

# BIOLOGY

0610 | Paper 6

2017 — 2024

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# CHAPTER 1

## CHARACTERISTICS AND CLASSIFICATION OF LIVING ORGANISMS

## 1 - (0610/61\_Summer\_2018\_Q2)



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.

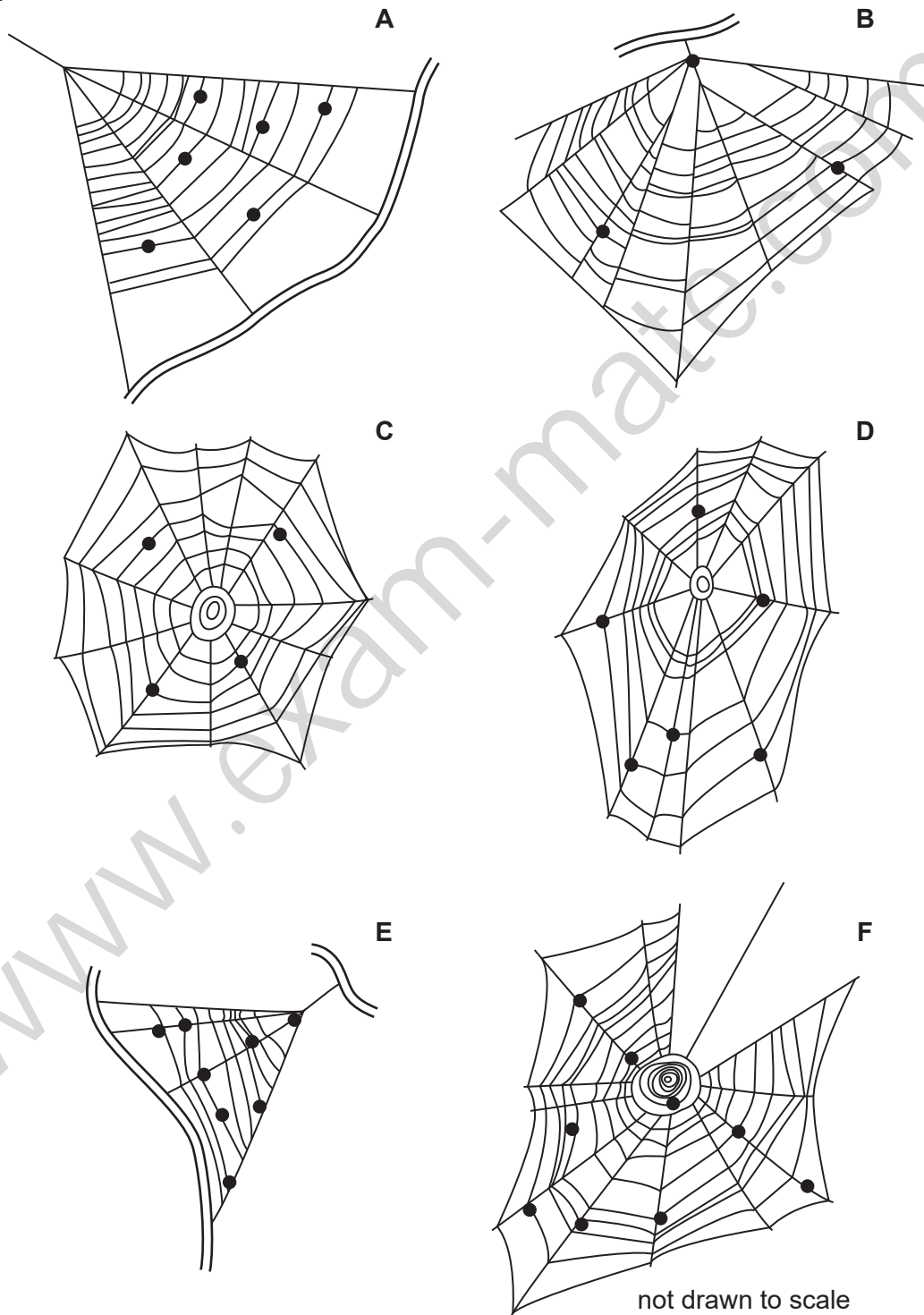


Fig. 2.1

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

**Table 2.1**

spider web	number of insects caught in each web
<b>A</b>	
<b>B</b>	
<b>C</b>	
<b>D</b>	
<b>E</b>	
<b>F</b>	
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.

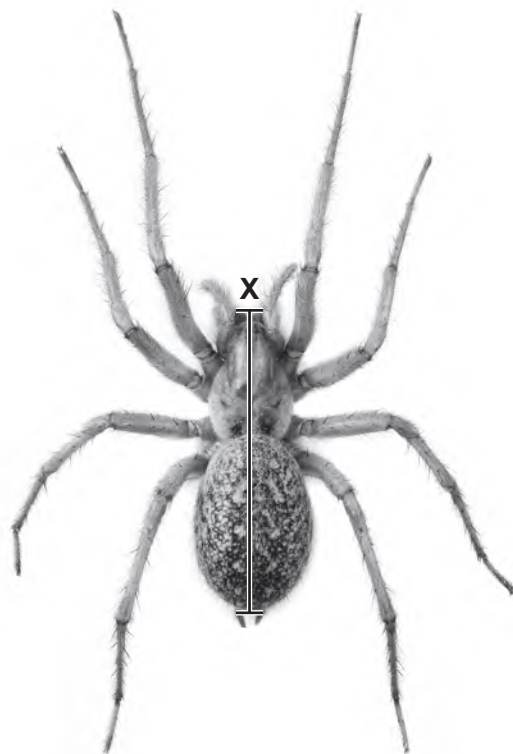


Fig. 2.2

- (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:

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

Space for working.

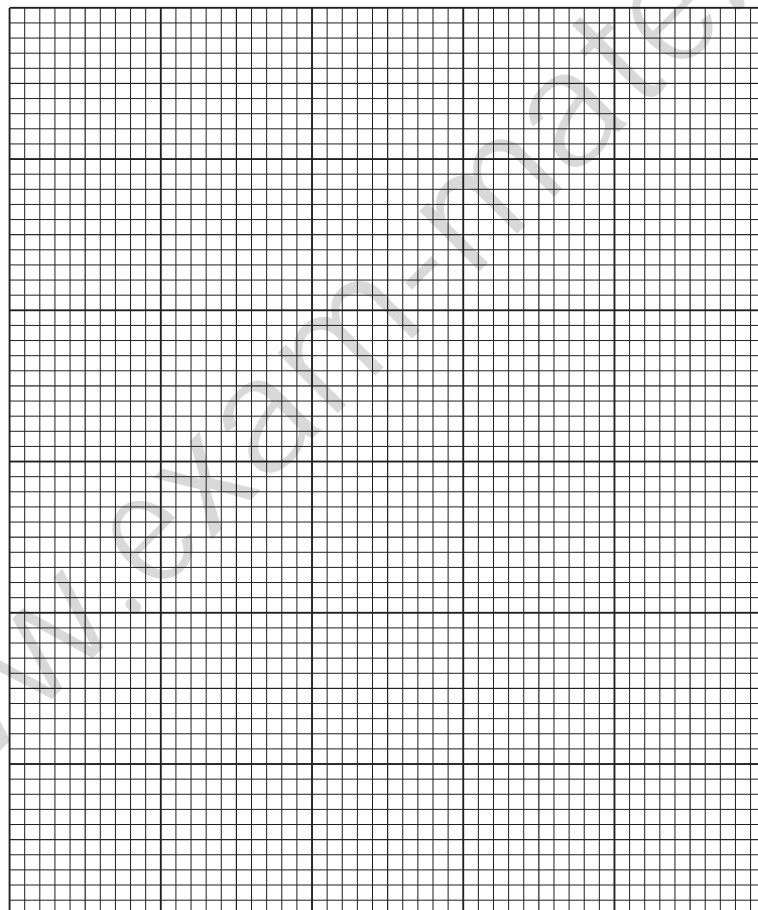
[3]

(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]

2 - (0610/62\_Summer\_2018\_Q2)



Fig. 2.1 shows *Asterionella*, which are microscopic algae that live in fresh water.

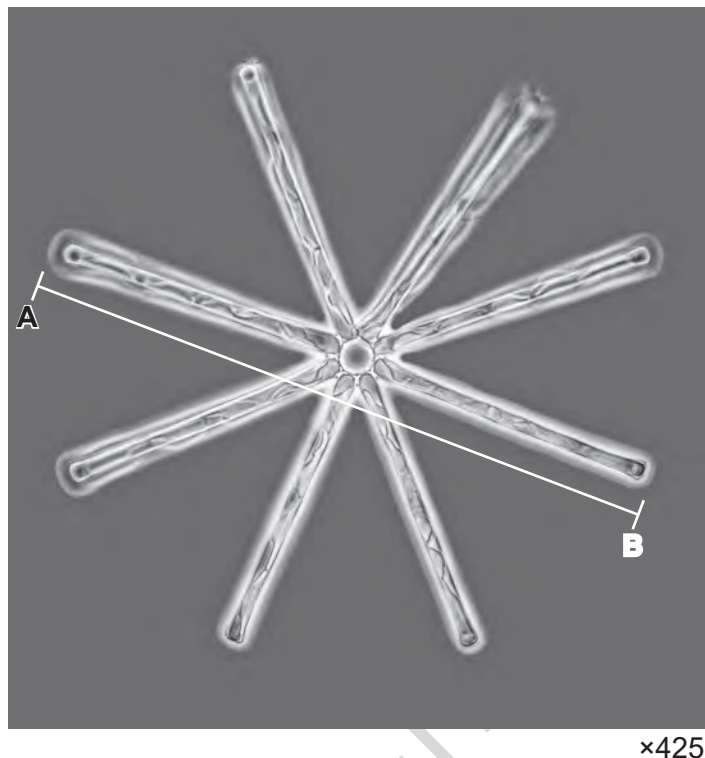


Fig. 2.1

(a) (i) Make a large outline drawing of the algae. Do not label your drawing.

[4]

(ii) Measure the length of the line **AB** in Fig. 2.1. Include the unit.

length of **AB** .....

Use the formula to calculate the actual diameter of the algae shown in Fig. 2.1. Include the units.

$$\text{magnification} = \frac{\text{length of line AB}}{\text{actual diameter of algae}}$$

Show your working.

.....  
[3]

(b) Algae photosynthesis. This process uses carbon dioxide.

Hydrogencarbonate indicator can be used to determine the concentration of carbon dioxide in a solution.

colour of hydrogencarbonate indicator	concentration of carbon dioxide
purple	low
red	medium
yellow	high

(i) A student wanted to use hydrogencarbonate indicator to investigate the effect of light intensity on photosynthesis in fresh water algae.

Describe how the student could carry out this experiment.

.....[6]

(ii) State the name of a pH indicator other than hydrogencarbonate which could be used to detect a change in pH.

.....[1]

[Total: 14]

3 - (0610/63\_Summer\_2018\_Q2)



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

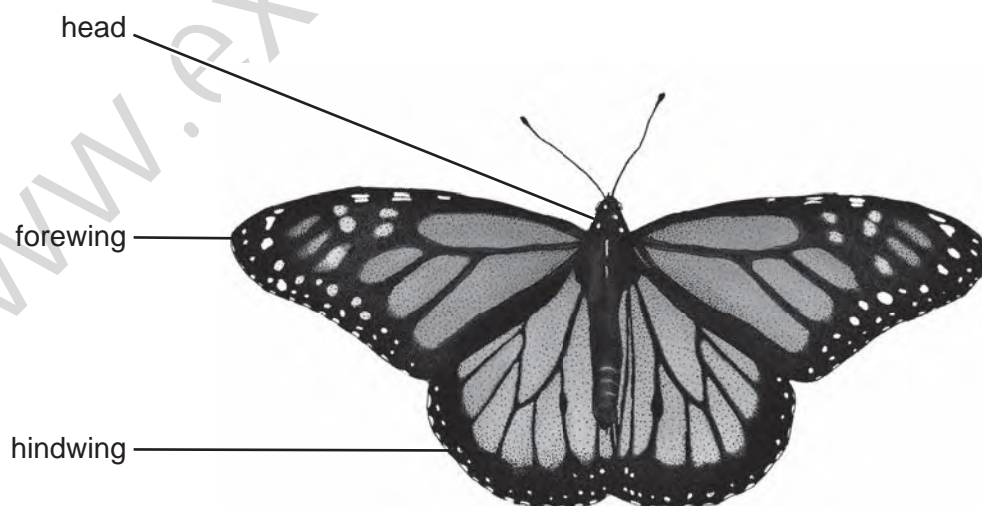


Fig. 2.1

(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 x1

**Fig. 2.2**

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

similarity .....

.....

difference 1 .....

.....

difference 2 .....

.....

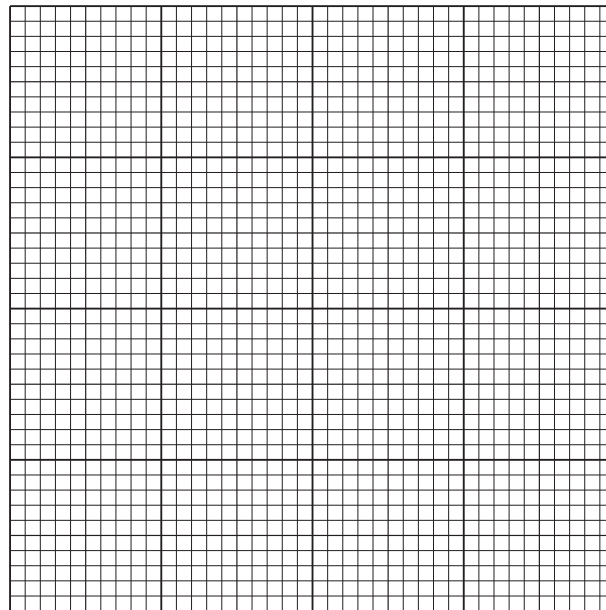
[3]

(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
<b>A</b>	0.2	38
<b>B</b>	0.3	42
<b>C</b>	0.5	50
<b>D</b>	0.7	58
<b>E</b>	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]

4 - (0610/63\_summer\_2020\_Q2)



(a) Fig. 2.1 shows a comparison of the nutrient content of beans and nuts.

nutrient facts		
serving size 100 g		
	beans	nuts
calories	333	660
total fat/g	0	54
• saturated	0	9
• trans fat	0	0
starch/g	60	15
sodium/mg	24	21
protein/g	24	26
vitamin C/mg	15	0

Fig. 2.1

A student was given a sample of food and wanted to know if it was from a bean or a nut.

The student decided to test for the presence of two of the substances listed in Fig. 2.1.

The results of the tests would enable the student to determine if the food sample was from a bean or a nut.

Complete Table 2.1 by stating:

- which **two** substances in Fig. 2.1 will enable the student to determine if the food sample is from a bean or a nut
- the food test that would be used to identify each substance
- the positive result for each food test.

Table 2.1

substance in Fig. 2.1	food test	positive result for the food test

[5]

- (b) Fig. 2.2 shows the caterpillar of a codling moth. The codling moth damages walnut trees and reduces the yield of the walnut crop.



**Fig. 2.2**

To reduce the damage to a walnut crop, scientists released wasps that can kill the codling moth caterpillars. Wasps are flying insects.

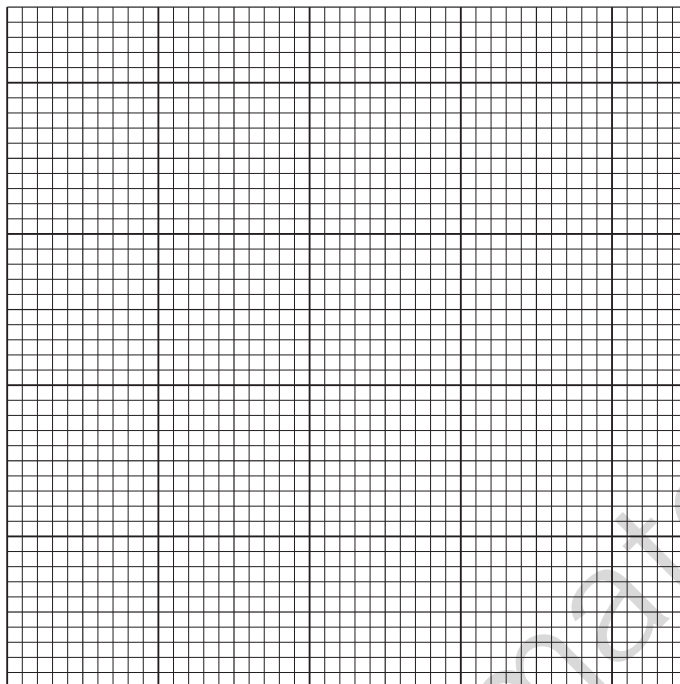
The effect of releasing different numbers of wasps on the damage to a walnut crop was investigated.

The results are shown in Table 2.2.

**Table 2.2**

number of wasps released / $\times 10^5$ per hectare	percentage damage to the walnut crop
0.0	4.0
0.5	3.2
0.9	2.4
1.8	1.2
3.4	1.3
4.0	1.2

(i) Plot a line graph on the grid of the data in Table 2.2.



[4]

(ii) Describe the pattern shown by the data on your graph.

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

(iii) Suggest the number of wasps that should be released into **one** hectare of walnut trees.  
State the evidence from your graph that supports your choice.

number of wasps released .....

evidence .....

.....

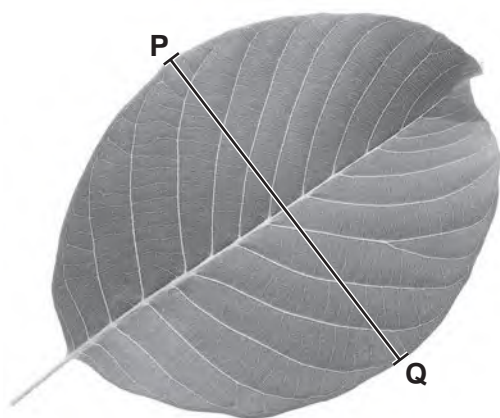
.....

[2]

(iv) Suggest **one** way the investigation could be modified to give a more accurate estimate of the optimum (best) number of wasps to release into a walnut crop.

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

(c) Fig. 2.3 shows a photograph of a walnut tree leaf.



magnification  $\times 0.5$

**Fig. 2.3**

(i) Make a large drawing of the leaf shown in Fig. 2.3.

[4]

(ii) Measure the length of line **PQ** on Fig. 2.3. Include the unit.

length of line **PQ** on Fig. 2.3 .....

Calculate the actual width of the leaf on Fig. 2.3 using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line PQ on Fig. 2.3}}{\text{actual width of the leaf}}$$

Space for working.

..... [3]

[Total: 21]

5 - (0610/63\_Winter\_2020\_Q2)



Fig. 2.1 shows a photograph of two winged seeds from a sycamore tree.

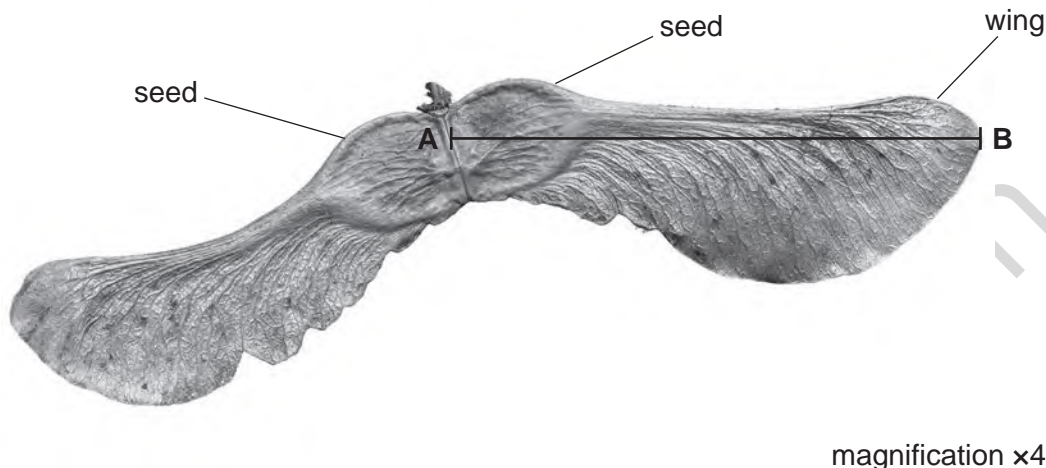


Fig. 2.1

(a) (i) Make a large drawing of the two winged seeds shown in Fig. 2.1.

Do **not** label your drawing.

[4]

(ii) Measure the length of line **AB** on the winged seed on Fig. 2.1.

length of line **AB** ..... mm

Calculate the actual seed length using the equation and your measurement. Include the unit.

$$\text{magnification} = \frac{\text{length of line AB}}{\text{actual seed length}}$$

..... [3]

(b) Fig. 2.2 is a photograph of a seed from another type of tree.



magnification  $\times 1.5$

Fig. 2.2

Describe **one** similarity and **one** difference between the seeds in Fig. 2.1 and the seed in Fig. 2.2.

similarity .....

.....

difference .....

.....

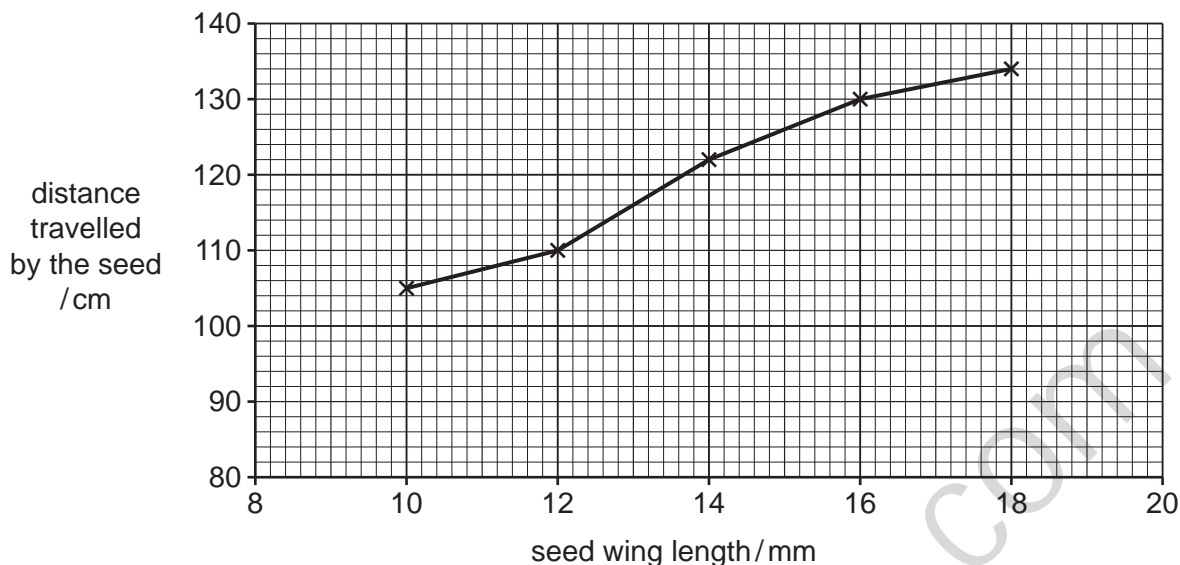
[2]

(c) Seeds such as those in Fig. 2.1 and in Fig. 2.2 can rotate when they fall, moving them further away from the parent tree.

A student collected sycamore seeds with wings of different lengths. They dropped the seeds from the same height and measured the distance travelled by each seed.



The results are shown in Fig. 2.3.



**Fig. 2.3**

- (i) Estimate, using the graph, the distance travelled by a seed with a wing length of 15 mm.

Show on your graph how you estimated this value.

..... cm  
[2]

- (ii) Calculate the percentage increase in the distance travelled by a seed with a wing length of 18 mm compared to a seed with a wing length of 10 mm.

Give your answer to two significant figures.

Space for working.

.....%  
[3]

- (iii) State **two** variables that should be kept constant in the investigation described in 2(c).

1 .....

.....

2 .....

.....

[2]

[Total: 16]

6 - (0610/63\_Winter\_2021\_Q2)



Fig. 2.1 is a photograph of the cut surface of an apple.

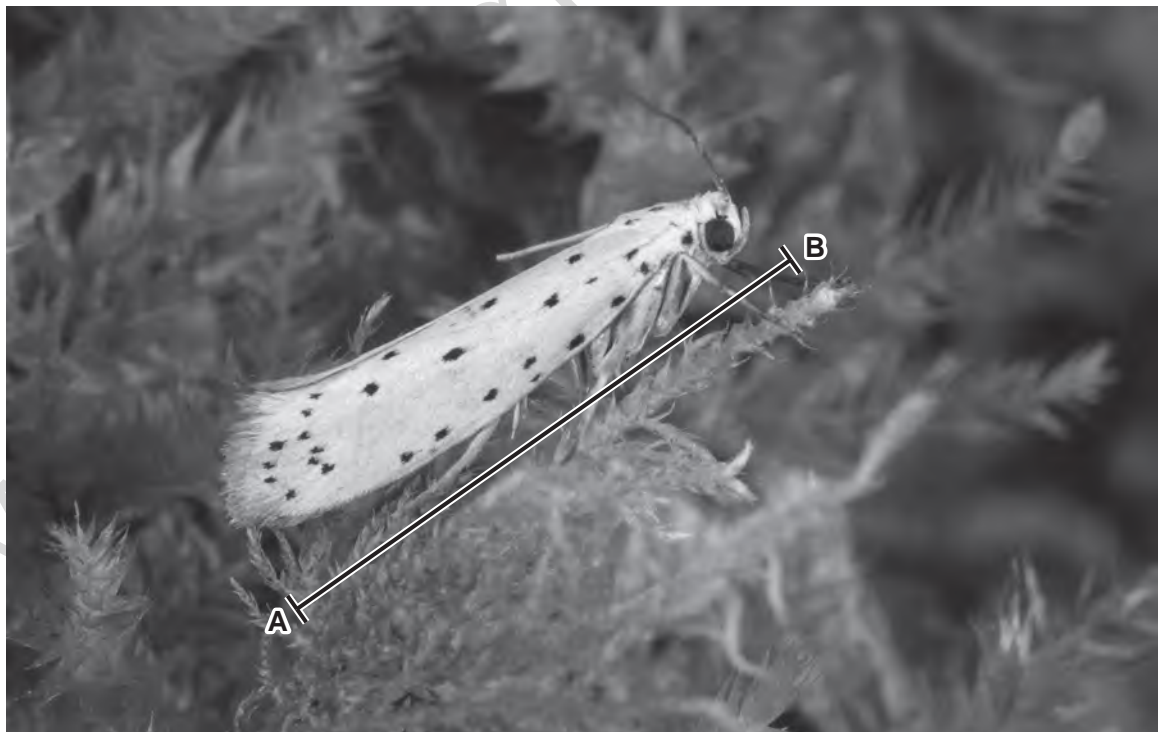


Fig. 2.1

(a) Make a large drawing of the cut surface of the apple shown in Fig. 2.1.

[4]

(b) Fig. 2.2 is a photograph of an apple ermine moth (*Yponomeuta malinellus*).



magnification  $\times 9$

Fig. 2.2

(i) Line **AB** represents the length of the apple ermine moth.

Measure the length of line **AB** on Fig. 2.2.

length of line **AB** on Fig. 2.2 ..... mm

Use your measurement and the formula to calculate the actual length of the apple ermine moth.

$$\text{magnification} = \frac{\text{length of line AB on Fig. 2.2}}{\text{actual length of the apple ermine moth}}$$

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

Space for working.

..... mm  
[3]

(ii) Fig. 2.3 is a photograph of a bird-cherry ermine moth (*Yponomeuta evonymella*).



magnification  $\times 9$

**Fig. 2.3**

Identify **two** similarities and **one** difference between the apple ermine moth in Fig. 2.2 and the bird-cherry ermine moth in Fig. 2.3.

similarity 1 .....

.....

similarity 2 .....

.....

difference .....

.....

[3]

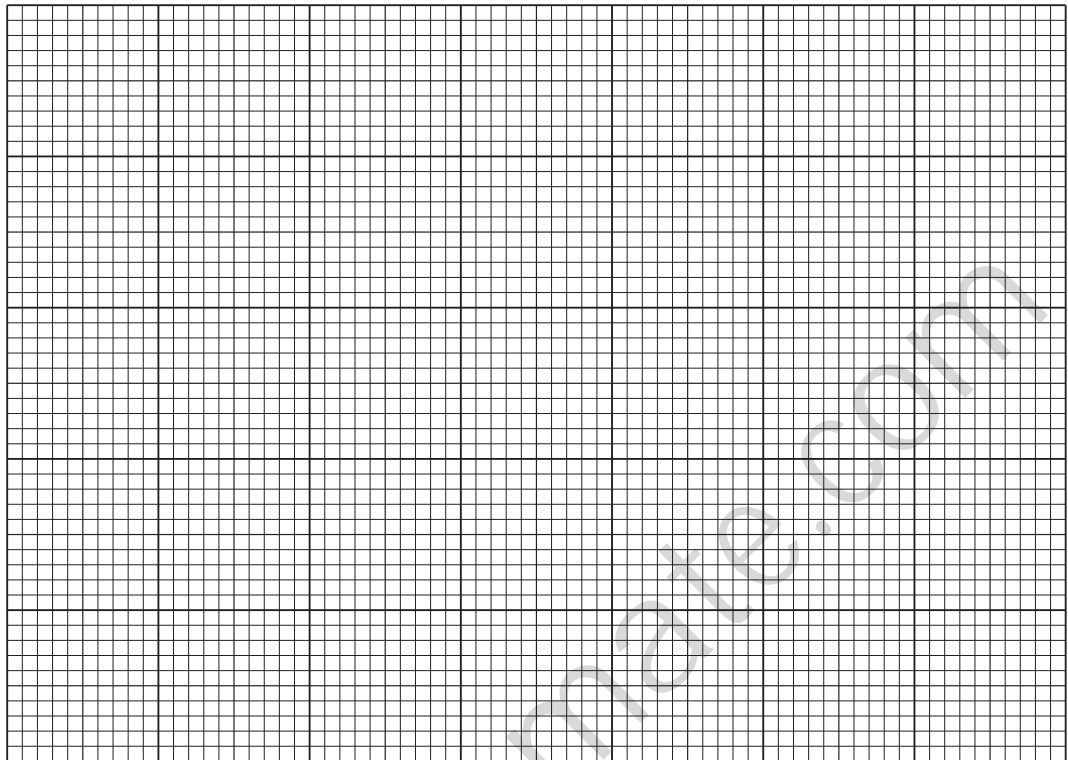
- (c) In a study, the number of apple ermine moths in one area was recorded every two weeks over a 12-week period.

The results are shown in Table 2.1.

**Table 2.1**

week	number of apple ermine moths
0	0
2	0
4	11
6	22
8	22
10	18
12	4

(i) Plot a line graph on the grid of the data in Table 2.1.



[4]

(ii) Use your graph to estimate the number of moths in week 11.

Show on your graph where you took your readings.

..... [2]

[Total: 16]

## 1 - (0610/61\_Summer\_2018\_Q2)



(a)(i)	<b>A 6, B 3, C 4, D 6, E 8, F 9 ;</b>  (total) 36 ;	<b>2</b>
(a)(ii)	6 ;	<b>1</b>
(a)(iii)	612 ;	<b>1</b>
(a)(iv)	variation in insect populations in different parts of garden / unrepresentative sample / some webs difficult to see / AW;  some insects eaten by spiders / or fallen off web ;  some insects, too small to be visible / difficult to count ;  some caught organisms may not be insects ;  AVP ;	<b>1</b>
(b)(i)	<b>O</b> (outer line) single, clear, continuous lines with no shading ;  <b>S</b> (size) occupies at least half the space provided (must be at least 75 mm in length) ;  <b>D</b> (detail) two body parts <u>and</u> 2 chelicerae (on the cephalothorax) <b>or</b> 2 spinnerets (on abdomen) ;  8 jointed legs, attached to the body in the correct position and in the correct orientation ;  <b>L</b> (label) <u>line</u> labelled <i>abdomen</i> ending on the abdomen ;	<b>5</b>

(b)(ii)	length of <b>XY</b> on Fig. 2.2 given as 38.5 mm – 41 mm ; line <b>XY</b> shown on the candidate's drawing in correct position ; correct calculation ;	<b>3</b>
(c)(i)	<b>A</b> (axes) labelled with units  <b>S</b> (scale and size) even scale bars to occupy at least half the grid in both directions ;  <b>P</b> (plotting) all five bars plotted accurately $\pm$ half a small square bars same width (at least 1 small squares wide) gaps between bars	<b>3</b>
(c)(ii)	3 : 1 ;;	<b>2</b>

## 2 - (0610/62\_Summer\_2018\_Q2)



(a)(i)	<b>O</b> (outline) single clear line no shading ; <b>S</b> (size) use at least half available space ( <b>AB</b> greater than 85 mm) ; <b>D</b> (detail) eight algae ; <b>D</b> (detail) circle drawn in the centre ;	<b>4</b>
(a)(ii)	<b>AB</b> = 85 mm or 8.5 cm ; 0.2 (mm) or 0.02 (cm) ;;	<b>3</b>

(b)(i)	<p><i>independent variable:</i></p> <p><b>1</b> at different light (intensities) ;</p> <p><i>dependent variable:</i></p> <p><b>2</b> record colour of hydrogencarbonate indicator after a time or record the time taken to reach a set colour ;</p> <p><i>controlled variables:</i></p> <p><b>3</b> same amount / number / mass / species / type, of algae ;</p> <p><b>4</b> same volume / concentration, of hydrogencarbonate indicator ;</p> <p><b>5</b> same temperature ;</p> <p><b>6</b> same time / same end colour ;</p> <p><b>7</b> same initial colour of indicator at the start ;</p> <p><i>methodology: Max 3 from mp8–11</i></p> <p><b>8</b> detail of a quantitative method used to achieve different light intensities e.g. moving light source / use of bulbs with different light intensities / determining light intensity with a light meter ;</p> <p><b>9</b> method of achieving constant temperature e.g. heat shield / screen / low energy bulb / LED bulb ;</p> <p><b>10</b> use of a control tube with no algae ;</p> <p><b>11</b> time to equilibrate (to different light intensities) ;</p> <p><b>12</b> two or more repeats / replicates ;</p>	<b>6</b>
(b)(ii)	Universal Indicator / litmus / AVP	<b>1</b>

## 3 - (0610/63\_Summer\_2018\_Q2)



(a)	<p><b>O</b> (utline) single clear line no shading ;</p> <p><b>S</b> (ize) use at least half available space ;</p> <p><b>D</b> (etail) dots visible ;</p> <p><b>D</b> (etail) 7 / 8 / 9 sections visible ;</p>	<b>4</b>
-----	---	----------



(b)	<p><i>one similarity</i> both have dots ; both have bars ; number of wings ; colours ; antennae / head ;</p> <p><i>two differences</i> wing, shape / position ; pattern / viceroy, has a dark horizontal band in lower half of hindwing ; shape of dots ; number of dots ; monarch / monarch's wings, larger ; <b>ora</b></p>	<b>3</b>
(c)(i)	<p><b>A</b>(xes) – labels with units mass / g <b>and</b> length / mm ; <b>S</b>(cale) – suitable even scale and data occupies more than half the grid in at least one direction ; <b>P</b>(lot) – all points plotted accurately <math>\pm</math> half a small square ; <b>L</b>(ine) – suitable line drawn through points ;</p>	<b>4</b>
(c)(ii)	as body mass increases wing length increases / AW ;	<b>1</b>
(c)(iii)	correct use of graph ; correct value ;	<b>2</b>
(d)	<p>collect samples of nectar (from plants) ; (repeat test on) more than one sample ;</p> <p>named nutrient molecule ; perform (named) food tests ; details of food testing method ; detail of positive and negative food test results ;</p> <p>valid safety precaution ;</p> <p>AVP ; e.g. sample from plants at different times of year to see if content changes / AW</p>	<b>6</b>

4 - (0610/63\_Summer\_2020\_Q2)



(a)	substance in Fig. 2.1	food test	positive result for the food test	5
	fat(s) and vitamin C ;	(ethanol) emulsion test ;	cloudy / white ;	
		DCPIP (test) ;	colourless ;	
(b)(i)	axes labelled with units: number of wasps / $\times 10^5$ per hectare and percentage damage (to the walnut crop) ; scale that fills at least half grid in both directions ; six correct plots ; suitable line drawn as either plotted points joined with ruled lines OR a smooth curve ;			4
(b)(ii)	<i>any 2 from:</i> decrease in damage (to walnut crop) as wasp numbers increase ; levels off ; data quote e.g. levels off at $1.8 \times 10^5$ per hectare ;			2
(b)(iii)	$1.8 \times 10^5$ / 180 000 ; <i>reason:</i> no further benefit after this point / no increased yield from adding more wasps / AW ;			2
(b)(iv)	more intermediate values ;			1
(c)(i)	<i>outline:</i> smooth continuous lines ; <i>size:</i> greater size than 5 cm wide ; <i>details</i> ;; e.g. correct detail of veins minimum 10 on each side extending to edge of leaf / notch shown at leaf tip / parallel veins branching at the same point from the central vein / branching of one vein on Q side in top third of the leaf			4
(c)(ii)	(length of line <b>PQ</b> ) $50 \pm 1$ mm ; 100 / 98 / 102, mm ;;			3

5 - (0610/63\_Winter\_2020\_Q2)



(a)(i)	outline ; smooth continuous lines, no shading size ; $\geq 130$ mm wide detail 1 ; two seeds drawn with dividing line and appropriate shape detail 2 ; at least 2 notches drawn on lower left wing edge and one or two notches on the right	4
(a)(ii)	<i>length of line AB:</i> $70 \pm 1$ (mm) ; <i>actual length:</i> 17.5 mm ;;	3
(b)	<i>similarity:</i> wings / wings long and narrow / veins ;  <i>difference:</i> ref. to, size / wing shape / seed shape / symmetry / wing orientation / number of seeds / number of wings per seed / AVP ;	2
(c)(i)	126 (cm) ; value marked on graph by candidate ;	2

(c)(ii)	28(%) ;;;	<b>3</b>
(c)(iii)	<i>any two from:</i> type / species, of seed ; age of seed ; (drop) height ; wind, speed / direction ; seed, mass / weight ; AVP ; humidity, damage to wing, seed width, temperature	<b>2</b>

6 - (0610/63\_Winter\_2021\_Q2)



(a)	all lines clear and continuous, no shading ; size greater than half of space provided ; <i>detail 1:</i> five ovary lobes drawn with central circle ; <i>detail 2:</i> left-hand lobe wider than lobe below it ;	<b>4</b>
(b)(i)	80 (mm) $\pm$ 1 mm ; 8.9 ;;	<b>3</b>
(b)(ii)	<i>similarity and two from:</i> 1 (black) spots ; 2 same / similar, length / size ; 3 (black) eyes ; 4 legs ; 5 antennae ; 6 (white) wings ; 7 (white) head ; 8 feathering / AW at wing-tips ; 9 long (body / wings) 10 other insect features exoskeleton, scales, spiracles etc.  <i>difference any one from:</i> 11 number of spots: more spots on bird-cherry ; 12 pattern of spots: bird cherry in more lines / spots closer etc. ; 13 position of antennae: flatter on bird-cherry ; 14 presence of mouthparts / beak in bird cherry moth 15 thicker legs on apple ermine moth	<b>3</b>
(c)(i)	axes labelled ; linear scale for plotted points to half or more in both dimensions ; <u>all</u> plotted points accurate to $\pm$ half small square ; line with no extrapolation ;	<b>4</b>
(c)(ii)	correct value from candidate's graph $\pm$ half a small square ; indication of value shown on the graph ;	<b>2</b>