UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

4843122136

BIOLOGY **0610/31**

Paper 3 Extended **October/November 2012**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
3	
4	
5	
6	
Total	

This document consists of **22** printed pages and **2** blank pages.

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Question 1 begins on page 3.

1 Arachnids, crustaceans, insects and myriapods are all classified as arthropods.

Scorpions, such as *Heterometrus swammerdami* shown in Fig. 1.1, are arachnids.

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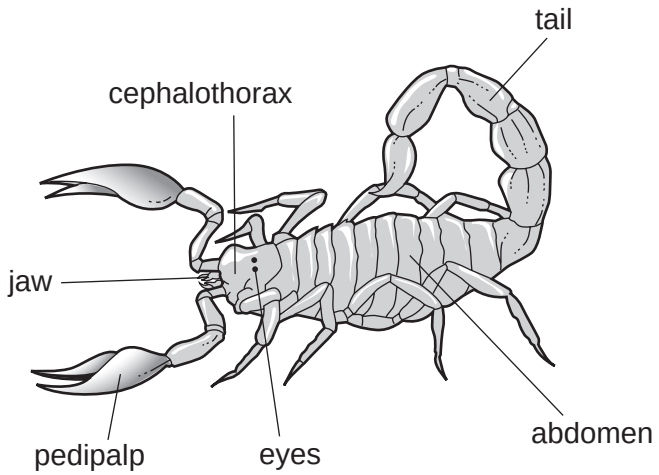


Fig. 1.1

(a) State **three** features, shown by *H. swammerdami* and **visible** in Fig. 1.1, that arachnids share with other arthropods.

1 .....

2 .....

3 ..... [3]

(b) Fig. 1.2 shows seven species of arachnid.

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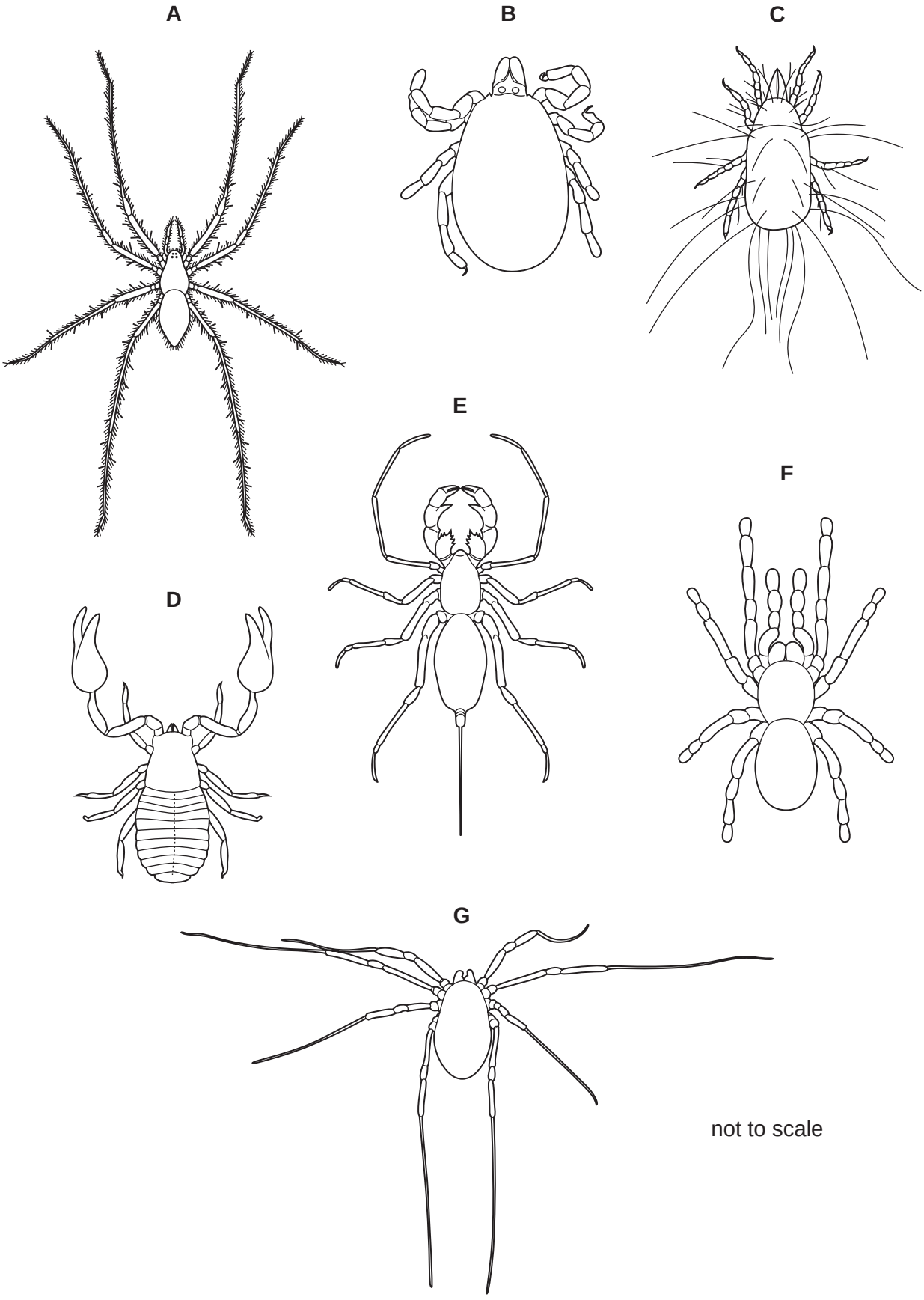


Fig. 1.2

Use the key to identify each species. Write the letter of each species (**A** to **G**) in the correct box beside the key. One has been done for you.

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Key

1 (a)	Abdomen with a tail	*Abaliella dicranotarsalis*	**E**
(b)	Abdomen without a tail	go to 2	
2 (a)	Legs much longer than abdomen and cephalothorax	go to 3	
(b)	Legs not much longer than abdomen and cephalothorax	go to 4	
3 (a)	Hairs on the legs	*Tegenaria domestica*	
(b)	No hairs on the legs	*Odielus spinosus*	
4 (a)	Cephalothorax or abdomen segmented	*Chelifer tuberculatus*	
(b)	Cephalothorax and abdomen not segmented	go to 5	
5 (a)	Abdomen and cephalothorax about the same size	*Poecilotheria regalis*	
(b)	Abdomen larger than cephalothorax	go to 6	
6 (a)	Body covered in long hairs	*Tyroglyphus longior*	
(b)	Body not covered in hairs	*Ixodes hexagonus*	

[4]

[Total: 7]

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2 Blood flows through the hepatic portal vein from some organs to the liver.

Fig. 2.1 shows the hepatic portal vein and these organs.

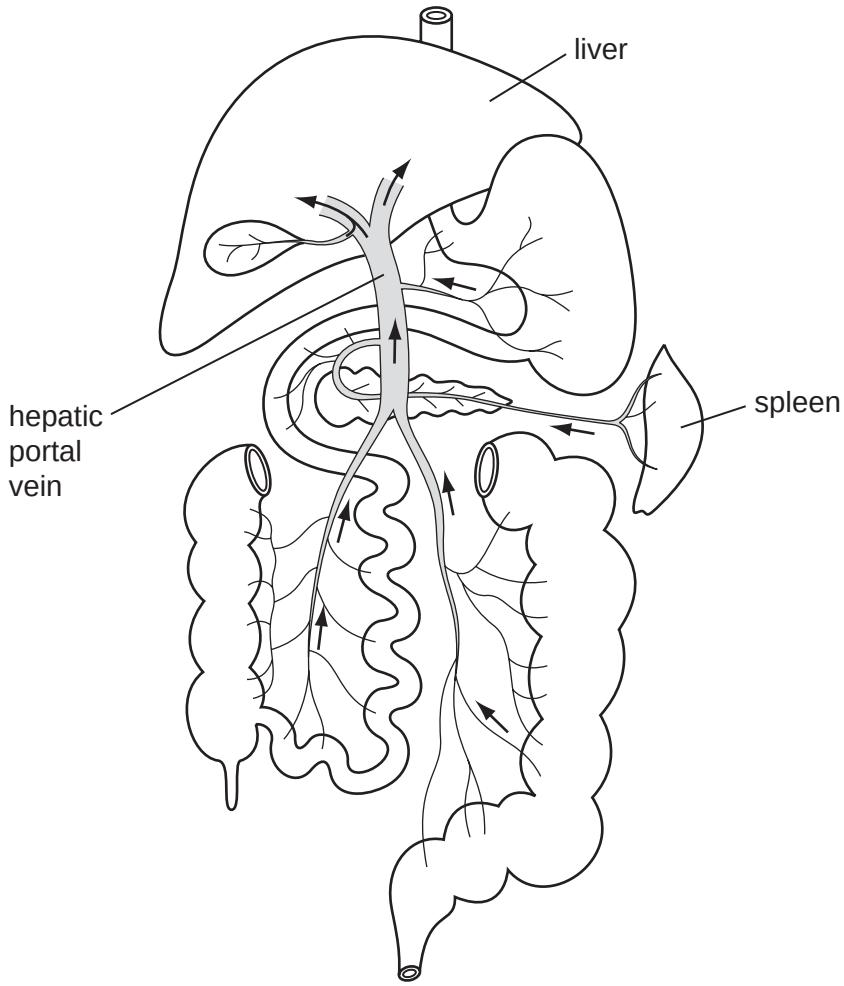


Fig. 2.1

(a) Blood in the hepatic portal vein is deoxygenated.

Explain why the blood in the hepatic portal vein is deoxygenated rather than oxygenated.

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..... [2]

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(b) Name **four** organs, **other than** the spleen, that are shown in Fig. 2.1 and from which blood flows into the hepatic portal vein.

For Examiner's Use

1 .....

2 .....

3 .....

4 ..... [4]

(c) Describe the role of the hepatic portal vein in the transport of absorbed nutrients.

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..... [3]

(d) Explain how the liver is involved in regulating the composition of the blood **and** in protecting the body against toxic substances.

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..... [5]

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[Turn over

(e) The spleen contains lymphatic tissue which is full of phagocytes and lymphocytes.

For Examiner's Use

Describe how phagocytes **and** lymphocytes protect the body against the spread of disease-causing organisms.

phagocytes .....

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.....

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lymphocytes .....

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..... [4]

[Total: 18]

Question 3 begins on page 10.

3 The ribcage and diaphragm are involved in the breathing mechanism to ventilate the lungs.

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Fig. 3.1 is a flow chart that shows the changes that take place when breathing in.

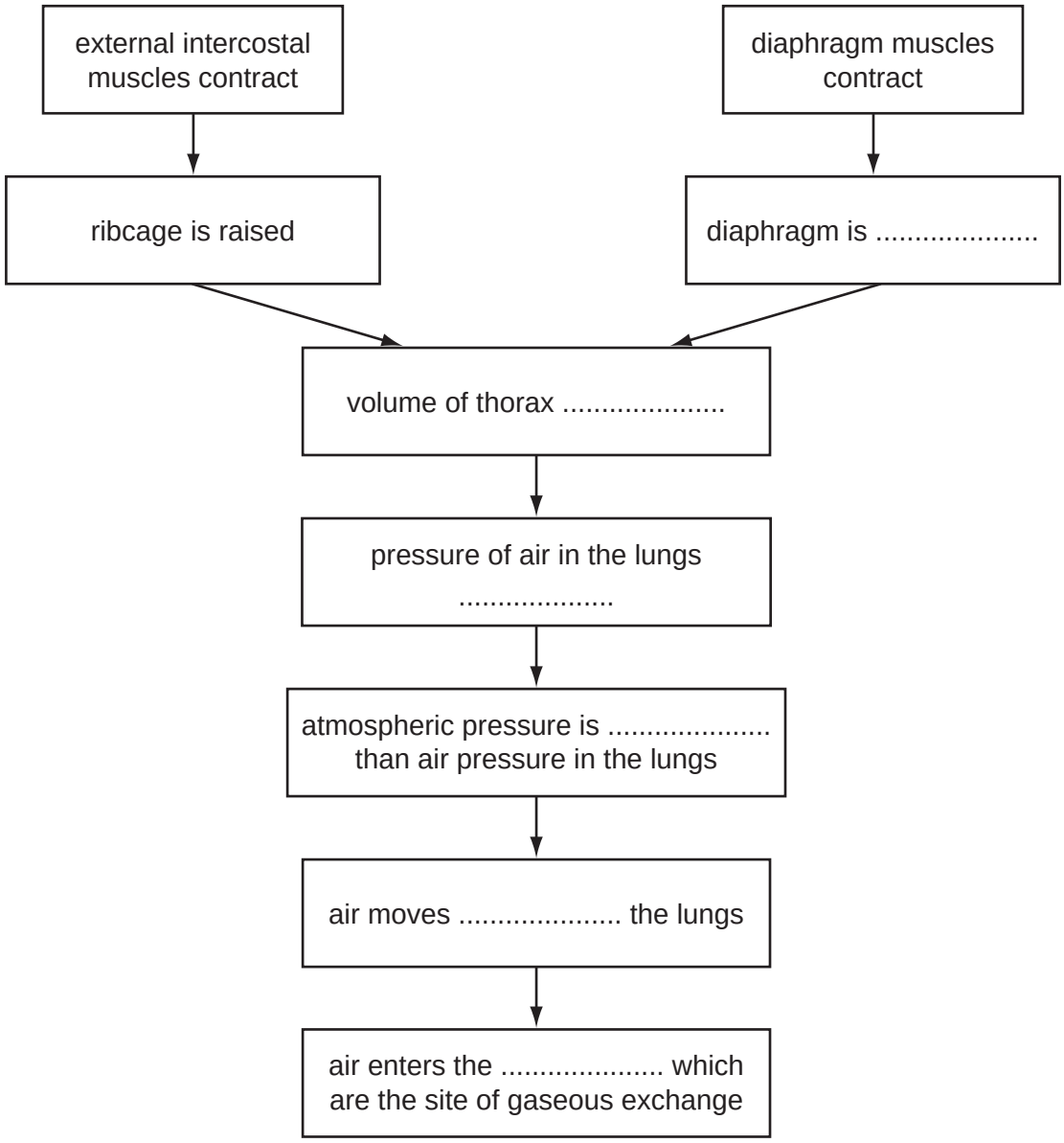


Fig. 3.1

(a) Complete Fig. 3.1 by writing appropriate words in the spaces provided. [6]

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(b) Fig. 3.2 shows part of the epithelium that lines the trachea.

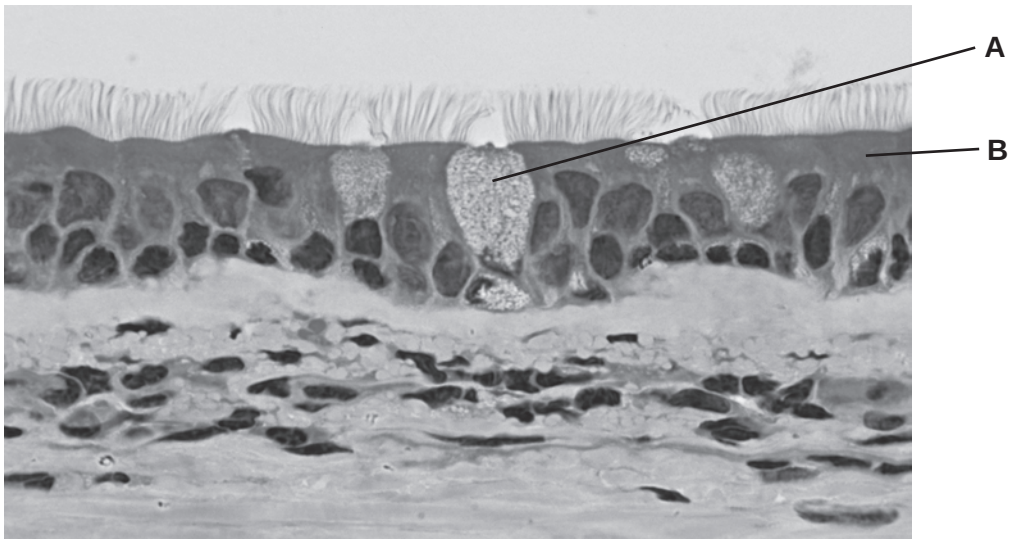


Fig. 3.2

Explain how the cells labelled **A** and **B** in Fig. 3.2 protect the gas exchange system.

A .....

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.....

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B .....

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..... [4]

[Total: 10]

Question 4 begins on page 13.

For Examiner's Use

4 **(a)** Complete the balanced chemical equation for photosynthesis.

$$\text{.....} + \text{.....} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{.....} + \text{.....} \quad [3]$$

A student investigated the effect of increasing the concentration of carbon dioxide on the rate of photosynthesis of *Cabomba*, an aquatic plant.

Fig. 4.1 shows the apparatus that the student used.

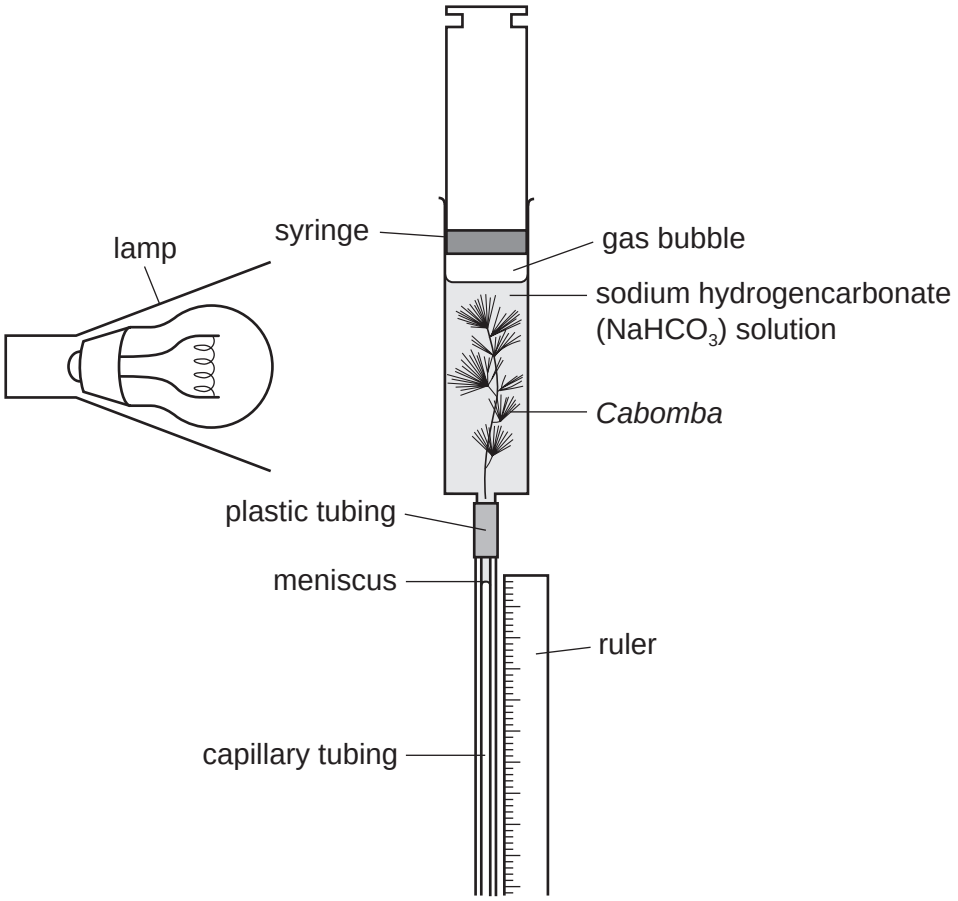


Fig. 4.1

The concentration of carbon dioxide in the water surrounding the plant was changed by adding different concentrations of sodium hydrogencarbonate solution to the water.

The student recorded the time taken for the meniscus to travel 50 mm down the tubing.

The rate of photosynthesis was calculated as:

$$\text{rate of photosynthesis} = \frac{1000}{\mathbf{t}}$$

where **t** = time taken in seconds for the meniscus to travel 50 mm.

The student's results are shown in Table 4.1.

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Table 4.1

concentration of sodium hydrogencarbonate solution / mol per dm^3	**t**, time taken for meniscus to travel 50 mm / s	rate of photosynthesis (1000/**t**)
0.00	4998	0.20
0.01	2500	0.40
0.02	1175	0.85
0.05	350	2.86
0.07	201	
0.10	199	5.03

(b) Calculate the rate of photosynthesis for the concentration of sodium hydrogencarbonate solution of 0.07 mol per dm^3.

Write your answer in Table 4.1. [1]

(c) (i) Explain why the lamp must be kept at a fixed distance from the syringe.

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..... [2]

(ii) Explain what caused the meniscus to move down the capillary tubing.

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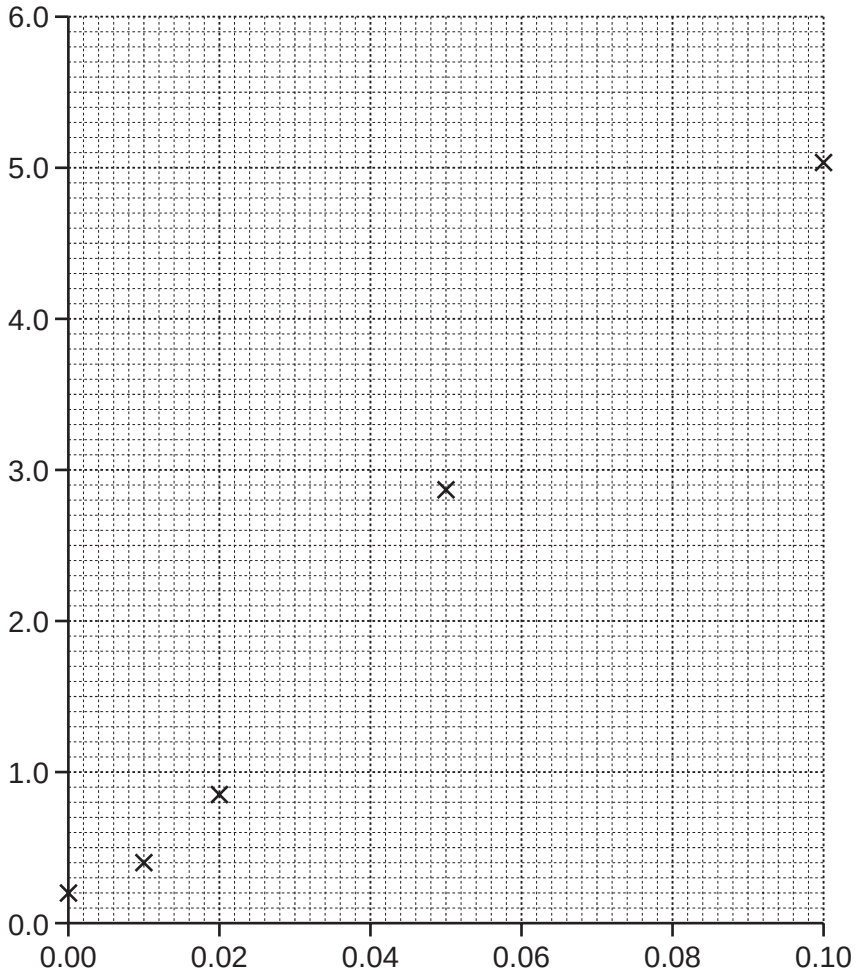
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(d) Fig. 4.2 is a partially completed graph of the student's results.

Complete the graph by labelling the axes, adding the missing point and drawing a suitable line.



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Fig. 4.2

[3]

(e) Explain, using the term **limiting factors**, the effect of carbon dioxide concentration on the rate of photosynthesis as shown by the student's results.

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You will gain credit for using the data in the table and the graph to answer the question.

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..... [5]

[Total: 16]

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5 Table 5.1 shows some information about air pollution.

Table 5.1

pollutant	source of air pollutant	effect of pollutant on the environment
…….	combustion of fossil fuels	increased greenhouse effect and global warming
methane	…… ……	increased greenhouse effect and global warming
sulfur dioxide	combustion of high sulfur fuels	acid rain
nitrogen oxides	fertilisers	acid rain

(a) Complete Table 5.1 by writing answers in the spaces indicated. [2]

(b) Explain how the increased greenhouse effect is thought to lead to global warming.

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(c) Fig. 5.1 shows changes in the emissions of sulfur dioxide in Europe between 1880 and 2004.

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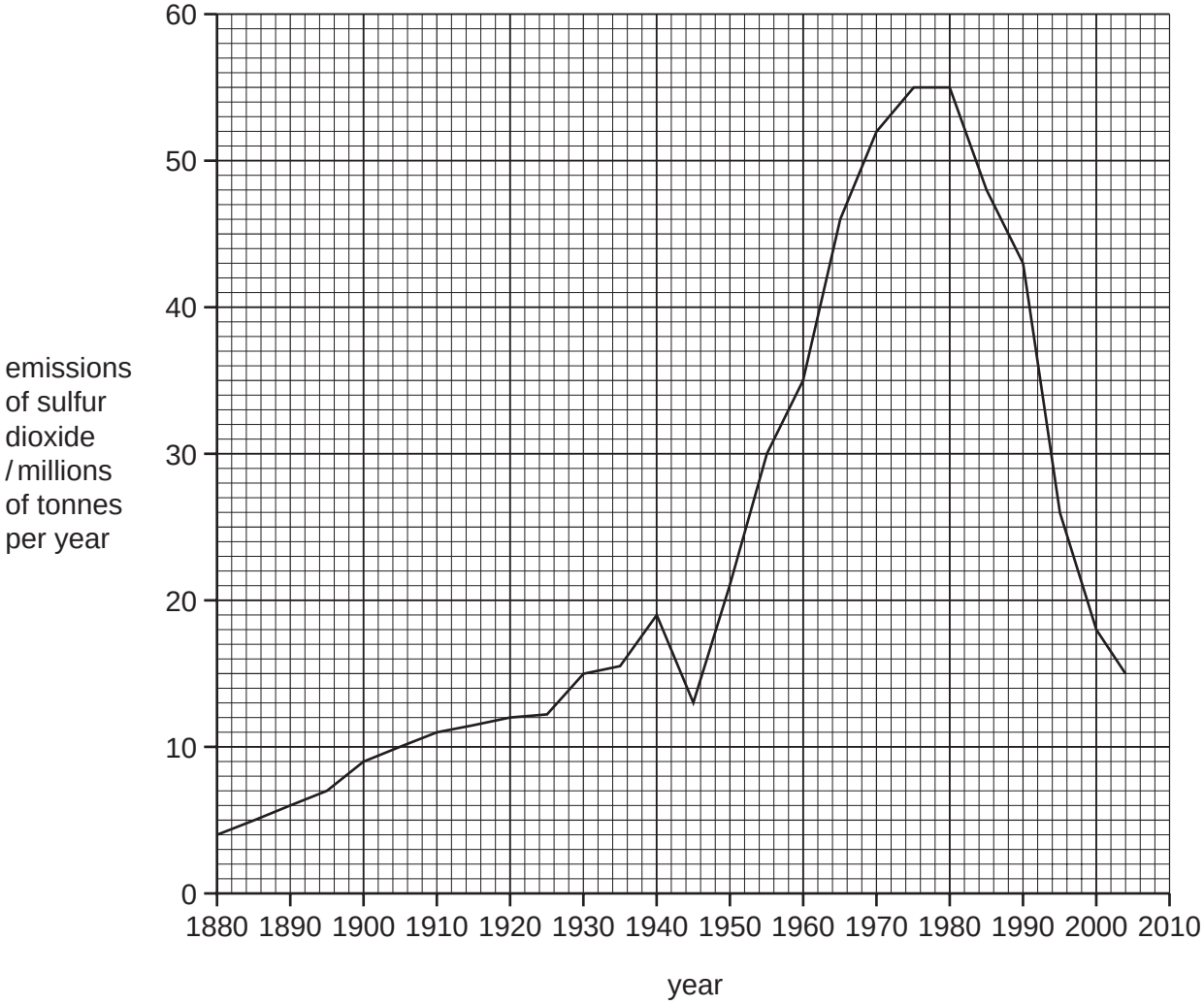


Fig. 5.1

(i) Use the information in Fig. 5.1 to describe the changes in the emissions of sulfur dioxide in Europe between 1880 and 2004.

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..... [4]

(ii) Describe the effects of acid rain on the environment.

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..... [3]

(iii) Outline the methods that have been used to reduce the emissions of sulfur dioxide.

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..... [3]

[Total: 15]

6 The flowers of pea plants, *Pisum sativum*, are produced for sexual reproduction. The flowers are naturally self-pollinating, but they can be cross-pollinated by insects.

(a) Explain the difference between self-pollination and cross-pollination.

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..... [2]

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(b) Explain the **disadvantages** for plants, such as *P. sativum*, of reproducing sexually.

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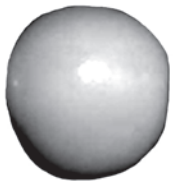
..... [4]

Pea seeds develop inside pea pods after fertilisation. They contain starch. A gene controls the production of an enzyme involved in the synthesis of starch grains.

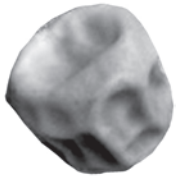
The allele, **R**, codes for an enzyme that produces normal starch grains.
This results in seeds that are round.

The allele, **r**, does not code for the enzyme. The starch grains are not formed normally. This results in seeds that are wrinkled.

Fig. 6.1 shows round and wrinkled pea seeds.



round pea seed



wrinkled pea seed

Fig. 6.1

Pure bred plants are homozygous for the gene concerned. A plant breeder had some pure bred pea plants that had grown from round seeds and some pure bred plants that had grown from wrinkled seeds.

(c) State the genotypes of the pure bred plants that had grown from round and from wrinkled seeds.

round .....

wrinkled ..... [1]

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These pure bred plants were cross-pollinated (cross **1**) and the seeds collected.
All the seeds were round. These round seeds were germinated, grown into adult plants (offspring 1) and self-pollinated (cross **2**).

The pods on the offspring 1 plants contained both round and wrinkled seeds.

Further crosses (**3** and **4**) were carried out as shown in Table 6.1.

Table 6.1

cross		phenotype of seeds in the seed pods		ratio of round to wrinkled seeds
		round seeds	wrinkled seeds	
1	pure bred for round seeds x pure bred for wrinkled seeds	✓	✗	1:0
2	offspring 1 self-pollinated	✓	✓	
3	offspring 1 x pure bred for round seeds			
4	offspring 1 x pure bred for wrinkled seeds			

(d) Complete Table 6.1 by indicating

- the type of seeds present in the pods with a tick (✓) or a cross (✗)
- the ratio of round to wrinkled seeds.

You may use the space below and on page 22 for any rough working. [3]

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[Turn over

(e) Seed shape in peas is an example of discontinuous variation.
Suggest **one** reason why seed shape is an example of discontinuous variation.

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..... [1]

Plants have methods to disperse their seeds over a wide area.

(f) Explain the **advantages** of having seeds that are dispersed over a wide area,

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..... [3]

[Total: 14]

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Question 3 Figure 3.2 © Reference A18K2A – Electronmicrograph Peter Arnold, Inc. / Alamy

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