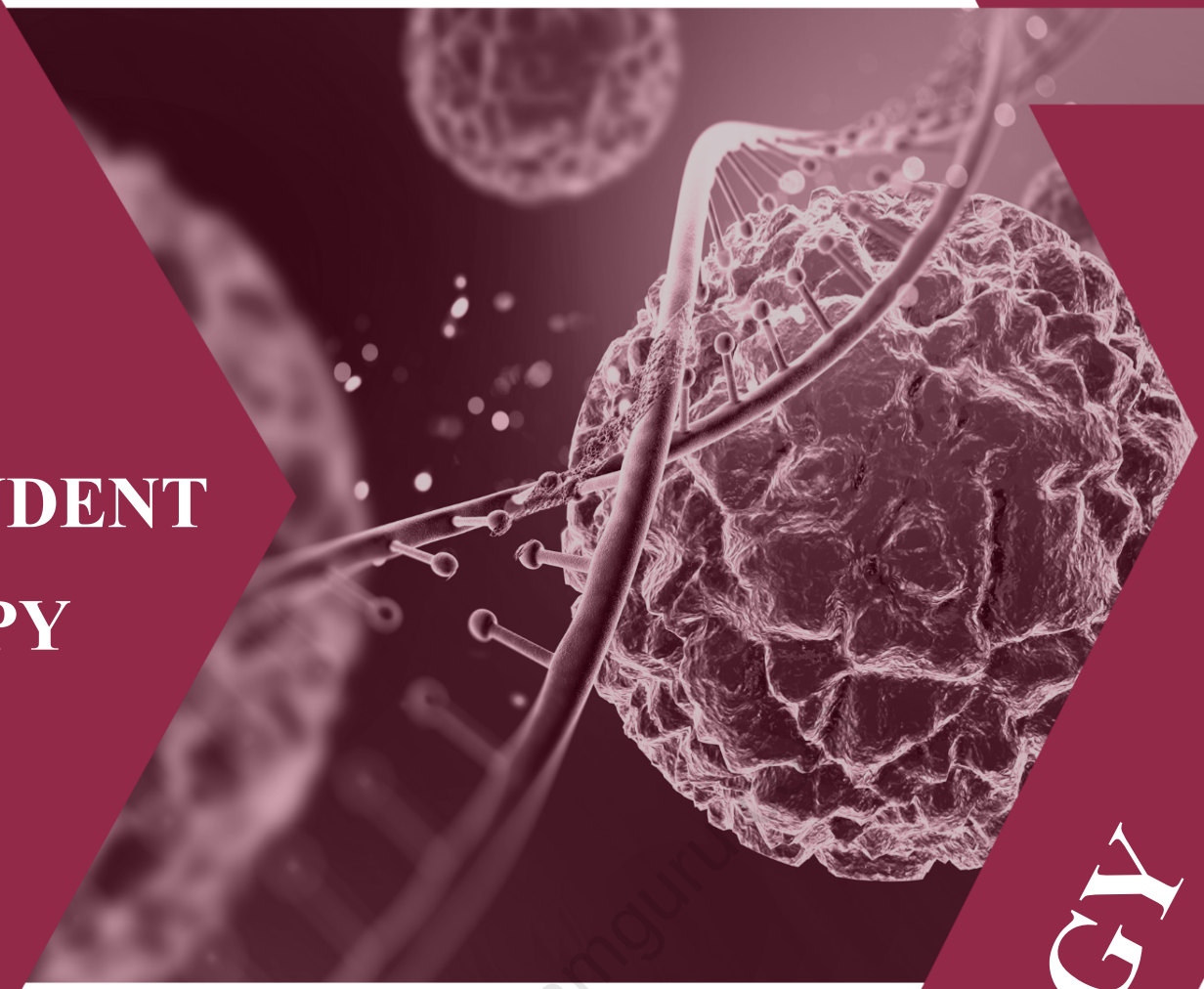
STUDENT COPY



HEADS-UP
REACH FOR THE STARS

IGCSE BIOLOGY

TOPICAL PRACTICE QUESTIONS

PAPER 6

VOL. 4

2020 EDITION

CHAPTERS 16-20

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Chapter 16: Reproduction

1 Fig. 3.1 is a photograph of the flower of Amaryllis, *Hippeastrum aglaiae*.

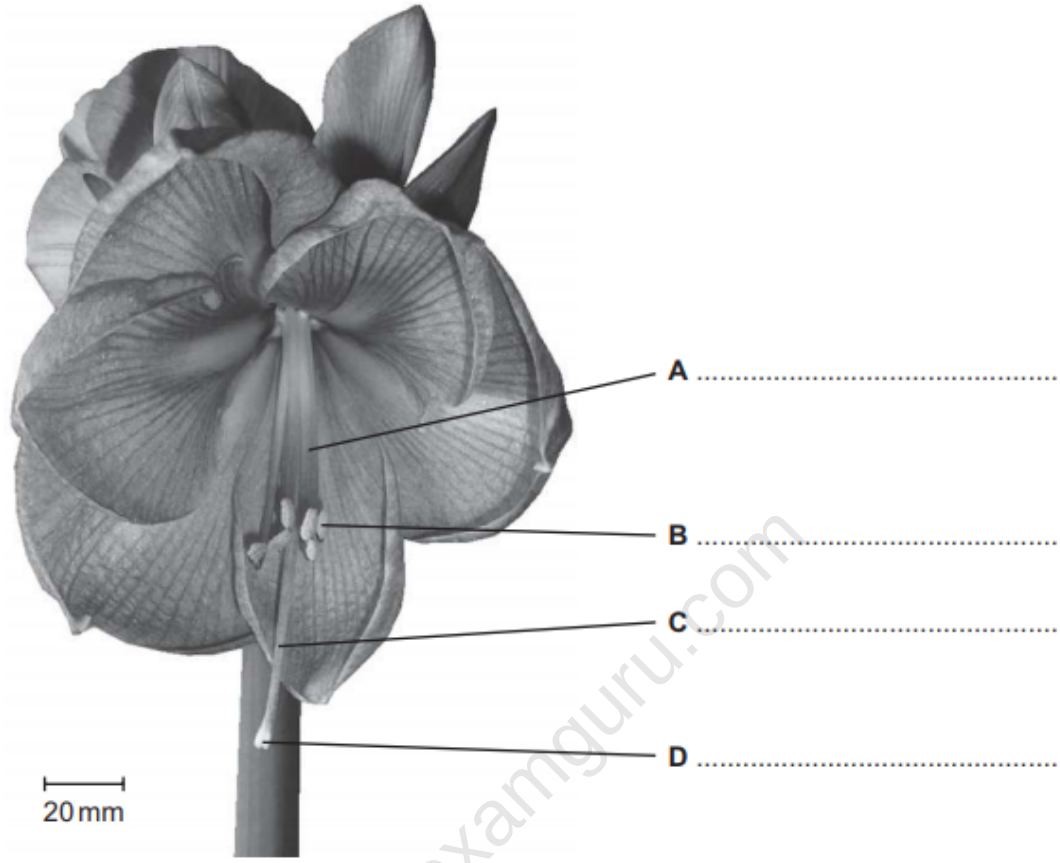


Fig. 3.1

(a) (i) On Fig.3.1, name the parts of the flower labelled **A**, **B**, **C** and **D**.

Write your answers on the lines in Fig.3.1 [4]

Plant breeders use small paint brushes to pollinate flowers of Amaryllis artificially.

(ii) State the letter of the part from which the pollen is taken.

..... [1]

(iii) State the letter of the part on which the pollen is put.

..... [1]

(iv) State one visible feature in Fig. 3.1 which shows that this flower is usually pollinated by insects.

.....

..... [1]

Fig 3.2 shows four pollen grains from an Amaryllis flower.

Fig. 3.2

(b) Measure the length of a pollen grain in mm.

Length of pollen grain ..... mm

Calculate the actual length of the pollen grain that you measured in mm.

Show your working.

actual length of pollen grain ..... mm [3]

[Total: 10]

2 **(a)** Some students investigated the effect of enzyme concentration on starch.
They were provided with a Petri dish containing a layer of starch agar jelly.
The students cut three small holes in the starch agar jelly and labelled them as shown in Fig. 1.1.

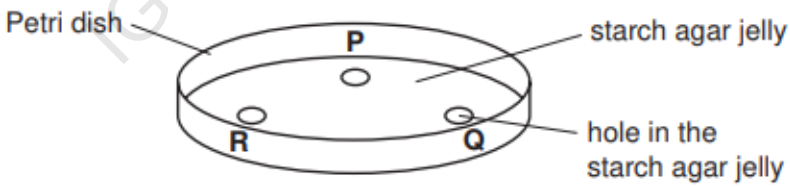


Fig. 1.1

They placed the starch agar jelly that had been cut out of the holes on a white tile and added two drops of dilute iodine solution to each piece.

The dilute iodine solution changed from yellow/brown to deep blue.

(i) State why the colour changed.

.....

..... [1]

The students were given two different concentrations of the same enzyme, solution **1** and solution **2**.

- They put two drops of enzyme solution **1** into hole **P**.
- They put two drops of enzyme solution **2** into hole **Q**.
- They put two drops of water into hole **R**.
- After 15 minutes dilute iodine solution was poured over the surface of the starch agar jelly.

Fig. 1.2 shows the appearance of the surface of the starch agar jelly after dilute iodine solution had been added. The Petri dish was placed on a piece of squared paper.

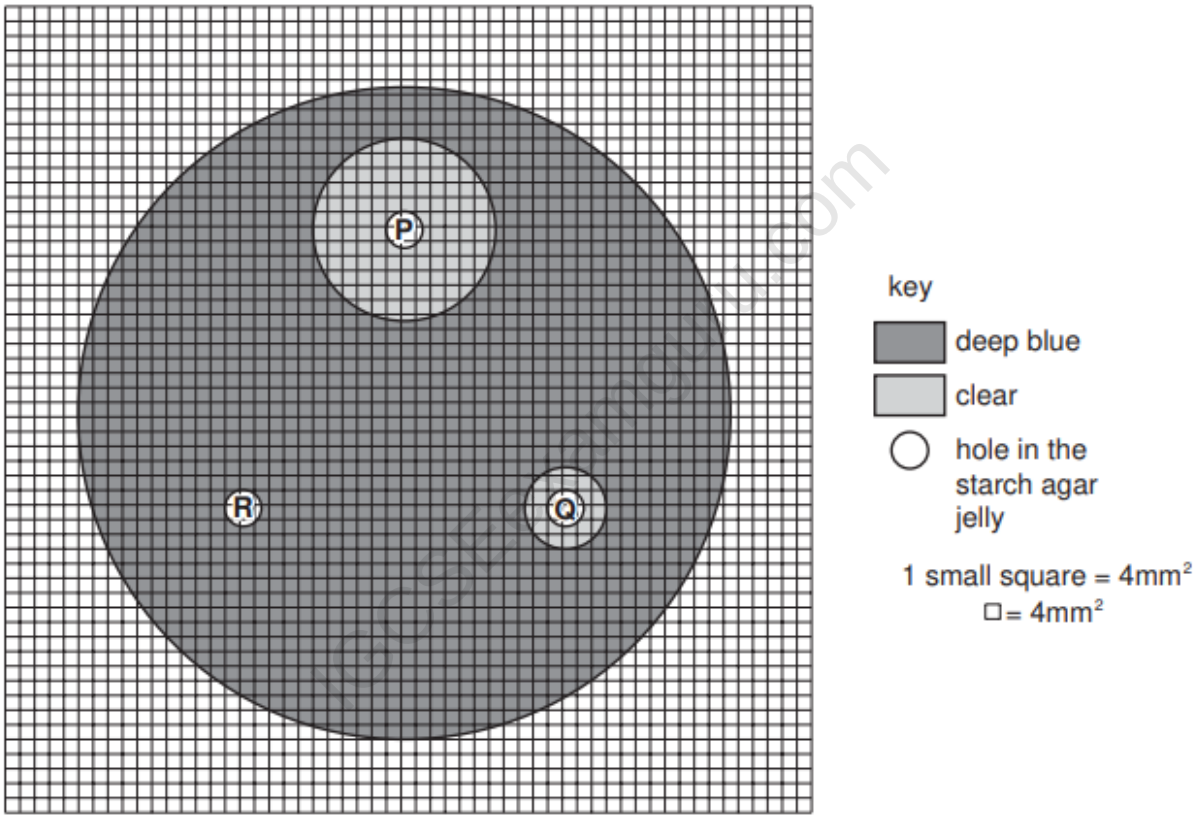


Fig. 1.2

(ii) Holes **P**, **Q** and **R** are the same size.
Use the grid and count the squares to estimate the area of hole **R**.

area of hole **R** ..... mm^2 [1]

(iii) Describe the results shown in Fig. 1.2.

.....

.....

.....

.....

.....

..... [3]

(iv) Explain the results shown in Fig. 1.2.

.....

.....

.....

.....

.....

..... [3]

(v) Suggest the name of the enzyme used in this investigation.

..... [1]

(vi) State why water was added to hole **R**.

.....

..... [1]

(b) Germinating seeds produce enzymes that change stored food into soluble materials.

Suggest a method similar to that in **(a)** that you would use to find out if germinating pea seeds produce the same enzyme as in enzyme solutions **1** and **2**.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Fig. 1.3 shows a pea seedling.

Fig. 1.3

Make a large, labelled drawing of the pea seedling in the space provided below.

Draw the pea seedling in the space below.

[4]

(d) Fig. 1.4 shows pea seeds in a pod.

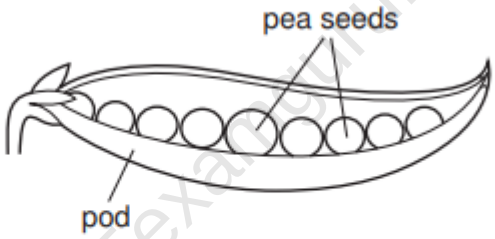


Fig. 1.4

The number of pea seeds in a pod varies.
Two students picked a sample of 23 pods.
They opened the pods and counted the number of pea seeds.

Fig. 1.5 shows the students' results.

number of pea seeds in each pod

8, 10, 11, 10, 9, 11, 9, 4,
10, 11, 12, 10, 10, 11, 8, 12,
10, 9, 11, 8, 10, 9, 12

Fig. 1.5

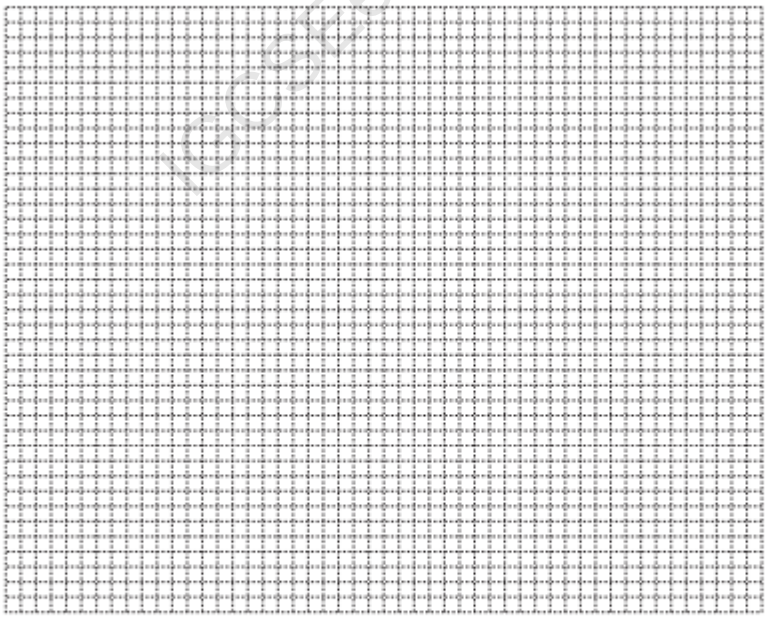
(i) Complete Table 1.1 using the results from Fig. 1.5 to show how many pods there were with each number of pea seeds.
Two rows have been completed for you.

Table 1.1

number of pea seeds in each pod	tally	number of pods
4		
5		
6		
7		
8	///	3
9		
10	~~////~~ //	7
11		
12		

[2]

(ii) Draw a histogram on Fig. 1.6 to show the number of pods with each number of pea seeds.



[4]

Fig. 1.6

(iii) Put an **X** in the bar on the graph which seems to be anomalous. [1]

(iv) Most pods contained 10 or 11 pea seeds.

Suggest a reason for some pods containing 8 or 12 pea seeds.

.....

..... [1]

[Total: 26]

3 **(a)** An investigation was carried out on the growth of onion seedlings.
Onion seedlings were grown in a tray.
One millimeter was removed from the tips of all of the onion seedlings on the left side of the dividing line, as shown in Fig. 3.1.

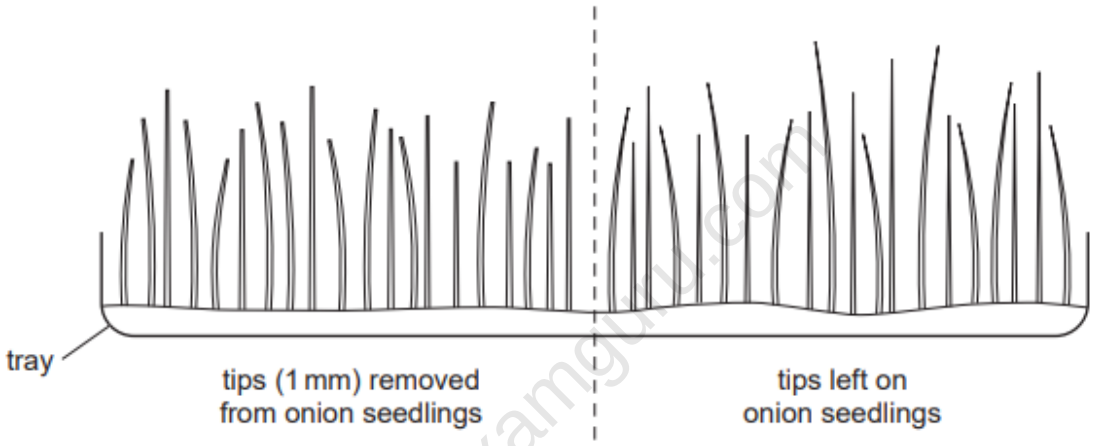


Fig. 3.1

Ten onion seedlings were cut at soil level from each side of the tray.
The heights of these onion seedlings were measured and recorded.
These are shown as the start heights in Table 3.1.

After three days, ten more onion seedlings were cut from each side, measured and recorded. The heights are shown in Table 3.1.

(i) Suggest why the onion seedlings were cut and removed from the tray before they were measured.

.....

..... [1]

(ii) State why a sample of ten onion seedlings is better than a sample of three onion seedlings.

.....

..... [1]

Table 3.1 shows the heights of the onion seedlings at the start and of those measured after three days.

Table 3.1

	height of seedling / mm			
	tips removed		tips left on	
	start	after three days	start	after three days
	84	70	70	63
	61	76	79	65
	54	63	57	83
	57	76	58	79
	56	80	53	83
	62	71	52	74
	68	73	61	76
	45	60	63	60
	64	76	51	85
	49	75	76	62
total height / mm	600		620	
mean height / mm	60		62	

(iii) Complete Table 3.1 by calculating the total height **and** mean height of the onion seedlings after three days. [2]

(iv) Calculate the mean **increase** in height of the onion seedlings:

tips removed ..... mm

tips left on ..... mm [1]

(b) The experiment was repeated with another tray of onion seedlings.
The same experiment was then performed on beetroot seedlings.
The results are shown in Table 3.2.

Table 3.2

mean increase in height / mm			
onion seedlings		beetroot seedlings	
tips removed	tips left on	tips removed	tips left on
10	9	1	7

(i) Draw a bar chart on Fig. 3.2 to show the data in Table 3.2.

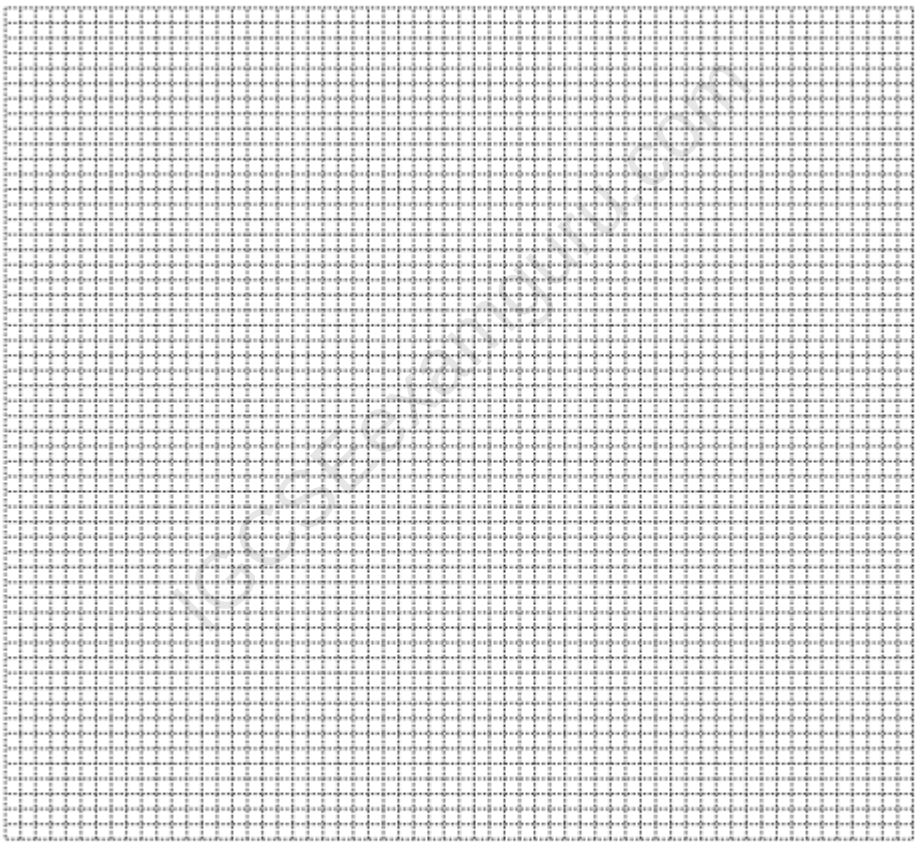


Fig. 3.2

[4]

(ii) Describe the effect of removing the tips on the growth of onion and beetroot seedlings.

onion .....

.....

beetroot .....

..... [2]

(iii) Suggest where growth takes place in the shoots of onion and beetroot seedlings.

onion .....

.....

beetroot .....

..... [2]

[Total: 13]

4 Arum lilies, such as *Arum maculatum*, are plants that have a smell like rotting meat.
The smell attracts flies so that the flowers can be pollinated.
Some arum lilies have a purple coloured sheath and some have a light green coloured sheath.

Fig. 3.1 shows an arum lily with part of the sheath cut away to show the inside.

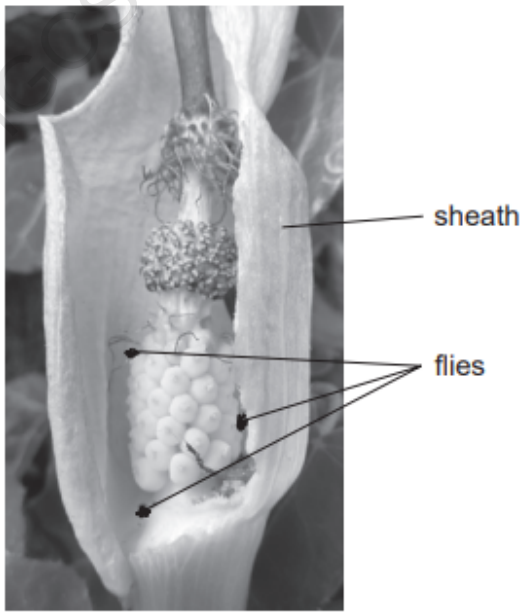


Fig. 3.1

A group of students collected arum lilies from the same habitat, **two** with purple coloured sheaths and **three** with light green coloured sheaths.
They opened the sheaths of each lily and counted the number of flies inside.

The results are shown in Table 3.1.

Table 3.1

colour of sheath	number of flies	total number of flies	mean number of flies
purple	3		
purple	5		
light green	5		
light green	6		
light green	4		

(a) Calculate the total **and** mean number of flies found in each colour of sheath.

Write your answers in Table 3.1. [2]

(b) Suggest **two** ways in which this investigation could be improved.

1 .....

.....

2 .....

..... [2]

[Total: 4]

5 Seeds from the plant family *Papilionaceae* form an important part of the human diet.

Fig. 1.1 shows three different types of seed that have been soaked in water for 24 hours.

lentils chickpeas soya beans

Fig. 1.1

(a) Describe the differences in shape **and** appearance of the seed coat (testa) between the three types of seed.

Write your answers in Table 1.1.

Table 1.1

feature	lentil	chickpea	soya bean
shape of seed			
appearance of seed coat			

[3]

(b) A group of students were planning an investigation into the effect of temperature on the germination of seeds.

The teacher gave them a list of possible variables.

temperature	number of seeds germinated
intensity of light	time
length of seedling	volume of water

From this list, select the most suitable:

variable to change; .....

variable to measure. .....

[2]

Fig. 1.2 shows the same three seeds after they have been germinated in suitable conditions.

lentil chickpea soya bean

Fig. 1.2

(c) (i) Make a large, labelled drawing of the **lentil** seedling.

[4]

(ii) You are going to calculate the magnification of your drawing.

Measure the length of the line **ST** on Fig. 1.2.

length of line **ST** ..... mm

Draw line **ST** on your drawing in the same position as in Fig. 1.2.

Measure the corresponding length of **ST** on your drawing.

length of **ST** in drawing ..... mm

Calculate the magnification of your drawing.

Show your working.

magnification × ..... [4]

Lentils contain protein and a small quantity of fat.

(d) Describe the food tests you could carry out to show that lentil seeds contain:

(i) protein;

.....

.....

.....

..... [2]

(ii) fat.

.....

.....

.....

.....

.....

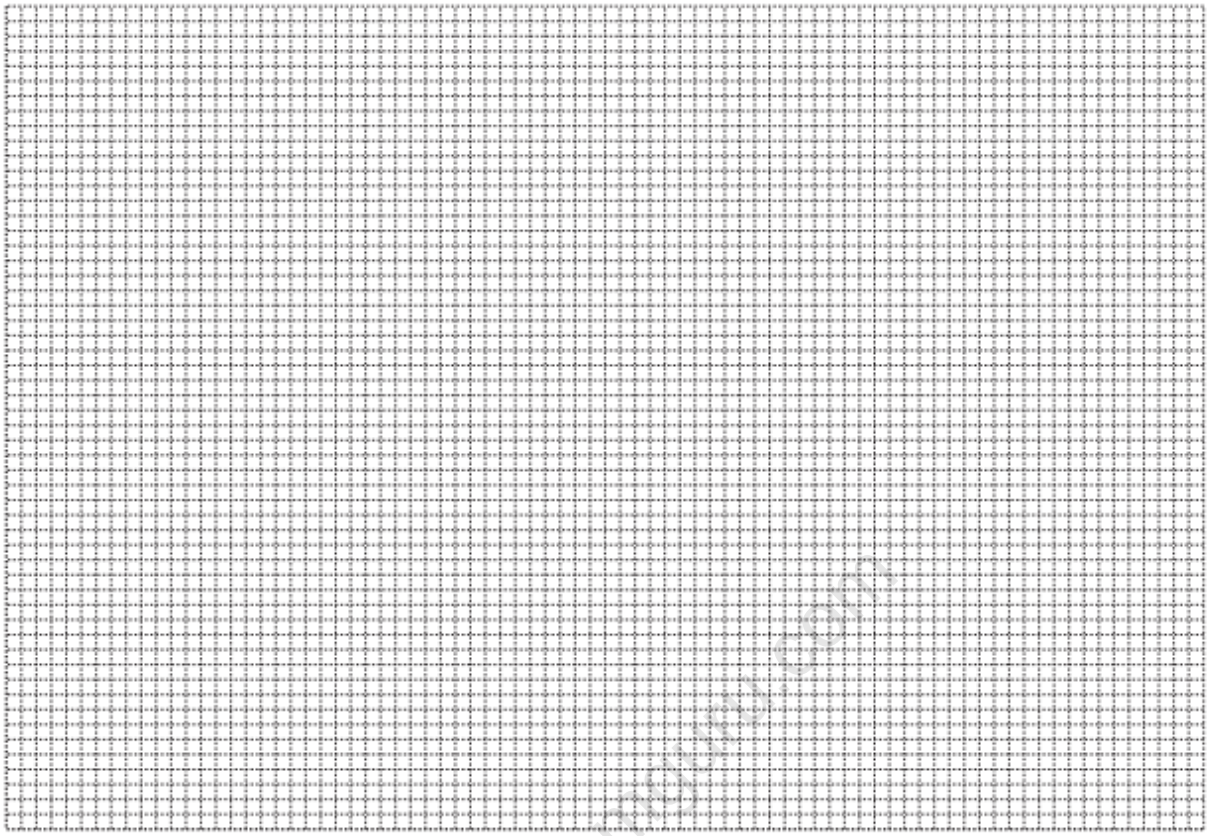
..... [3]

(e) The percentage of protein and fat in five types of seed, are shown in Table 1.2.

Table 1.2

type of seed	percentage of protein / %	percentage of fat / %
chickpea	8.0	2.5
lentil	9.0	0.6
lima bean	8.0	0.4
mung bean	7.0	0.4
soya bean	16.0	8.0

(i) Construct a bar chart to show the percentages of protein and fat in the five types of seed. Use the same axes for the two sets of data.



[5]

(ii) Meat is a good source of protein.

Name the type of seed in Table 1.2 that would be a good alternative to meat in the human diet.

..... [1]

Fig. 1.3 shows part of a label from a packet of soya bean seeds. The label shows the energy content measured in kilojoules.

Soya Beans

Nutrition

Typical composition	50 g serving provides
Energy	230 kJ
Protein	8.5 g
Carbohydrate	4.5 g
Fat	4.0 g

Fig. 1.3

Fig. 1.4 shows a simple calorimeter.
This apparatus can be used to find the energy content of a soya bean seed.
The soya bean seed is burned and the energy released is absorbed by the water in the test-tube.

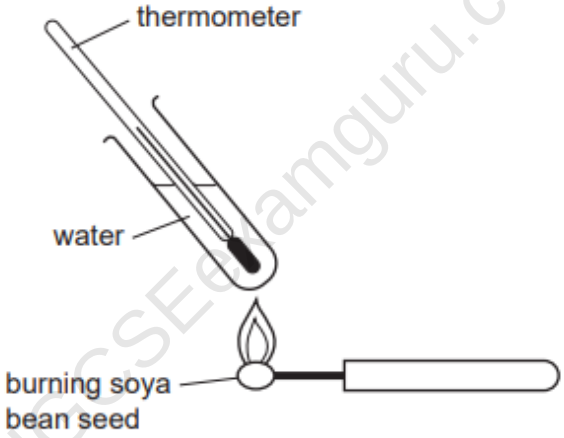


Fig. 1.4

(f) Suggest how you could **safely** carry out a simple investigation to find the energy content of a sample of soya bean seeds.

State what you would need to measure and control.

.....

.....

.....

.....

.....

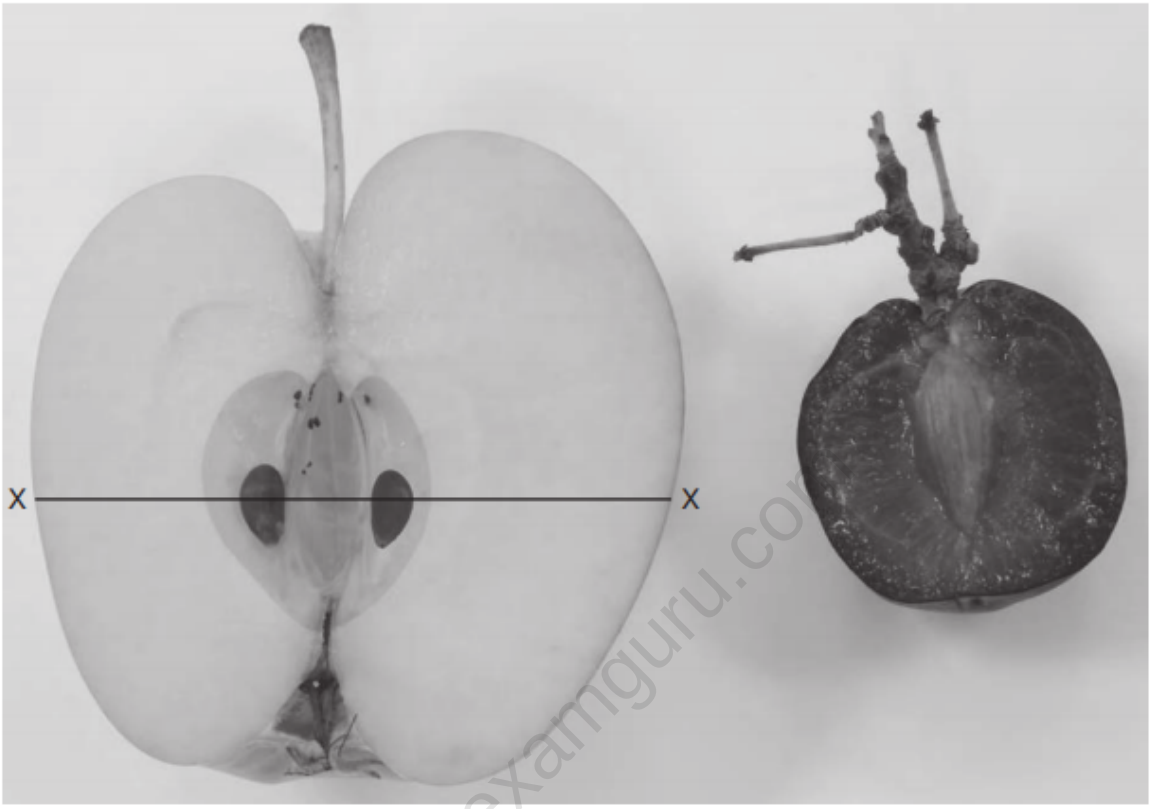
..... [3]

[Total: 27]

6 Fig. 1.1 shows two fruits, an apple and a plum, cut in half.

The apple is referred to as a false fruit because the edible part is not developed from the ovary.

The plum is a true fruit because the edible part is developed from the ovary.



apple plum

Fig. 1.1

(a) (i) Make a large, labelled drawing of the apple.
Include details of the ovary in your drawing.

[4]

(ii) You are going to calculate the magnification of your drawing.
Measure the width of the apple on Fig. 1.1, between X and X.

width of apple in Fig.1.1 ..... mm

Draw a line on your drawing, corresponding to the line between X and X.
Measure this width of the apple in your drawing.

width of apple in your drawing ..... mm

Calculate the magnification of your drawing.

Show your working.

magnification × ..... [4]

The apple and the plum have a similar shape.

(b) (i) Describe **one** other **similarity**, visible in Fig. 1.1, of the two fruits.

.....

..... [1]

(ii) Complete Table 1.1 to describe **three** visible **differences**, shown in Fig. 1.1, between the two fruits.

Table 1.1

difference	apple	plum
1	....	....
2	....	....
3	....	....

[3]

As the two fruits ripen they become sweeter and softer.

(c) Describe how you could safely test the apple for the presence of reducing sugars.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 16]

7 Fig. 2.1 shows a section through a carrot, *Daucus carota*.

Fig. 2.1

(a) Make a large drawing of the carrot to show:

- the number of layers
- the thickness of the layers.

Label where the leaves are attached.

[4]

(b) The carrot is an example of a storage organ.

Describe how you would carry out a test to show the presence of starch in this storage organ.

.....

.....

.....

.....

.....[2]

(c) Carrot plants produce storage organs in their first year. These are used in their second year to produce flowers and seeds.

Fig. 2.2 shows three carrot seeds as seen under a light microscope.

Fig. 2.2

You are going to calculate the magnification of Fig. 2.2.

Measure the length of line **ST** drawn on one of the seeds in Fig. 2.2.

length of **ST** ..... mm

The scale rule shows 10 mm, divided into 100 divisions, each of 0.1 mm. Use the scale rule to measure the actual width of the seed marked by line **ST**.

actual width of seed, marked by **ST** (using scale rule) ..... mm.

Calculate the magnification of Fig. 2.2.

Show your working.

Give your answer to the nearest whole number.

magnification × .....[4]

(d) Some students wanted to investigate the conditions needed for the germination of carrot seeds.

As part of their plan, they listed the conditions shown in Fig. 2.3.

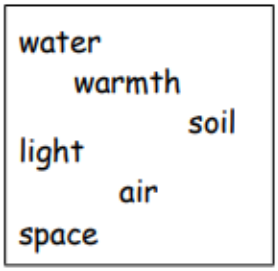


Fig. 2.3

One student selected light as a factor and suggested a plan for an investigation into the effect of light on germination.

- Samples of 15 soaked seeds were left to germinate in each of two open dishes.
- One dish was covered with black paper and the other dish was left uncovered.
- Both dishes were placed on a window bench for three days.
- Most seeds germinated successfully.

(i) Give a conclusion that the student could make from this investigation.

.....

.....

.....[1]

(ii) Describe one improvement that the student could make to their method.

.....

.....

.....[1]

[Total: 12]

8 Fruits contain the seeds of a plant. They are dispersed from the parent plant in a variety of ways.

A student investigated the dispersal of two different fruits, **E** and **F**, by measuring the distance travelled by the fruits from their parent plants.

Fig. 2.1 shows fruits **E** and **F**.

E **F** **not to scale**

Fig. 2.1

(a) Use Fig. 2.1 to describe two **visible** differences, other than size, between fruits **E** and **F**.

Write your answers in Table 2.1.

Table 2.1

difference	**E**	**F**
1		
2		

[2]

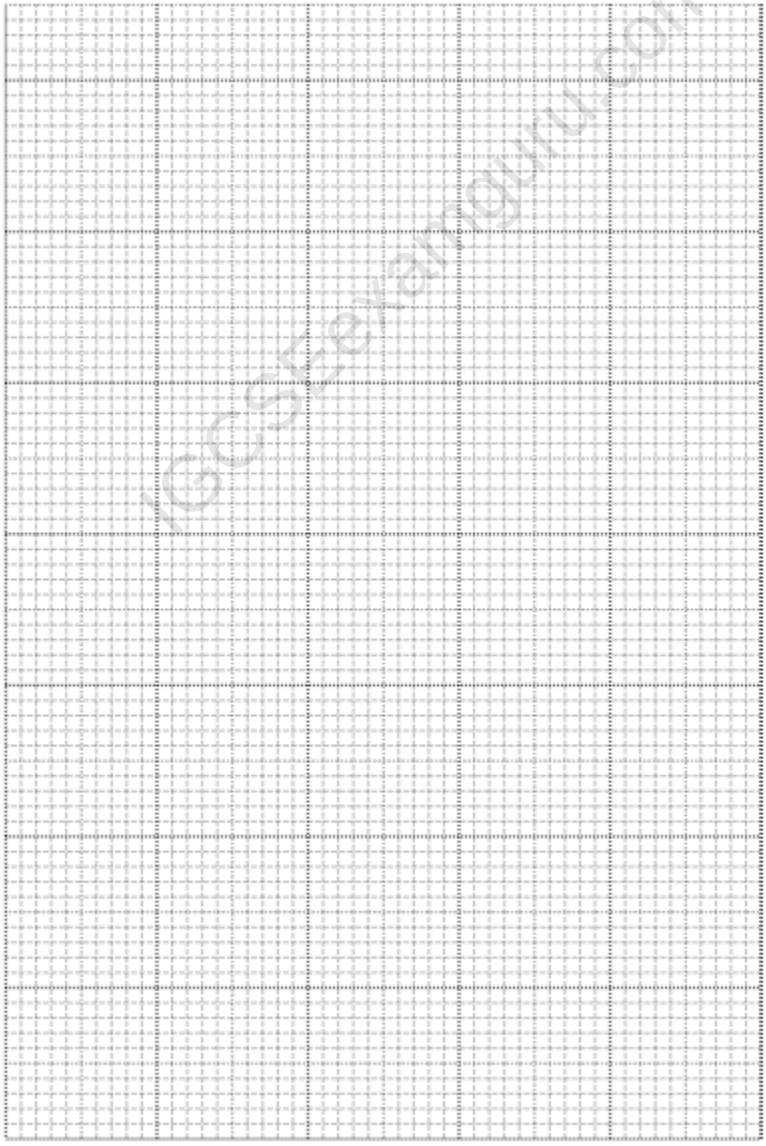
(b) The student measured the distance travelled by 10 fruits of each type from their parent plants

(i) Draw a graph to show the data in Table 2.2 on the grid below. ach wind speed.

Use the same set of axes to show the data for both fruits.

Table 2.2

wind speed / ms^{-1}	average distance travelled by fruit / m	
	E	**F**
2	2.6	0.2
4	4.5	3.6
6	7.9	2.3
8	9.9	4.2
10	14.2	6.7



[5]

(ii) **E** is dispersed by the wind.

Describe the evidence **from the data** that supports this statement.

.....

..... [1]

(c) Once a fruit has been dispersed, the seeds can germinate.

Fig. 2.2 shows a seed germinating.

Fig. 2.2

Draw a large, labelled diagram of this germinating seed.

[4]

(d) A student wanted to find out how temperature might affect the germination of seeds.

State:

(i) the variable that should be changed

.....[1]

(ii) the variable that should be measured and recorded

.....[1]

(iii) **two** variables that should be kept constant.

1 .....

2 .....[2]

(e) Seeds store protein.

Before the seed germinates, enzymes in the seed begin to break down the protein.

(i) Describe a method you would use to test a seed for the presence of protein.

.....

.....

.....

.....

.....[2]

(ii) State the results you would expect to see if protein is present.

.....

.....[1]

[Total: 19]

9 Fig. 2.1 shows an insect-pollinated flower.

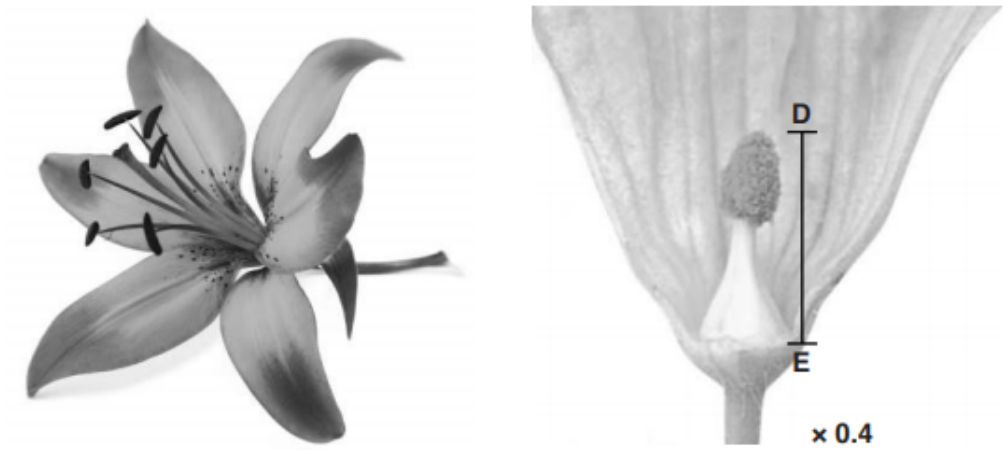
Fig. 2.1

(a) Draw a large, labelled diagram of Fig. 2.1.

Your diagram should show the arrangement of the male and female parts.

[5]

(b) Fig. 2.2 shows a reduced image of the flower shown in Fig. 2.1, **A**, and a section through a different flower, **B**.



A **B**

Fig. 2.2

Look carefully at the flowers in Fig. 2.2. You may also find it helpful to look back at the enlarged image of **A** shown in Fig. 2.1.

(i) State **one visible** way in which flower **A** is **similar** to flower **B**.

.....

..... [1]

(ii) State **one** way in which the flower **A** is **different** to flower **B**.

.....

..... [1]

(c) Measure the length of line **DE** in Fig. 2.2.

length of line **DE** .....mm

Calculate the actual length of line **DE**.

Show your working. Give your answer to the nearest whole number.

actual length of line **DE** ..... mm [3]

(d) Flowers produce a sugar solution so that a pollen tube can grow.

A student was planning an investigation to find out how the concentration of sugar solution might affect the rate of growth of pollen tubes.

State:

(i) the variable that should be changed

..... [1]

(ii) what should be measured

..... [1]

(iii) **three** variables that should be kept constant.

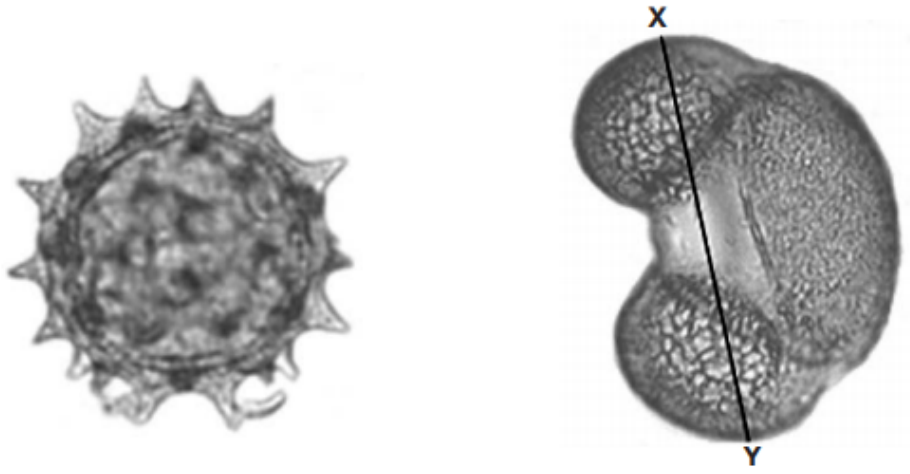
1 .....

2 .....

3 ..... [3]

[Total: 15]

10 Fig. 2.1 shows photomicrographs of two types of pollen grain, **R** and **S**.



R **S** **not to scale**

Fig. 2.1

(a) **(i)** Make a large drawing of pollen grain **S**.

[3]

(ii) Measure the length of the line **XY** on Fig. 2.1. Include the unit.

length of **XY** .....

Draw the line **XY** on your drawing, in the same position as on Fig. 2.1.

Measure the length of **XY** on your drawing. Include the unit.

length of **XY** on your drawing .....

Calculate the magnification of your drawing.
Show your working.

magnification x .....
[5]

(b) (i) State **two** ways, visible in Fig. 2.1, in which pollen grain **R** is different from pollen grain **S**.

Write your answers in Table 2.1.

Table 2.1

feature	pollen grain **R**	pollen grain **S**
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

[2]

(ii) Describe **one** feature, visible in Fig. 2.1, of pollen grain **R** that helps it to be dispersed.

.....

.....[1]

(c) Some students placed samples of each type of pollen grain on a microscope slide and added a drop of dilute sugar solution. Pollen tubes started to grow.

To find out which of the pollen tubes grew faster, students measured the length of the pollen tubes every 2 minutes for 20 minutes.

(i) Suggest how the pollen tubes could be measured using a microscope.

.....[1]

Their results are recorded in Table 2.2.

Table 2.2

time/min	length of pollen tubes/μm	
	pollen grain **R**	pollen grain **S**
2	0.5	0.4
4	1.8	1.5
6	4.2	3.9
8	12.6	13.4
10	18.8	21.1
12	24.9	29.6
14	30.2	36.8
16	36.6	44.2
18	41.9	52.8
20	48.5	59.8

(ii) Compare the growth of pollen grain **S** with pollen grain **R**, using the data from Table 2.2.

.....

.....

.....

.....

.....[3]

(d) The plant that produces pollen grain **R** produces fruits that contain seeds. These fruits disperse the seeds by splitting along the edges, throwing out the seeds.

The students counted the number of seeds in a random sample of 100 fruits.

Fig. 2.2 is a frequency histogram of their results.

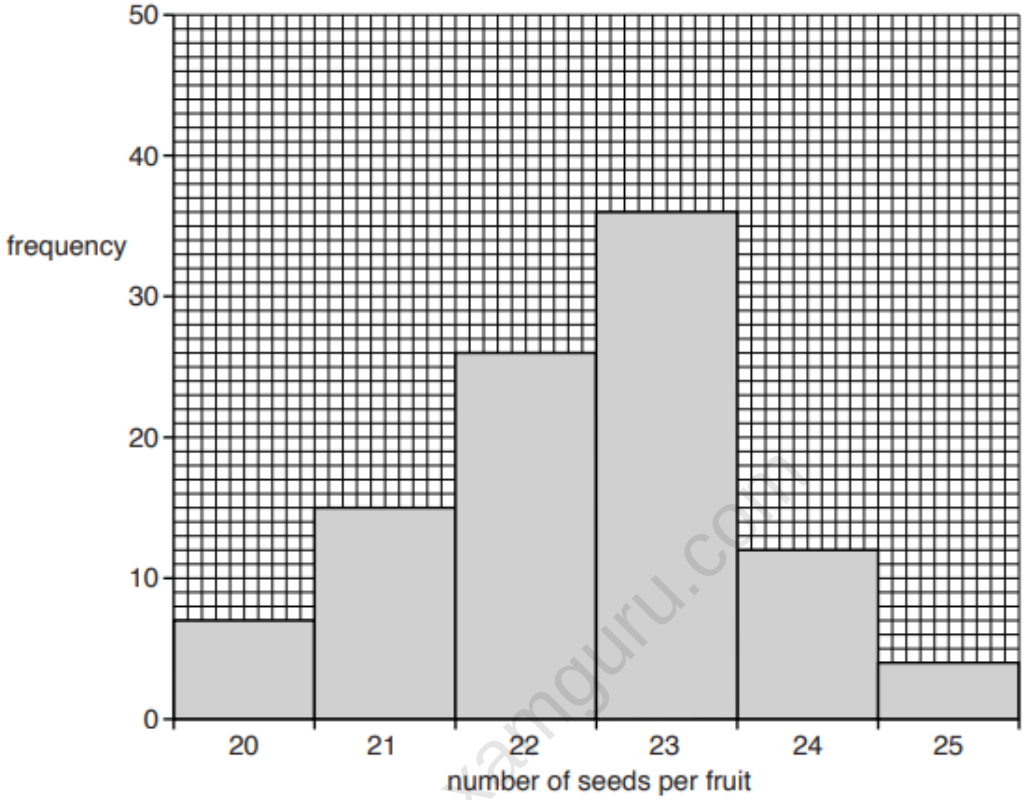


Fig. 2.2

(i) Suggest how the students could collect a random sample and count the seeds accurately.

.....

.....

.....

.....

.....

.....[3]

(ii) Identify the most frequent number of seeds in a fruit.

.....[1]

(iii) Suggest **one** reason why some fruits have a lower number of seeds than others.

.....

.....[1]

[Total: 20]

Chapter 17: Inheritance

1 Fig. 2.1 shows part of a plant organ cut vertically in half.

Fig. 2.1

(a) (i) Make a large, labelled drawing of the cut surface of this organ.

[4]

(ii) Suggest **two** biological functions of this organ for the plant.

1 .....

2 ..... [2]

(b) A student removed a small sample of the organ and tested it for the presence of starch. State the name of the reagent used to test for the presence of starch.

..... [1]

(c) Fig. 2.1, on page 5, shows roots growing from the organ.

Fig. 2.2 shows some cells found just behind the growing tip of a root.

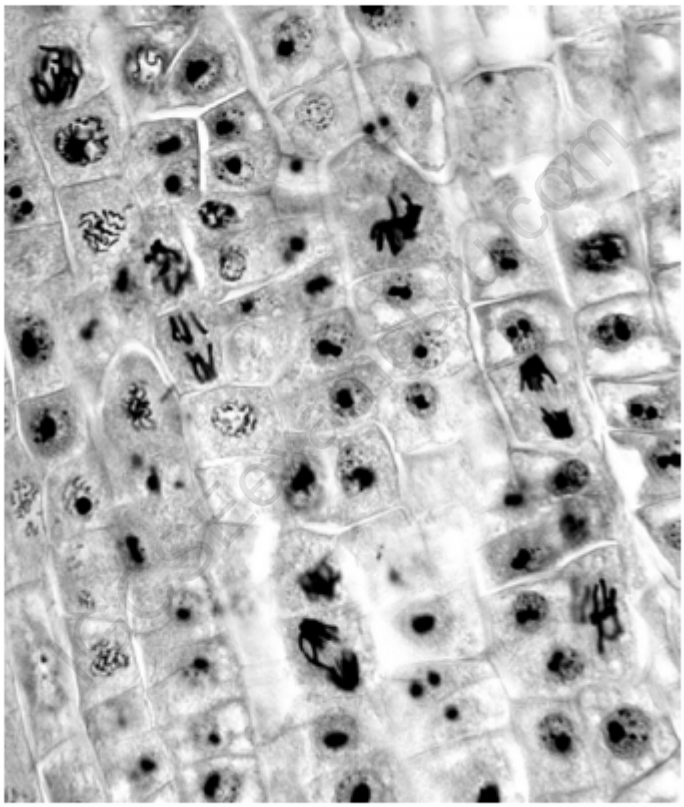


Fig. 2.2

(i) Some of these cells are dividing. During division the 'daughter' chromosomes separate at the equator and move towards the poles of the cell.

On Fig. 2.2 draw a circle around **one** cell that shows the chromosomes which have separated. [1]

(ii) Name the type of cell division taking place in Fig. 2.2.

..... [1]

Fig. 2.3 shows some mature root cells further from the tip.

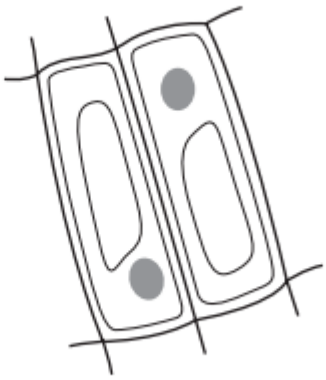


Fig. 2.3

(d) Describe two visible differences between the dividing cells shown in Fig. 2.2 and the mature cells shown in Fig. 2.3.

dividing cells	mature cells
1	....
2	....

[2]

[Total: 11]

2 Fig. 2.1 shows cells in the growing part of a root as seen using a microscope.

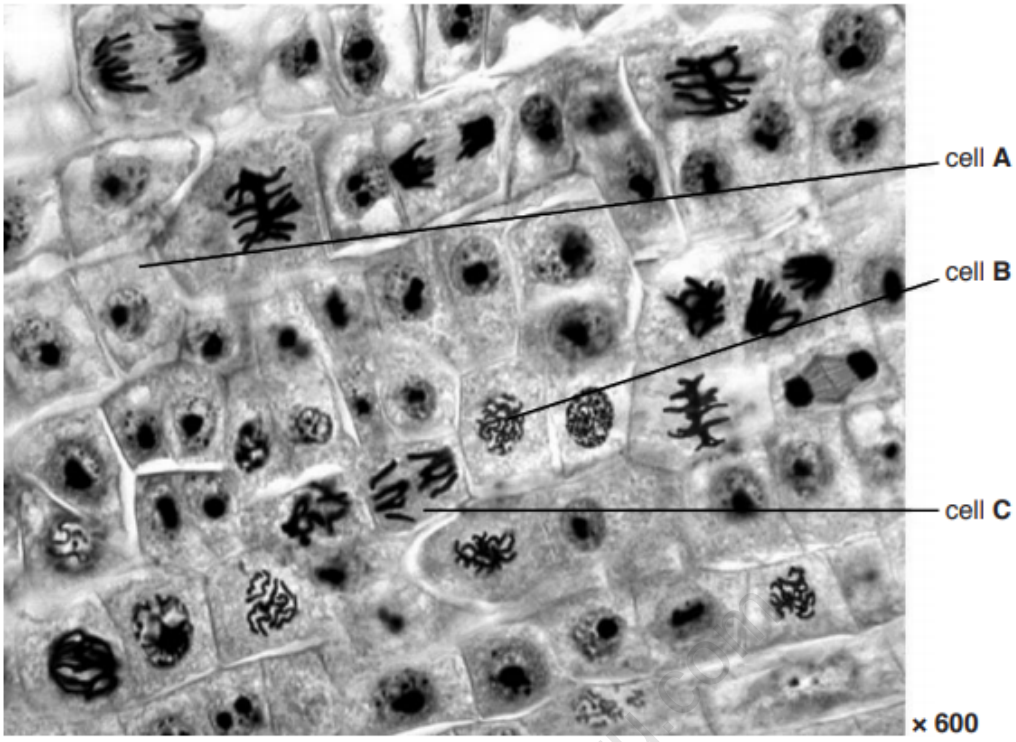


Fig. 2.1

(a) **(i)** Count and record the total number of cells in Fig. 2.1. Do **not** include any cells that are only partly visible.

.....[1]

(ii) Chromosomes can be seen in cells that are undergoing mitosis. There are 18 of these cells in Fig. 2.1.

Calculate the percentage of the cells that are undergoing mitosis in Fig. 2.1.
Show your working. Give your answer to the nearest whole number.

..... % [2]

(b) State two ways, visible in Fig. 2.1, in which the cell labelled **B** is different from the cell labelled **A**.

1 .....

.....

2 .....

.....

[2]

(c) Fig. 2.2 is a magnified view of cell **C** in Fig. 2.1.

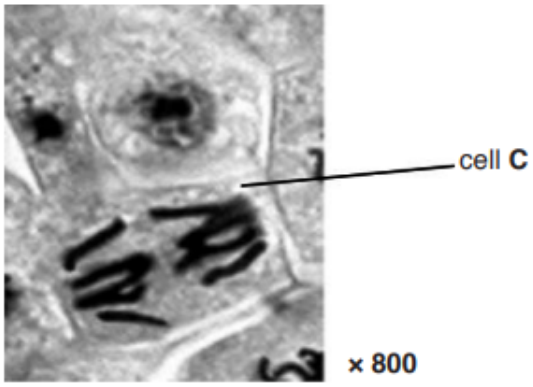


Fig. 2.2

(i) Make a large drawing of the cell labelled **C** to show:

- the cell wall
- the chromosomes.

Label a chromosome.

[5]

(ii) Measure the length of cell **C** on Fig. 2.2 and record your result. **Include the unit**.
Draw a line on Fig. 2.2 to show where you have made your measurement.

length of cell **C** .....[2]

(iii) Calculate the actual length of the cell.
Show your working. Give your answer to the nearest whole number.

size of cell .....mm [2]

(d) Cancer in the bronchus can be caused by smoking. When cancer develops, mitosis in cells becomes uncontrolled, forming tumours.
Fig. 2.3 shows cancer in the wall of a bronchus as seen using a microscope.

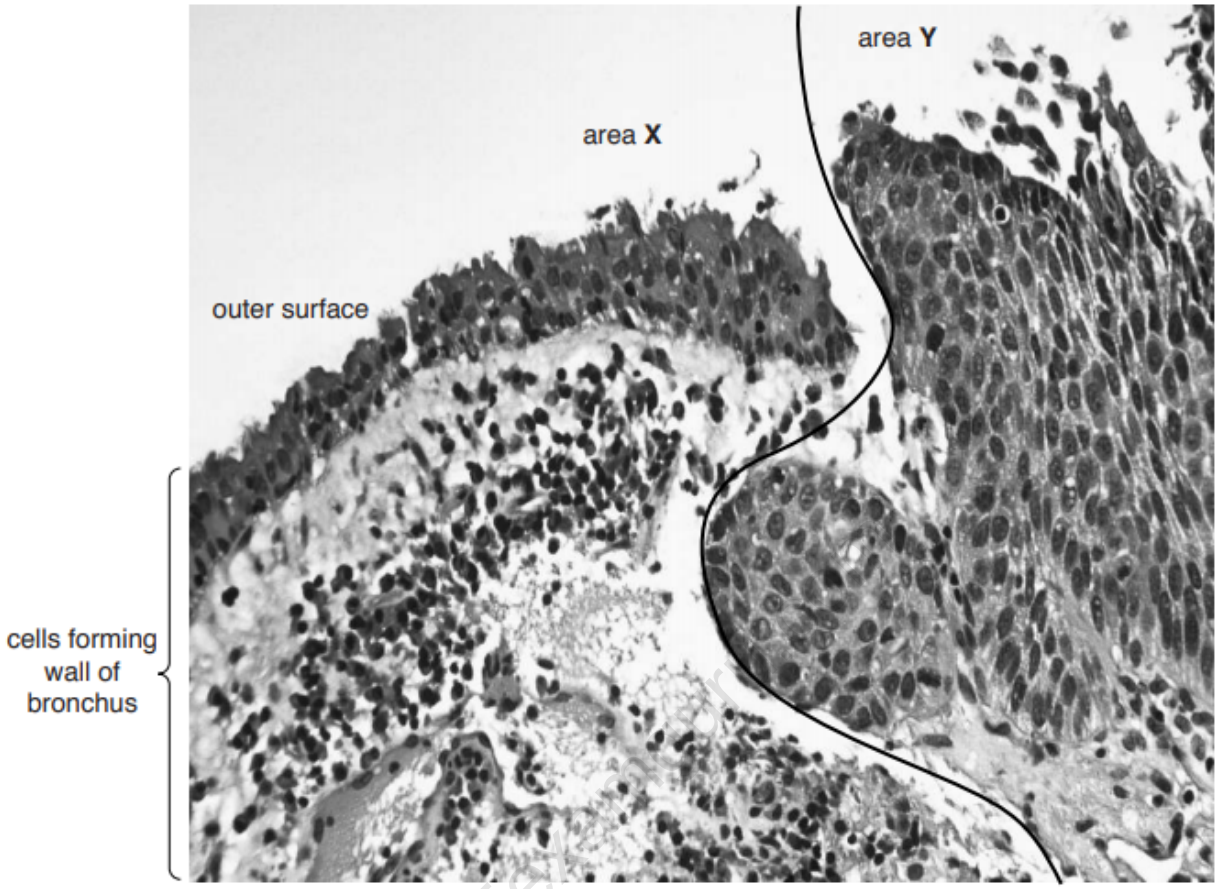


Fig. 2.3

Describe **two** features, visible in Fig. 2.3, that suggest that area **X** is healthy and area **Y** is cancerous.

1 .....

.....

.....

2 .....

.....

.....[2]

[Total: 16]

Chapter 18: Variation and Selection

1 The water hyacinth, *Eichhornia crassipes*, is a free-floating perennial water plant found in many parts of the world.

Fig. 2.1 and Fig. 2.2 show plants growing on the surface of water.

Fig. 2.1

Fig. 2.2

Fig. 2.3 shows a leaf from one of the water hyacinth plants.

Fig. 2.3

(a) Make a large, labelled drawing of the leaf in Fig. 2.3 to show the whole leaf, including the swollen leaf stalk.

[4]

Fig. 2.4 shows a cross section through a swollen leaf stalk.

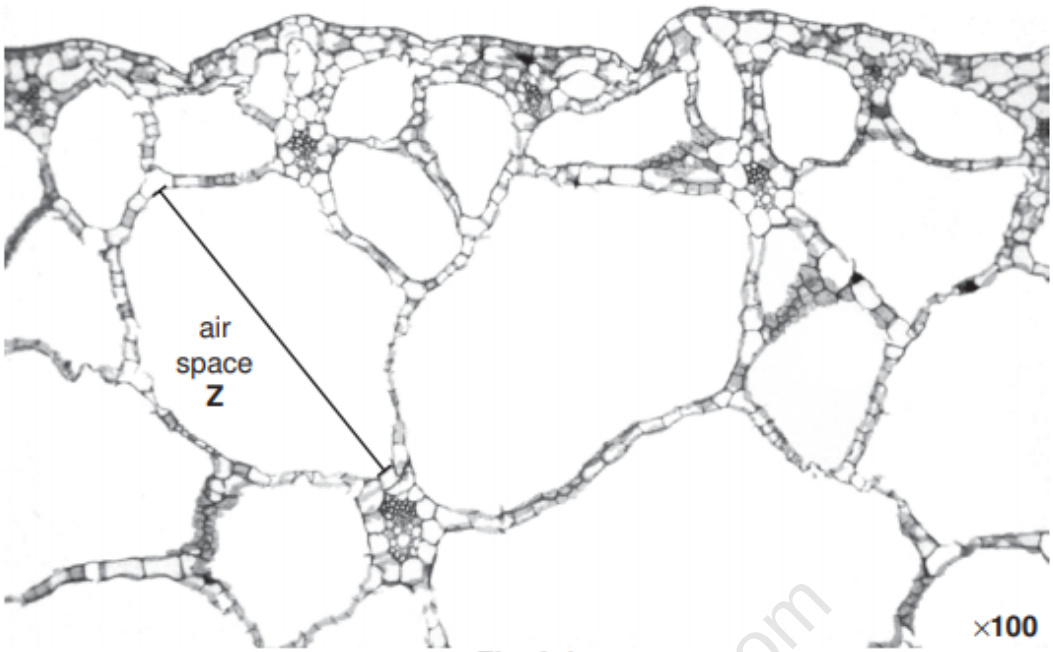


Fig. 2.4

(b) The internal tissue is shown in Fig. 2.4. The internal tissue has many large air spaces between the cells.

Measure the size of the air space **Z** on Fig. 2.4.

size of air space **Z** ..... mm

Use your measurement to calculate the actual size of air space **Z**.

Show your working.

actual size of air space **Z** ..... mm [3]

(c) Using the information provided, suggest how the structure of the leaf stalk helps the plant to grow in the environment in which it is found.

.....

.....

.....

..... [2]

Water hyacinths will flower and form seeds in warm climates. They can also reproduce and spread asexually (by vegetative means).

The growth rate can be very rapid and so the plant can become a problem and spread over the surface of rivers and lakes.

(d) (i) Suggest **two** ways in which the spread of this water plant can harm other aquatic organisms.

1 .....

.....

2 .....

..... [2]

(ii) Suggest **two** ways in which the spread of the plant could be controlled.

1 .....

.....

2 .....

..... [2]

[Total: 13]

Chapter 19: Organisms & Their Environment

61/MJ 2018

1 A student wanted to investigate a garden ecosystem.

She counted the number of insects caught in spider webs in one small section of the garden.

She found six spider webs in the small section of garden sampled.

Diagrams of the spider webs are shown in Fig. 2.1. Each black dot represents one insect caught in a spider web.

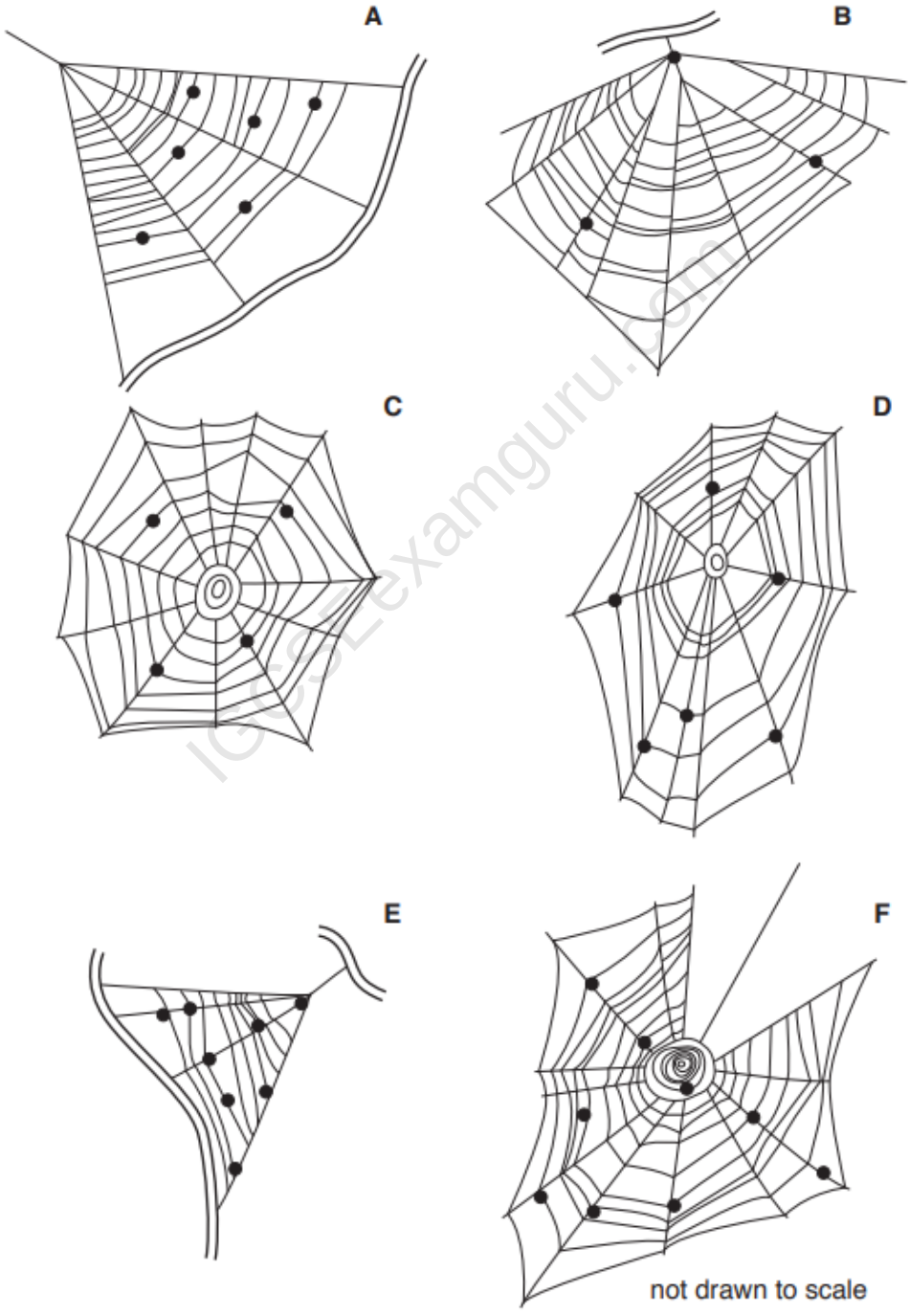


Fig. 2.1

(a) (i) Use Fig. 2.1 to complete Table 2.1.

Table 2.1

spider web	number of insects caught in each web
A	
B	
C	
D	
E	
F	
total	

[2]

(ii) Calculate the average number of insects per web in the small section of garden, using the information in Fig. 2.1 and Table 2.1.

Space for working.

..... [1]

(iii) The student counted the total number of spider webs in the whole garden and found that there were a total of 102 spider webs.

Use this information and your answer to part **2(a)(ii)** to estimate the total number of insects caught in webs in the whole garden.

Space for working.

..... [1]

(iv) Suggest **one** reason why the estimated total number of insects caught in webs in the whole garden may not be accurate.

.....

.....

..... [1]

(b) Fig. 2.2 is a photograph of a spider.

A spider's body has two main parts. The legs are all attached to the cephalothorax which is the upper part of the body and starts at label **X** on Fig. 2.2. The lower part of the body is called the abdomen and is nearest to label **Y** on Fig. 2.2.

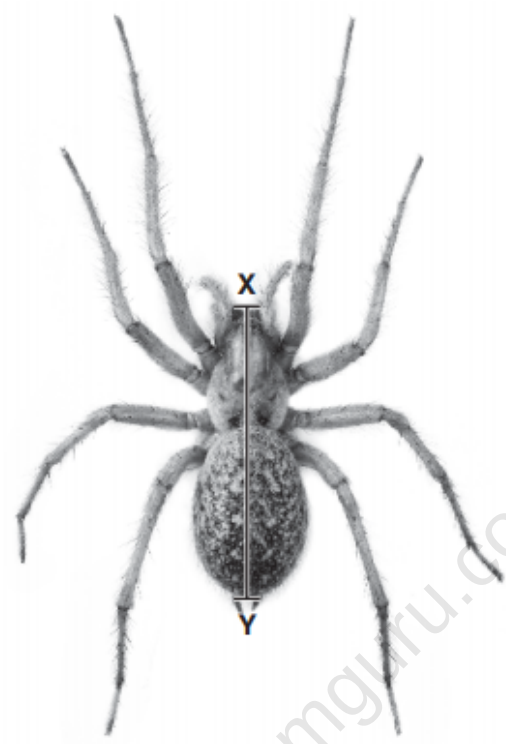


Fig. 2.2

(i) Make a large drawing of the spider in Fig. 2.2 to show its outline, including its legs.

Label the abdomen.

[5]

(ii) Measure the length of the spider between points **X** and **Y** on Fig. 2.2. Include the units.

Length of line **XY** on the spider in Fig. 2.2 .....

Draw a line in the same position on your drawing and measure the length on your drawing.

Length of line **XY** on the spider in your drawing .....

Calculate the magnification of your drawing using your measurements and the following equation:

$$\text{magnification} = \frac{\text{length of line } \mathbf{XY} \text{ on your drawing}}{\text{length of line } \mathbf{XY} \text{ on Fig. 2.2}}$$

Space for working.

.....

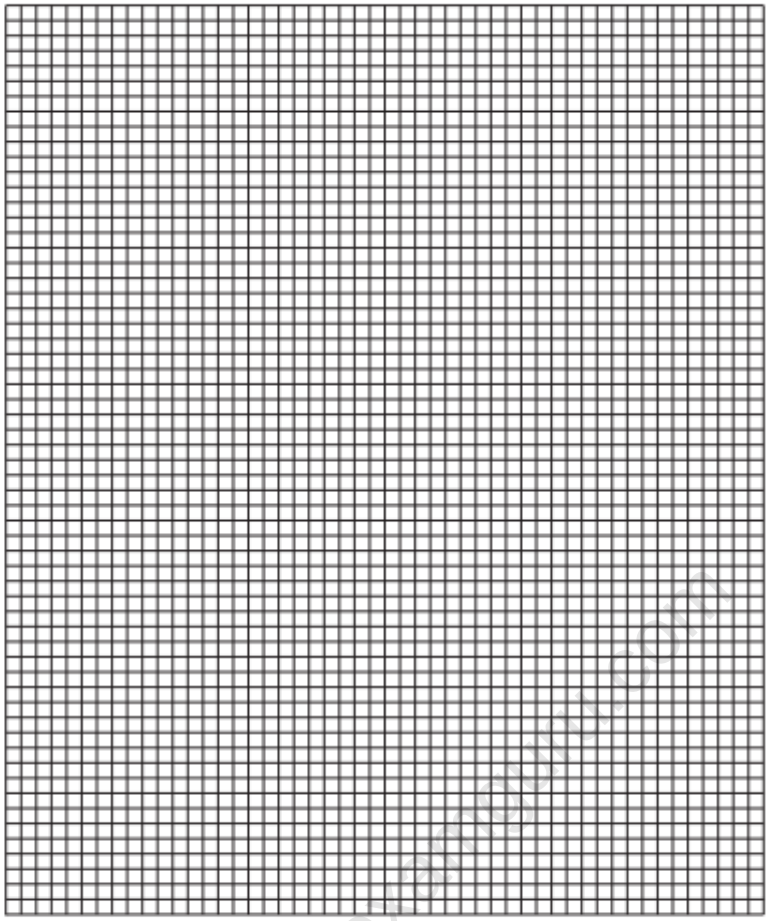
[3]

(c) Table 2.2 contains some other data collected by the student from the garden ecosystem.

Table 2.2

type of organism	number found in the garden ecosystem
trees	2
bushes	5
other plants	37
herbivores	118
carnivores	14

(i) Plot a bar chart of the data in Table 2.2.



[3]

(ii) Herbivores and carnivores are animals.

Use the data in Table 2.2 to calculate the ratio of animals to plants.

Show your working and give your answer in its simplest form.

.....

[2]

[Total: 18]

2 Fig. 2.1 shows an image of a monarch butterfly, *Danaus plexippus*.

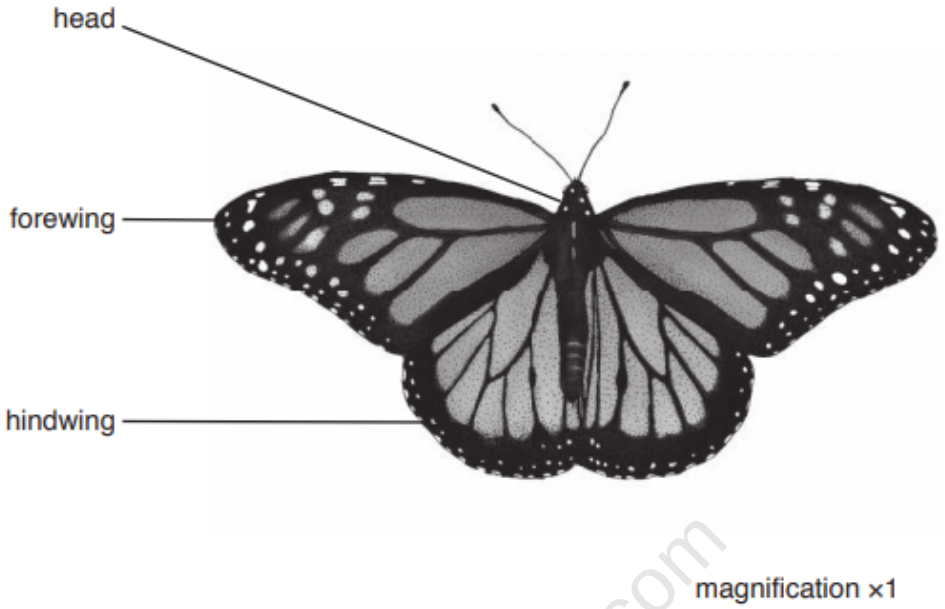


Fig. 2.1

(a) Make a large drawing of **one** of the hindwings of the monarch butterfly shown in Fig. 2.1.

[4]

(b) Fig 2.2 shows an image of a viceroy butterfly, *Limenitis archippus*.

magnification ×1

Fig. 2.2

Describe **one** visible similarity and **two** visible differences between the viceroy and the monarch butterflies' **wings**.

similarity .....

.....

difference 1 .....

.....

difference 2 .....

.....

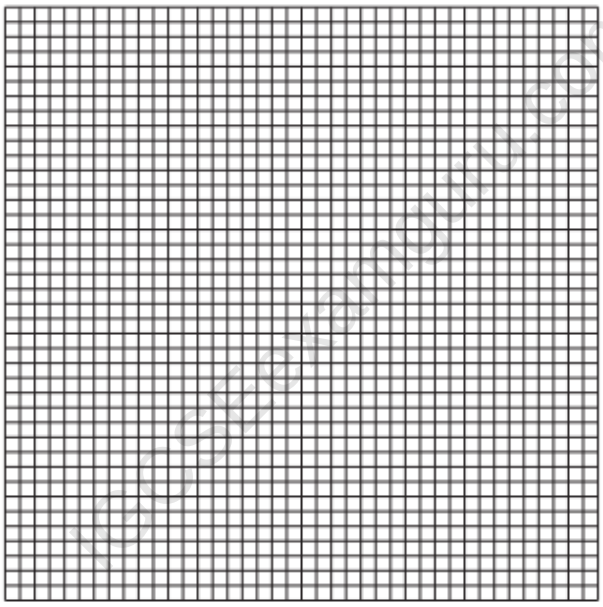
[3]

(c) A student investigated the relationship between the body mass of monarch butterflies and the length of their forewings. The student recorded the data for five butterflies in Table 2.1.

Table 2.1

butterfly	body mass/g	forewing length/mm
A	0.2	38
B	0.3	42
C	0.5	50
D	0.7	58
E	0.8	62

(i) Plot a graph on the grid to show the relationship between body mass and forewing length.



[4]

(ii) Describe the relationship shown on the graph.

.....

.....

.....

.....[1]

(iii) A student found a monarch butterfly with a forewing length of 55 mm. Use the graph to estimate the body mass of this butterfly.

Show **on the graph** how you obtained your answer.

..... g
[2]

(d) Adult monarch butterflies feed on nectar. Nectar is a liquid that is produced by plants.

Plan an investigation to determine the types of food molecules that nectar contains.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[6]

[Total: 20]

Chapter 20: Biotechnology & Genetic Engineering

1 Yeast, *Saccharomyces cerevisiae*, is used in bread-making.

Some students mixed flour, sugar and a yeast suspension to make bread dough and investigate the rate at which the dough rises.

- 25 g of wheat flour and 1 g of sugar were weighed and placed in a beaker.
- 25 cm^3 of yeast suspension was added to the flour and sugar.
- The mixture was stirred with a glass rod until it formed a smooth paste. This was the bread dough.
- The narrow opening of three clean 20 cm^3 syringes was sealed as shown in Fig.1.1.
- 5 cm^3 of the dough was poured into each of the syringes.
- The syringes were placed vertically in a test-tube rack, as shown in Fig. 1.1.

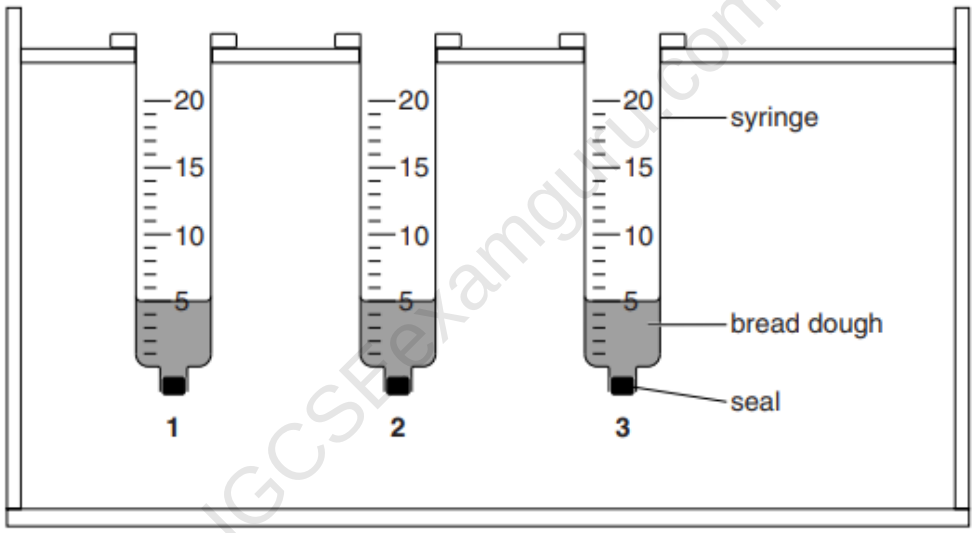


Fig. 1.1

- After 5 minutes, the volume of the dough in each syringe was measured and recorded.
- The volume of the dough in each syringe was then measured and recorded every 5 minutes for a total of 20 minutes.

Fig. 1.2. shows the appearance of the three syringes after 5, 10, 15 and 20 minutes.

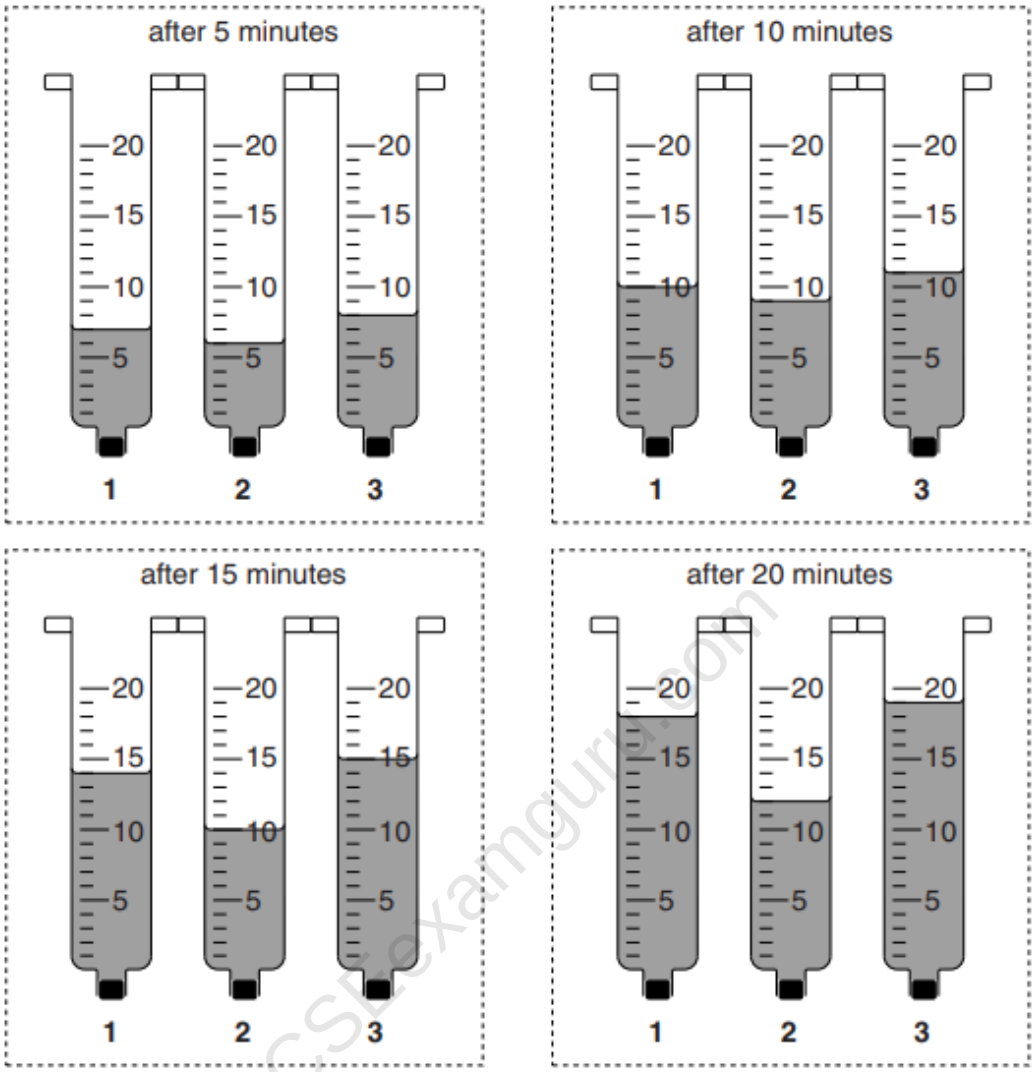


Fig. 1.2

(a) Prepare a table to record the results of the investigation shown in Fig. 1.1 and Fig. 1.2.

Read the volume of the dough in each syringe and record it in your table.

[6]

(b) (i) Give a reason why **three** syringes were used.

.....

.....[1]

(ii) Identify the syringe in which the results may be anomalous and explain your choice.

.....

.....[1]

(iii) Calculate the average volume of the bread dough in the three syringes after 20 minutes.

Show your working.

Give your answer to the nearest whole number.

.....cm^3 [1]

(c) Some students used the same method described in part **(a)** to investigate the effect of temperature on the volume of bread dough.

They used three 50 cm^3 syringes at each of seven temperatures.

The starting volume in each syringe was 5 cm^3.

Their results are recorded in Table 1.1.

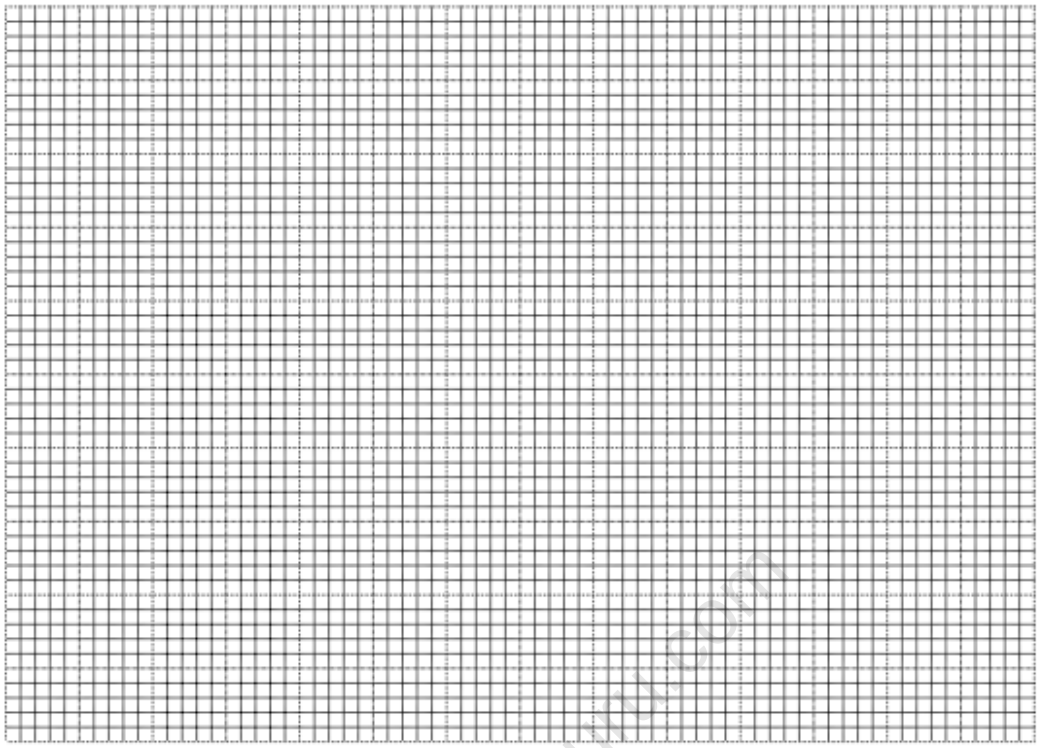
Table 1.1

temperature / °C	average volume of bread dough after 20 minutes / cm^3	average increase in volume / cm^3
10	6	1
20	10	5
30	20	15
40	35	.....
50	47	42
60	30	25
70	7	2

(i) Calculate the average increase in volume at 40 °C.

Write your answer in the space in Table 1.1. [1]

(ii) Use the data in Table 1.1 to plot a graph of the average increase in volume of bread dough against temperature.



[4]

(iii) Describe the results shown by the graph.

.....

.....

.....

.....[2]

(iv) Suggest what the students could conclude from this investigation about the effect of temperature on the activity of yeast.

.....

.....[1]

[Total: 17]

2 Fig. 1.1 shows part of an orange.

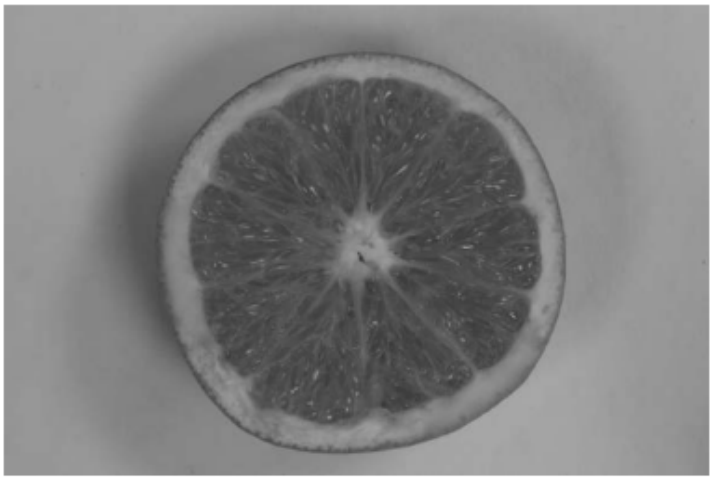


Fig. 1.1

(a) Make a large, labelled drawing of the cut surface of this fruit to show the internal structure.

[4]

Juice can be extracted from fruits on a commercial scale. This process uses an enzyme to digest part of the plant structure to release a larger volume of juice.

The juice of citrus fruits, such as the orange, is acidic.

Students investigated the effect of pH on the activity of this enzyme.

Buffer solutions **X** and **Y** were used to change the pH.

Pieces of Universal Indicator paper were used to test the pH of buffer solutions **X** and **Y**.

(b) Observe the shade of the pieces of Universal Indicator paper shown in Fig. 1.2 and estimate the pH by comparing with the chart.

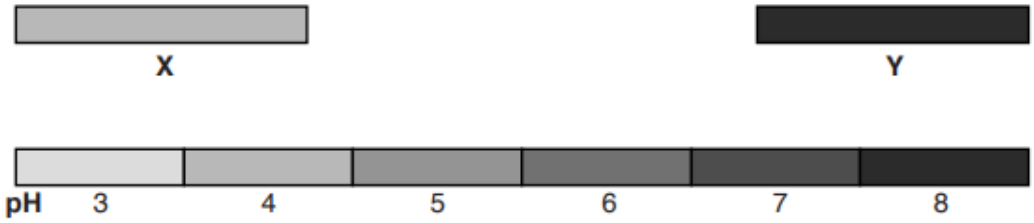


Fig. 1.2

pH of buffer **X** ..... pH of buffer **Y** .....

[2]

Four plastic cups **A**, **B**, **C** and **D** were set up as shown in Table 1.1.

Table 1.1

contents	volume of contents added/cm^3			
	A	**B**	**C**	**D**
crushed fruit	25	25	25	25
buffer **X**	5	5	–	–
buffer **Y**	–	–	5	5
water	2	–	2	–
enzyme	–	2	–	2

(c) Suggest why water was added to cups **A** and **C**.

.....

.....

.....[1]

The contents of plastic cups **A**, **B**, **C** and **D** were stirred and left to stand for 10 minutes. The contents were then filtered into measuring cylinders.

The results are shown in Fig. 1.3.

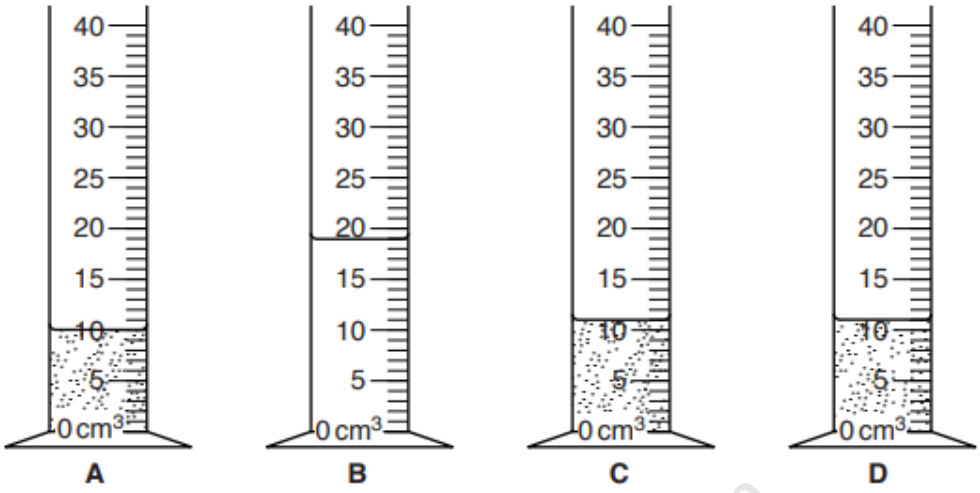


Fig. 1.3

(d) Complete Table 1.2 by recording:

- the units in the appropriate place
- the volume of filtered juice shown in Fig. 1.3.

Table 1.2

volume of juice filtered/.....			
A	**B**	**C**	**D**
.....	.....	.....	.....

[2]

(e) Compare the volumes and describe the appearance of the filtered juice in measuring cylinders:

(i) **A** and **B**

.....

.....

.....

.....

.....[2]

(ii) **C** and **D**.

.....

.....

.....

.....

.....[2]

(f) Describe the effect of pH on the enzyme by comparing the volumes and the appearance of the filtered juice in measuring cylinders **B** and **D**.

.....

.....

.....

.....

.....

.....

.....[3]

(g) **(i)** State **two** variables that were controlled in this investigation.

1 .....

2 .....

[2]

(ii) Suggest **two** ways in which you could modify this investigation to produce more accurate results.

1 .....

.....

2 .....

.....

[2]

[Total: 20]