7. One theory about the evolution of organelles is the endosymbiotic theory. This theory suggests that the mitochondria and chloroplasts found in eukaryotic cells represent formerly free-living bacteria that were absorbed into a larger cell.

The following list describes a number of features of mitochondria and chloroplasts.

Place a tick (✓) next to the **three** statements that could be used as evidence for the endosymbiotic theory.

mitochondria contain ribosomes that are smaller than those found in the cell cytoplasm	☐
chloroplasts contain chlorophyll and other photosynthetic pigments	☐
mitochondria are a similar size to bacteria	☐
the inner membrane of a mitochondrion is folded to form cristae	☐
chloroplasts contain many disc-shaped membranes called thylakoids	☐
chloroplasts have their own circular DNA	☐

[3]

Question: 4

9. Please refer to Fig. 2 in Insert H020/02, Depth in biology, June 2019, which is a photomicrograph of a mammalian blood smear.

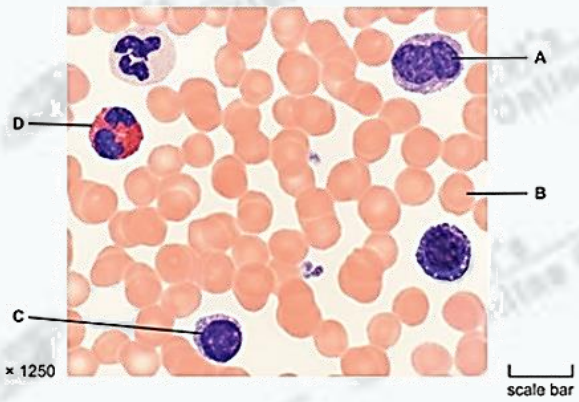


Fig 2

i. Name the cell labelled **B**.

_____ [1]

ii. Cells **A**, **C** and **D** work together to carry out an important function.

State the function that cells **A**, **C** and **D** perform.

_____ [1]

Question: 5

10. Sago pondweed is an underwater plant that grows in many regions of the world.

Fig. 1.1 shows a transmission electron micrograph of a sago pondweed cell.

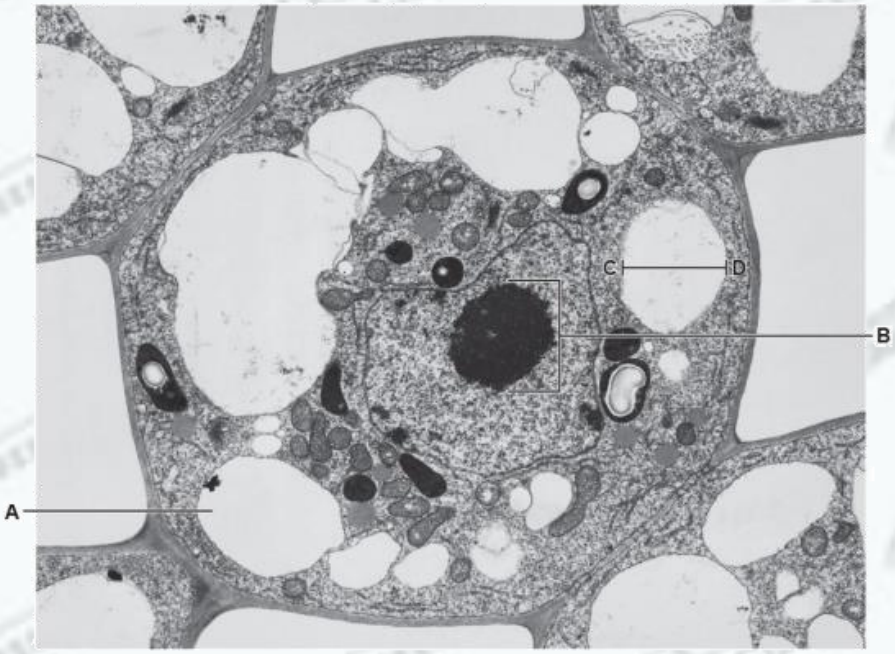


Fig. 1.1

i. Identify the **cellular components** shown at **A** and **B**.

A .....

B .....

[2]

ii. The real size of the line between **C** and **D** on Fig. 1.1 is 1.4×10^{-6} m.

Calculate the magnification that was used to produce the image in Fig. 1.1.

Give your answer to **2 significant figures**.

magnification = ... **[2]**

iii. Fig. 1.2 shows a student's drawing of another sago pondweed cell, which was observed under a light microscope. The student used a sharp pencil but did not label the drawing.

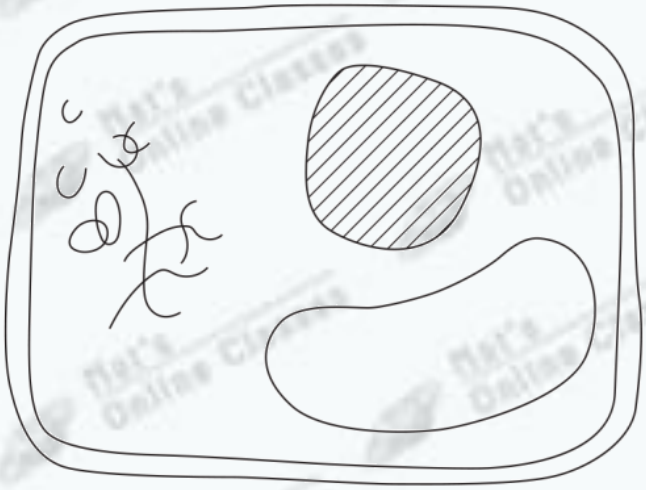


Fig. 1.2

Describe **two other** ways in which the drawing could be improved.

---**[2]**

iv. The student stained a sago pondweed sample to improve the contrast between cellular components when viewed under a microscope.

The student used the following procedure to stain the sample:

- Use forceps to place the sample on a glass slide.
- Use a pipette to place two drops of the stain in the centre of the sample.
- Carefully lower a cover slip onto the sample, ensuring that the cover slip is parallel with the slide as it is lowered.

1

2

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[2]