2 What is a function of Golgi bodies?

A formation of vesicles for endocytosis

B modification of proteins for secretion

C synthesis of ATP

D synthesis of polypeptides

3 Which organelles have a partially permeable membrane?

1 Golgi apparatus

2 lysosome

3 mitochondrion

4 ribosome

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

4 Mouse cells were grown in a dish containing a growth medium. Radioactively labelled amino acids were added to the growth medium. The table shows the time taken for the radioactively labelled amino acids to appear in three different organelles, R, S and T.

organelle	time taken for radioactivity to appear / min
R	2
S	9
T	35

Which row correctly identifies the organelles?

	R	S	T
A	Golgi body	lysosome	rough endoplasmic reticulum
B	Golgi body	rough endoplasmic reticulum	lysosome
C	rough endoplasmic reticulum	Golgi body	lysosome
D	rough endoplasmic reticulum	lysosome	Golgi body

2 **M1** is a slide of a stained transverse section through a plant stem.

(a) **(i)** Draw a large plan diagram of the region on **M1** indicated by the shaded area in Fig. 2.1.
Use a sharp pencil.

Use **one** ruled label line and label to identify the xylem.

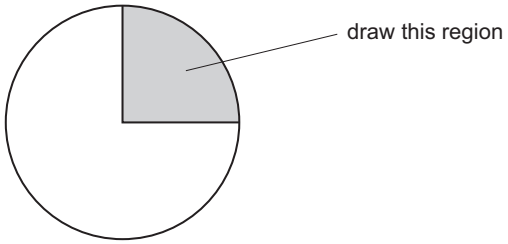

Fig. 2.1

[5]

(ii) Observe the xylem vessel elements in the stem on **M1**.

Select a group of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** other xylem vessel element.

- Make a large drawing of this group of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of a stem from a different plant to **M1**.

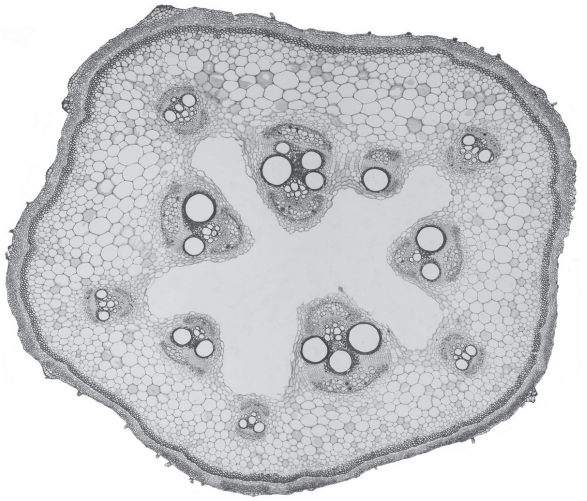

Fig. 2.2

Identify **three** observable differences, other than colour, between the stem section on **M1** and the stem section in Fig. 2.2.

Record these **three** observable differences in an appropriate table.

[4]

(c) Fig. 2.3 shows a photomicrograph of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

One division, on either the stage micrometer scale or the eyepiece graticule, is the distance between two adjacent lines.

The length of one division on the stage micrometer in Fig. 2.3 is 1.0 mm.

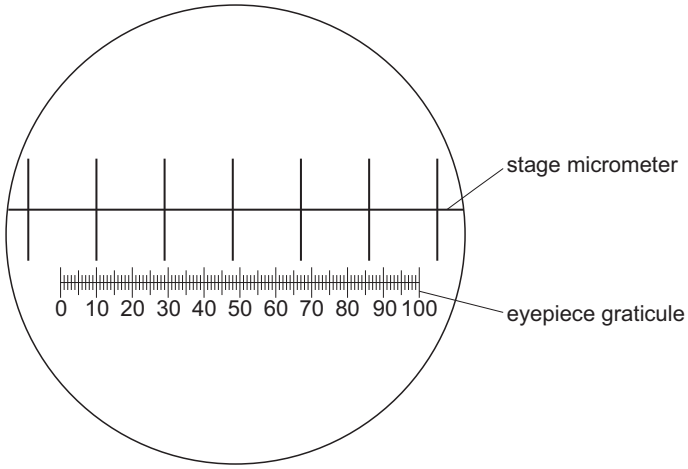

Fig. 2.3

(i) Calculate the actual length of one eyepiece graticule unit shown in Fig. 2.3.

Give your answer in micrometres (μm).

Show your working and give your answer to **three** significant figures.

actual length of one eyepiece graticule unit = ... μm
[3]

(ii) Fig. 2.4 is the same photomicrograph as that shown in Fig. 2.2. This was taken with the same microscope and the same lenses used to take the photomicrograph in Fig. 2.3.

The eyepiece graticule has been placed across the length of a vascular bundle.

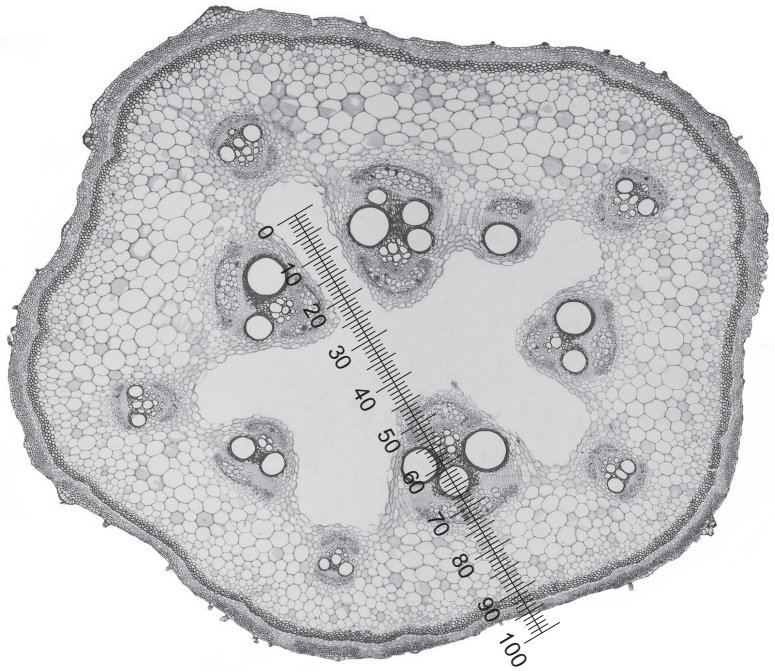

Fig. 2.4

Use the calibration of the eyepiece graticule unit from **(c)(i)** to calculate the actual length of the vascular bundle in Fig. 2.4.

Show your working and use appropriate units.

actual length of the vascular bundle = ...
[2]

[Total: 19]

2 The buff-tailed bumblebee, *Bombus terrestris*, is an insect that uses its tongue to feed on the nectar and pollen of flowers.

Buff-tailed bumblebees can feed on the nectar and pollen of flowers by either gripping (holding) onto flower petals or by hovering (flying) in front of the flowers.

Fig. 2.1 shows the buff-tailed bumblebee.

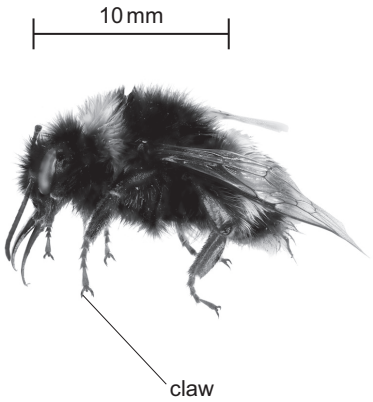

Fig. 2.1

The buff-tailed bumblebee has adaptations, such as claws, to help it to grip on to flower petals to obtain nectar and pollen.

Fig. 2.2 shows the buff-tailed bumblebee using its claws to grip on to the flower petals as the bee feeds.

Fig. 2.2

Fig. 2.3 is a magnified image of the claw of a bee.

Fig. 2.3

(a) Suggest a method that can be used to measure the image length of the longest part of the curved claw in Fig. 2.3.

.....

.....

..... [1]

(b) The surfaces of flower petals of different plant species have different textures.

Fig. 2.4 shows a scanning electron micrograph of a rough surface of a flower petal.

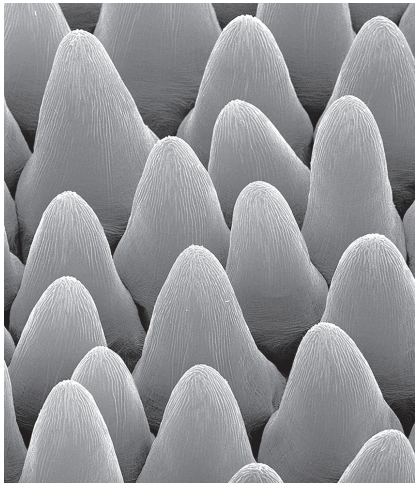

Fig. 2.4

Fig. 2.5 shows a scanning electron micrograph of a smoother surface of a flower petal.

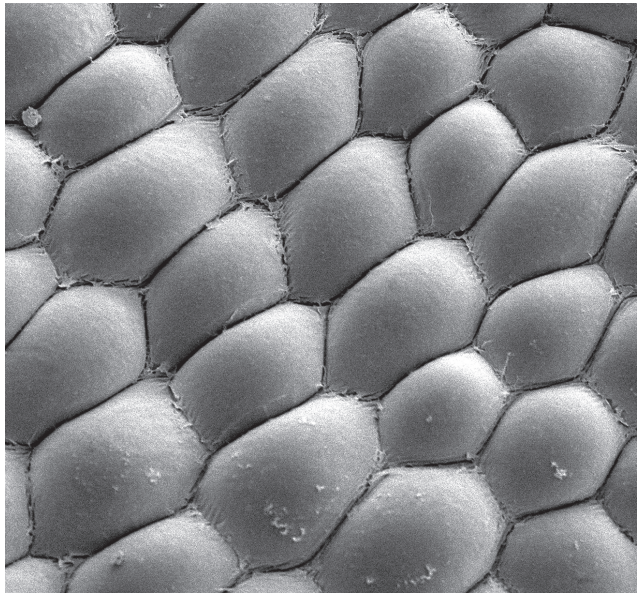

Fig. 2.5

A scientist made an artificial flower apparatus, as shown in Fig. 2.6.

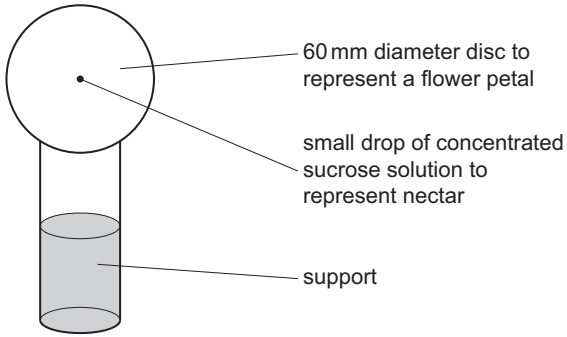

Fig. 2.6

To model flower petals with different levels of roughness, the scientist used different discs.

Each disc was made using particles of different diameters attached to the surface of the disc, as shown in Table 2.1.

Table 2.1

mean particle diameter on the disc / μm	**level of roughness**
5	smooth ↓
9	
12	
16	
30	
53	rough

(i) The diameter of each disc was standardised as 60 mm.

Identify **one** other variable the scientist should standardise when making the discs.

.....

.....

..... [1]

(ii) The scientist investigated if the level of roughness of the discs affects whether buff-tailed bumblebees grip on to the disc or hover when they feed (feeding visit) from the small drop of concentrated sucrose solution.

For each disc, the scientist:

- recorded the number of feeding visits when the buff-tailed bumblebees gripped on to the disc
- recorded the number of feeding visits when the buff-tailed bumblebees hovered in front of the disc
- calculated the percentage of feeding visits when the buff-tailed bumblebees gripped on to the disc.

State the **independent** variable in this investigation.

.....

..... [1]

(iii) For the disc with a mean particle diameter of 16 μm, the scientist calculated that the buff-tailed bumblebees gripped on to the disc for 79% of their feeding visits.

The total number of feeding visits was 117.

Calculate the number of feeding visits when the buff-tailed bumblebees hovered in front of the disc.

Give your answer to the nearest whole number.

number of feeding visits when the buff-tailed bumblebees hovered = ... [1]

(iv) Fig. 2.7 shows the results of the investigation.

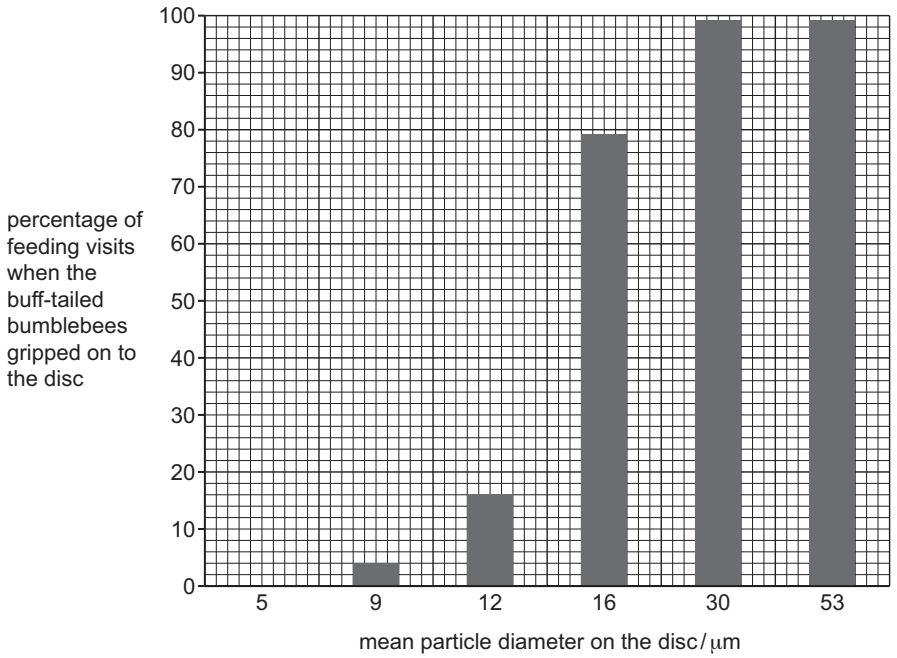

Fig. 2.7

State **two** conclusions that can be made from the results in Fig. 2.7.

.....

.....

.....

.....

..... [2]

(c) A student used the Spearman's rank correlation to analyse the data in Fig. 2.7.

The student stated the null hypothesis as:

There is no correlation between the mean particle diameter on the disc and the percentage of feeding visits when the buff-tailed bumblebees gripped on to the disc.

The formula for Spearman's rank correlation (r_s) is:

$$r_s = 1 - \left(\frac{6 \times \Sigma D^2}{n^3 - n} \right)$$

key to symbols:
D = difference in rank between each pair of measurements

n = number of pairs of items in the sample

(i) Complete Table 2.2 to calculate ΣD^2.

Table 2.2

mean particle diameter on the disc / μm	rank of mean particle diameter on the disc	percentage of feeding visits when the buff-tailed bumblebees gripped on to the disc	rank of percentage of feeding visits when the buff-tailed bumblebees gripped on to the disc	Difference in rank, D	D^2
5	1	0			
9	2	4			
12	3	16			
16	4	79			
30	5	99			
53	6	99			
				$\Sigma D^2 =$	

[2]

(ii) Use the calculated value for ΣD^2 from Table 2.2 to calculate r_s.

$r_s =$ ..... [1]

(iii) Table 2.3 shows the critical values of r_s at the 0.05 probability level.

Table 2.3

n	5	6	7	8	9	10	11	12
critical value of r_s	0.90	0.83	0.71	0.64	0.60	0.56	0.54	0.50

Use the data from Table 2.3 to explain why the student rejected the null hypothesis.

.....

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..... [1]

[Total: 10]