Surname	Centre Number	Candidate Number
Other Names		0

GCSE

3400UA0-1

S19-3400UA0-1

BIOLOGY – Unit 1:
Cells, Organ Systems and Ecosystems

HIGHER TIER

FRIDAY, 7 JUNE 2019 – AFTERNOON

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**11**	
2.	**9**	
3.	**6**	
4.	**6**	
5.	**11**	
6.	**14**	
7.	**6**	
8.	**10**	
9.	**7**	
Total	**80**	

3400UA01
01

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **7** is a quality of extended response (QER) question where your writing skills will be assessed.

JUN193400UA0101

© WJEC CBAC Ltd.

Examiner only

Answer **all** *questions.*

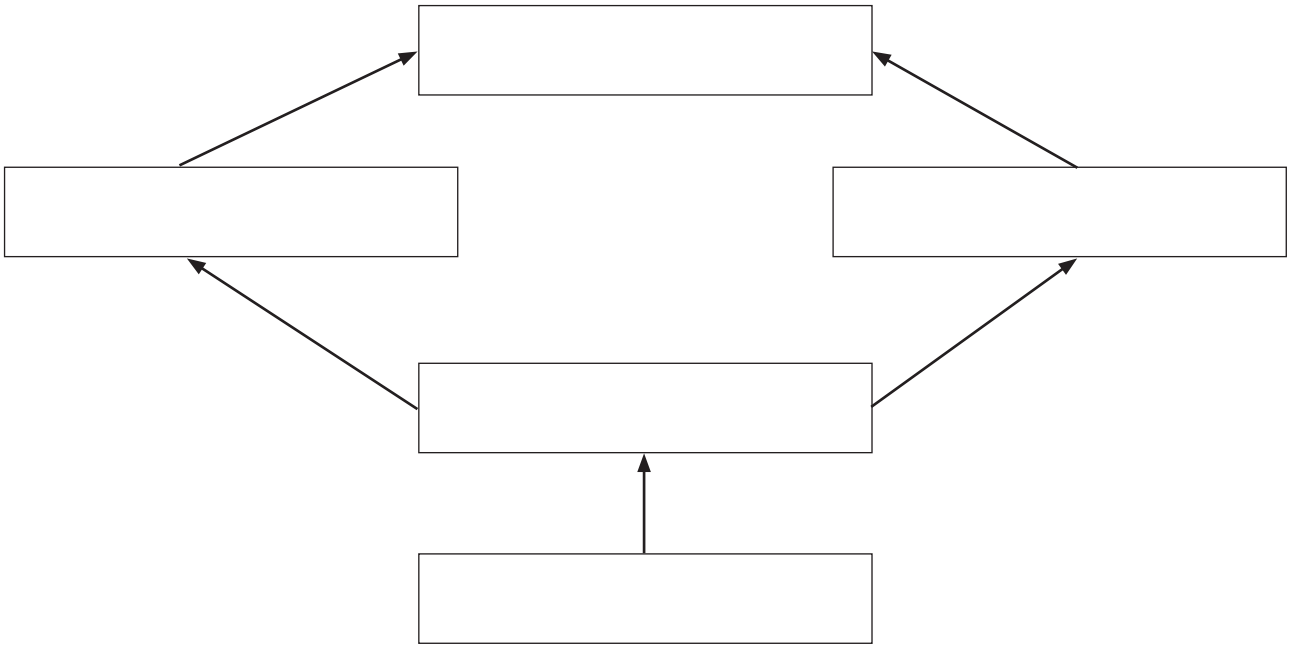
1. Killer whales *(Orcinus orca*) feed on thousands of large fish and squid. These large fish and squid feed on hundreds of small fish. Small fish feed on tiny organisms called plankton.

In 2016, a dead killer whale was found washed up on an island off the West Coast of Scotland. Tests revealed the whale contained one of the highest levels of PCBs (polychlorinated biphenyls) ever recorded. Levels of PCBs are measured in milligrams per kilogram of fat in an animal's body. Scientists believe that the threshold where PCBs can cause harm to killer whales is 30 mg / kg of fat. The level of PCB in the dead whale was 957 mg / kg of fat.

During the last century, PCBs were widely used in plastics, electrical goods and cement. PCBs were banned in the 1970s. It is estimated that there are a million tonnes of PCB-contaminated material waiting to be disposed of in Europe. PCBs are released into the environment from decomposing products that have not been disposed of properly. Plankton absorb PCBs that are washed into the oceans.

There are only eight resident killer whales remaining in UK waters. Scientists have not observed any offspring being born to the resident killer whales in the 25 years they have been studying them.

(a) (i) Complete the simple food web below to show the feeding relationships of a killer whale. [3]



(ii) State the term used to describe the feeding stage of killer whales. [1]

.....

© WJEC CBAC Ltd.

Examiner only

(b) Calculate how many times greater the level of PCBs was in the dead killer whale's body when compared to the threshold where PCBs cause harm. [1]

Times greater = ...

(c) Suggest the name of a group of micro-organisms responsible for releasing PCBs into the environment. [1]

.....

(d) Explain how the PCBs led to the death of the killer whale. [2]

.....

.....

.....

.....

(e) Apart from causing death, describe another effect of PCBs on killer whales in UK waters. Give evidence to support your answer. [2]

.....

.....

.....

.....

(f) Suggest why PCBs are still present in UK waters even though they have been banned since the 1970s. [1]

.....

.....

11

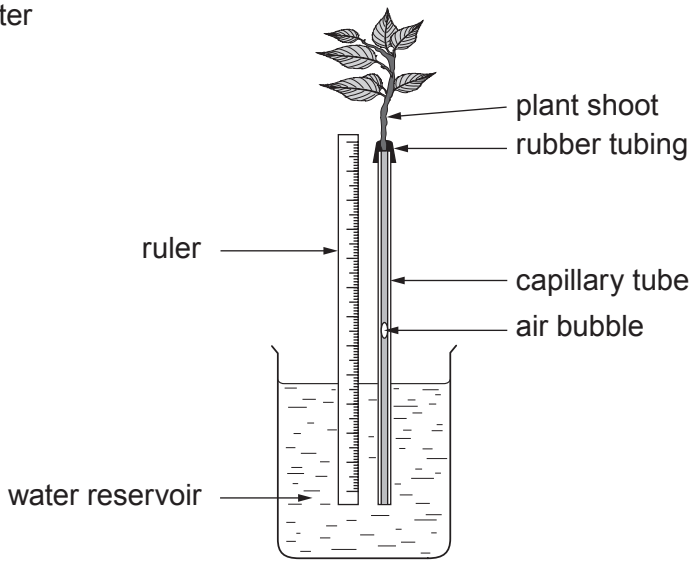
3400UA01 03

© WJEC CBAC Ltd.

Examiner only

2. Students used a simple potometer as shown below to compare the rate of transpiration in shoots from a beech tree *(Fagus sylvatica)* and a bay tree *(Laurus nobilis)*.

A simple potometer



(a) State the name of the tissue that transports water in plants. [1]

.....

(b) State **two** uses of water in plants. [2]

.....

.....

(c) (i) When the beech tree shoot was used, the air bubble in the capillary tube took 87 seconds to travel 50 mm. Calculate the rate of transpiration for the shoot from the beech tree in mm / s. [1]

Rate of transpiration = ... mm / s

(ii) When the bay tree shoot was used, the air bubble in the capillary tube took 51 minutes and 58 seconds to travel 50 mm.

State **one** conclusion that could be reached from the results. [1]

.....

.....

© WJEC CBAC Ltd.

Examiner only

(d) (i) State **one** factor that should have been kept constant in this investigation. [1]

.....

(ii) Describe how the students could improve their confidence in the results. [1]

.....

.....

(e) Explain why a potometer cannot be used to study transport of sugars in a plant. [2]

.....

.....

.....

.....

3400UA01 05

9

© WJEC CBAC Ltd.

Examiner only

3. A student examined cells from an onion epidermis using a light microscope.

The student used the following method:

1. Peel a thin layer of epidermis from inside a freshly cut onion.
2. Lay epidermis on glass slide.
3. Add a drop of iodine solution to the onion epidermis on the glass slide.
4. Gently lower a coverslip onto the glass slide.
5. Using a light microscope examine the slide to identify some of the cell structures.

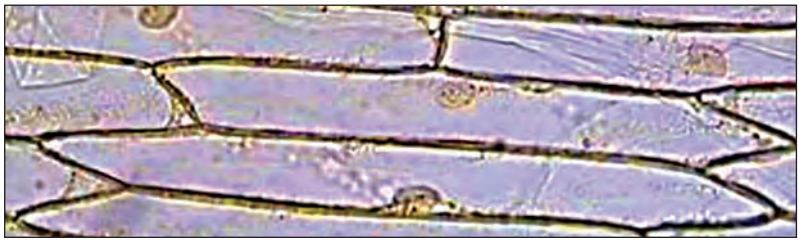
(a) One hazard for this method has been assessed and given in the table below. Identify **one** further hazard involved in this method and complete the risk assessment for it in the table below. [2]

Hazard	Risk	Control measure
Iodine solution is an irritant	Transfer of iodine solution from hand to eye can irritate the eyes	Use lowest concentration possible
.....	.....	.....
.....	.....	.....

© WJEC CBAC Ltd.

Examiner only

(b) A photograph of the student's observation is shown below.



(i) Draw **one** of the onion cells from the photograph above in the space below. [1]

(ii) **On your drawing**, label **three** parts of the cell **you can see** in the photograph. [2]

(c) State how the student would calculate the total magnification of the microscope she was using. [1]

.....

.....

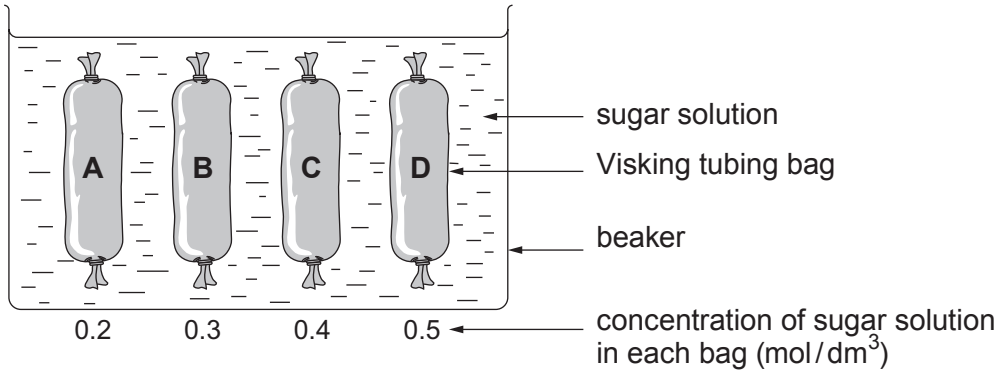
6

3400UA01 07

© WJEC CBAC Ltd.

4. A group of students carried out the following investigation.

- Four identical Visking tubing bags were filled with 10 cm^3 of a sugar solution.
- Each bag contained a different concentration of sugar solution.
- The outsides of the bags were washed and dried and then the mass of each bag was recorded.
- The bags were placed in a large beaker containing a sugar solution of unknown concentration.
- The bags were left for 30 minutes.
- The bags were removed from the beaker, the outsides of the bags were dried and their final mass recorded.
- The percentage change in mass was calculated.



The results are shown in the table.

Visking tubing bag	Concentration of sugar in the Visking tubing bag (mol / dm^3)	Percentage change in mass at 30 minutes (%)
A	0.2	–2.6
B	0.3	+1.3
C	0.4	+3.6
D	0.5	+4.2

© WJEC CBAC Ltd.

Examiner only

(a) Explain the result for Visking tubing bag **D**. [4]

.....

.....

.....

.....

.....

.....

.....

.....

(b) Estimate the concentration of the sugar solution in the beaker. Give a reason for your answer. [2]

Estimated concentration = ... mol / dm^3

Reason:

.....

.....

.....

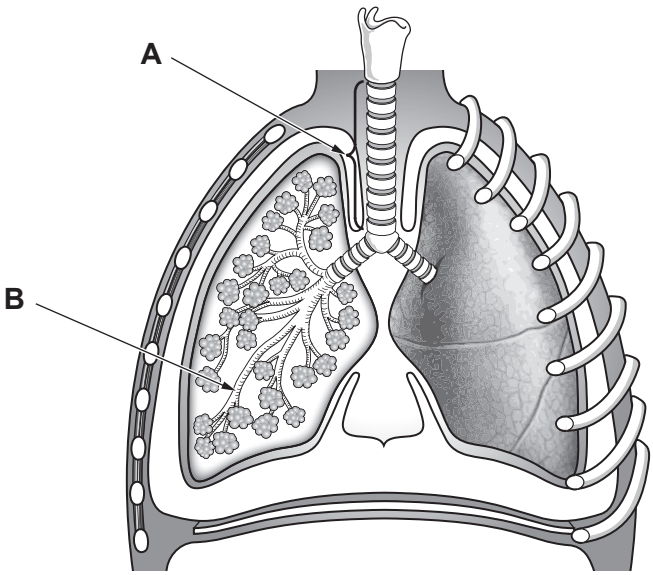
6

3400UA01 09

© WJEC CBAC Ltd.

Examiner only

5. The diagram shows a section through the human thorax.



(a) State the names of structures **A** and **B**. [2]

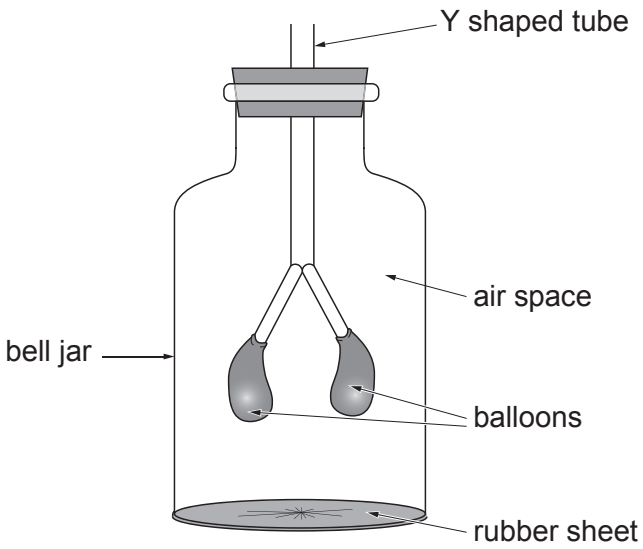
(i) **A** .....

(ii) **B** .....

© WJEC CBAC Ltd.

Examiner only

A bell jar model can be used to demonstrate inspiration and expiration.



(b) Describe and explain how the bell jar model could be used to demonstrate **inspiration**. [4]

.....

.....

.....

.....

.....

.....

.....

.....

(c) Describe **two** limitations of the bell jar as a model to demonstrate inspiration. [2]

.....

.....

.....

.....

.....

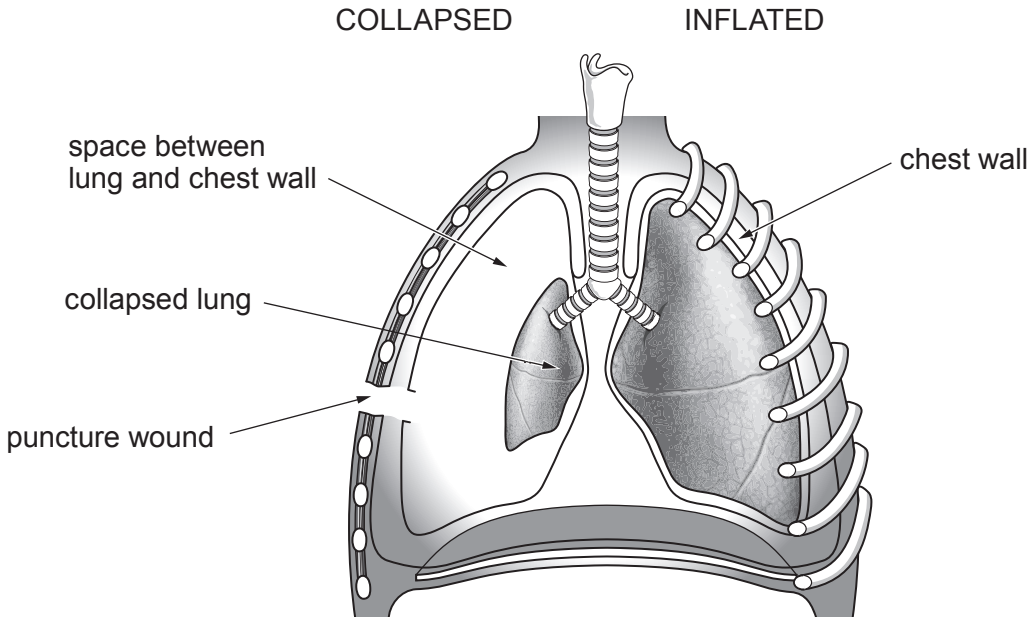
.....

3400UA01 11

© WJEC CBAC Ltd.

Examiner only

(d) A collapsed lung, as shown below, can be caused by an injury to the chest, such as a broken rib or puncture wound. Air enters the space between the lung and the chest wall causing the pressure in the thorax to increase and the lung to collapse.



(i) Suggest why a collapsed lung would not be considered to be life-threatening. [1]

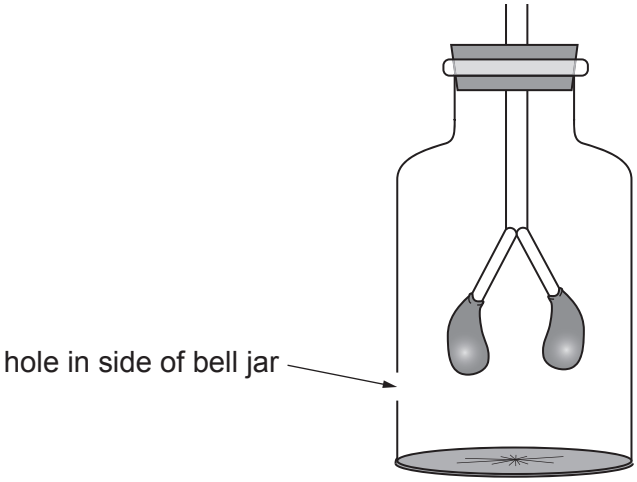
.....

.....

© WJEC CBAC Ltd.

Examiner only

Some students attempted to model a punctured lung using a bell jar model.



(ii) Describe and explain how the hole will affect the bell jar model when the rubber sheet is pulled down. [2]

.....

.....

.....

.....

.....

3400UA01 13

11

© WJEC CBAC Ltd.

Examiner only

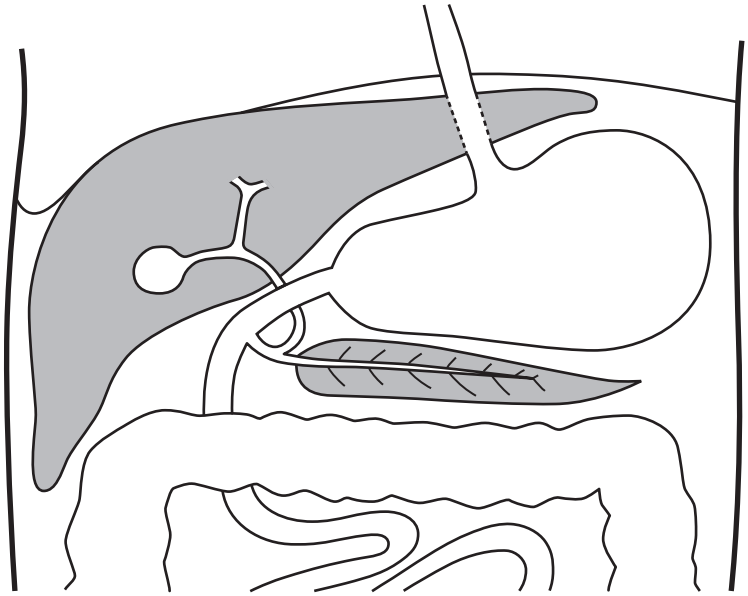
6. Cystic fibrosis is a genetic condition that affects many organs in the body including the pancreas. People with cystic fibrosis may have blockages in the pancreas which prevent enzymes from the pancreas reaching the small intestine. To overcome the problem of these blockages, people with cystic fibrosis take pancreatin tablets.

Pancreatin tablets have a tough coating that can resist low pH values. They contain a mixture of digestive enzymes normally produced in the pancreas.

(a) State the name of the process that moves the tablet along the digestive system after it has been swallowed. [1]

.....

(b) The diagram below shows part of the digestive system. [2]



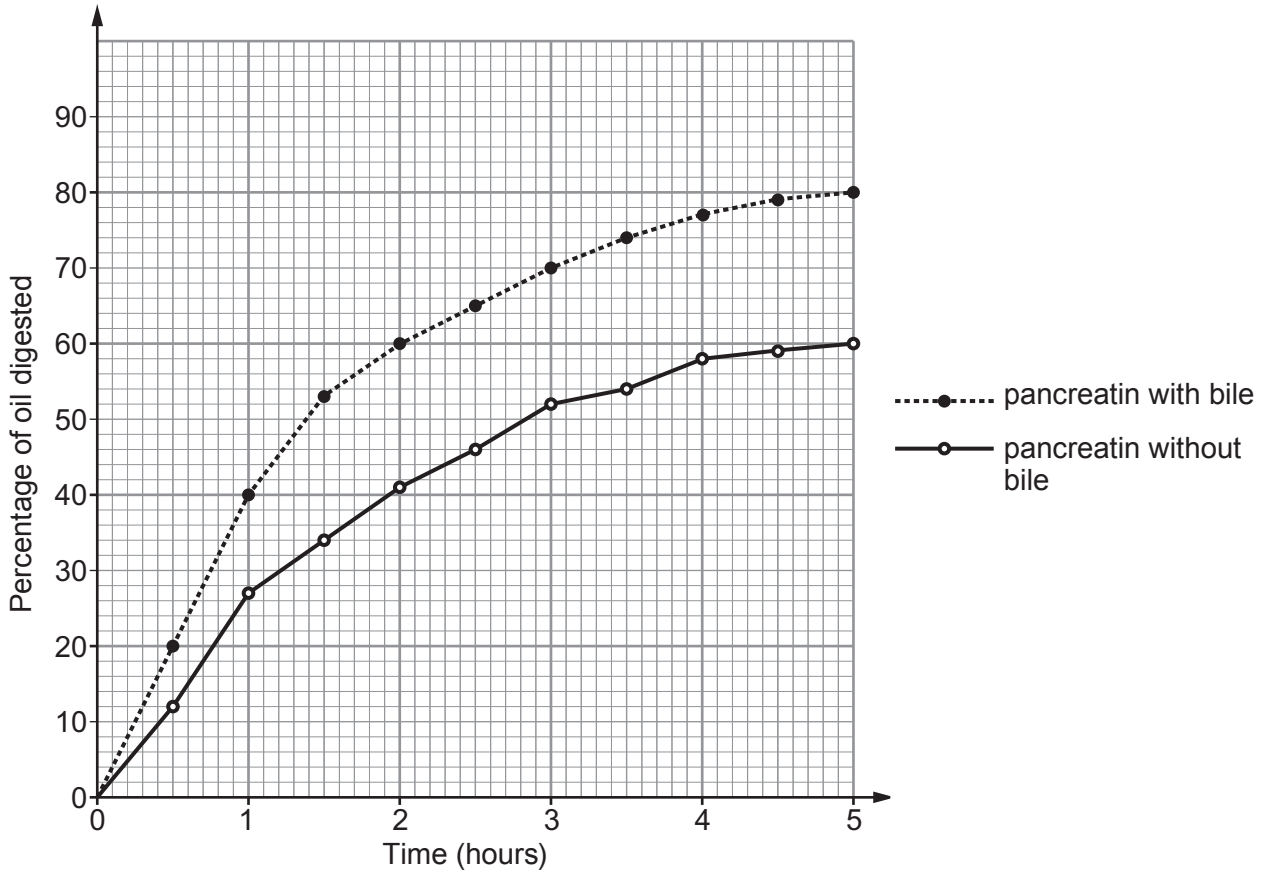
(i) Use a line labelled **X** to suggest the location of the blockage caused by cystic fibrosis.

(ii) Use a line labelled **Y** to show the organ that secretes bile.

© WJEC CBAC Ltd.

Examiner only

(c) The graphs below show the results of some experiments involving pancreatin.



Graph – Percentage of olive oil digested by pancreatin with and without bile.

(i) Pancreatin contains three different digestive enzymes, one of which is lipase. State the name of the *other* **two** enzymes present in pancreatin. [2]

I. .....

II. .....

(ii) Explain the effect of bile on the digestion of olive oil. [3]

.....

.....

.....

.....

.....

© WJEC CBAC Ltd.

Examiner only

(iii) State the products formed when olive oil is digested and give **one** use of these products in the body. [2]

.....

.....

(d) Suggest why pancreatin tablets need to have *'a tough coating that can resist low pH values'*. Explain your answer. [2]

.....

.....

.....

.....

.....

(e) State the name of the group of molecules to which enzymes belong and explain why the three enzymes in the pancreatin tablets have different structures. [2]

.....

.....

.....

.....

.....

14

© WJEC CBAC Ltd.

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

© WJEC CBAC Ltd.

Examiner only

7. The following extract is from an article published on the BBC news website.

Mega chicken factory plan approved

Campaigners have lost their battle against plans for a huge poultry factory after the proposal was approved by councillors.

The farm will house nearly 180 000 chickens.

Villagers say the factory will cause unacceptable levels of noise, smell and traffic.

The company behind the scheme insists it will improve the local environment.

Outline the advantages and disadvantages of allowing the development of the chicken farm and suggest why an environmental impact assessment would be required. [6 QER]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

© WJEC CBAC Ltd.

Examiner only

8. The picture shows a label from a packet of pasta.

Typical values (as consumed)	per 100g
Energy	658kJ
	155Kcal
Fat	0.6g
of which saturates	0.1g
Carbohydrate	30.3g
of which sugars	0.4g
Fibre	3.4g
Protein	5.5g
Salt	trace

(a) From the label above, identify the nutrient that provides bulk in the diet. [1]

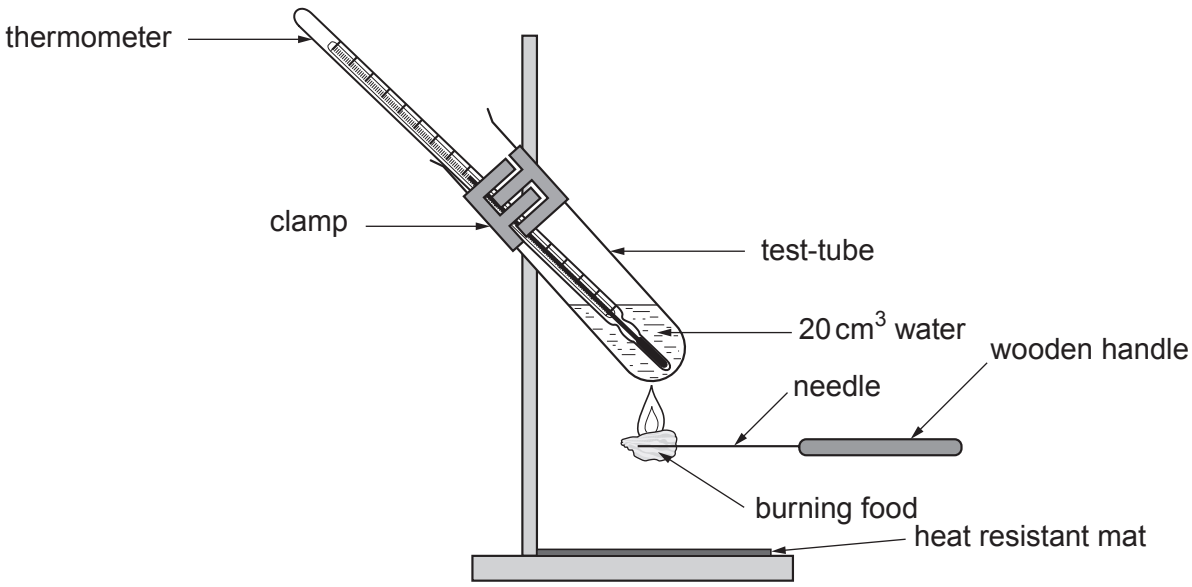
.....

(b) State why the government recommends that added sugars should not make up more than 5% of the energy obtained from food and drink each day. [1]

.....

© WJEC CBAC Ltd.

Students compared the energy content of crisps and pasta using the following apparatus.



The energy content of food can be calculated using the following formula.

$$\text{Energy (J/g)} = \frac{(4.2 \times \text{volume of water} \times \text{change in temperature})}{\text{mass of food}}$$

The following results were obtained.

Table 1

Food	Mass of food (g)	Temperature of water in test tube (°C)		Change in temperature (°C)
		Initial	Final	
Crisp	0.7	20	59	39
Pasta	1.3	20	36	16

© WJEC CBAC Ltd.

Examiner only

The table below shows the energy values for the crisps.

Table 2

Food	Energy calculated from the experiment (J/g)	Energy calculated from the experiment (kJ/g)	Energy recorded on the food label (kJ/g)
Crisp	4680	4.680	22.788
Pasta	.....	.....	.....

(c) Complete **Table 2** to show the energy values for pasta. You will need to refer to **Table 1** opposite and the food label on page 19. [4]

Space for working

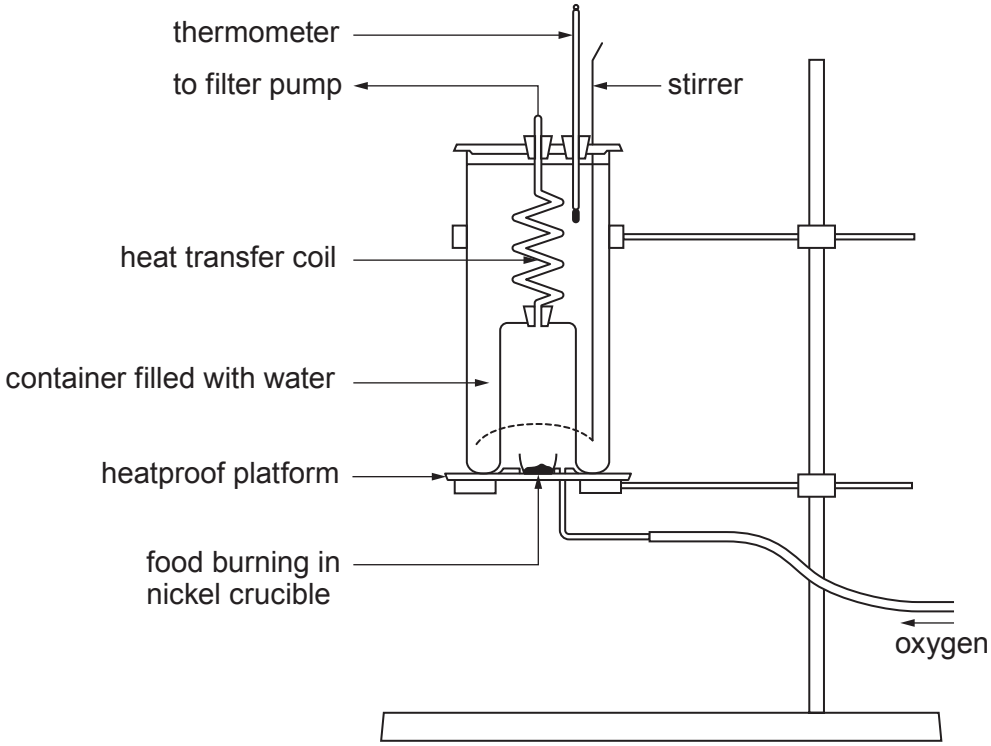
(d) Use the information from **Table 2** to calculate the percentage by which the value on the label for the crisps was greater than the value obtained in the experiment. [2]

Answer = ... %

© WJEC CBAC Ltd.

Examiner only

(e) The value calculated on the food label is worked out experimentally in a laboratory using apparatus similar to that shown below.



Suggest **two** ways in which the design of this apparatus makes it more efficient than the class experiment. [2]

.....

.....

.....

.....

.....

.....

10

© WJEC CBAC Ltd.

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

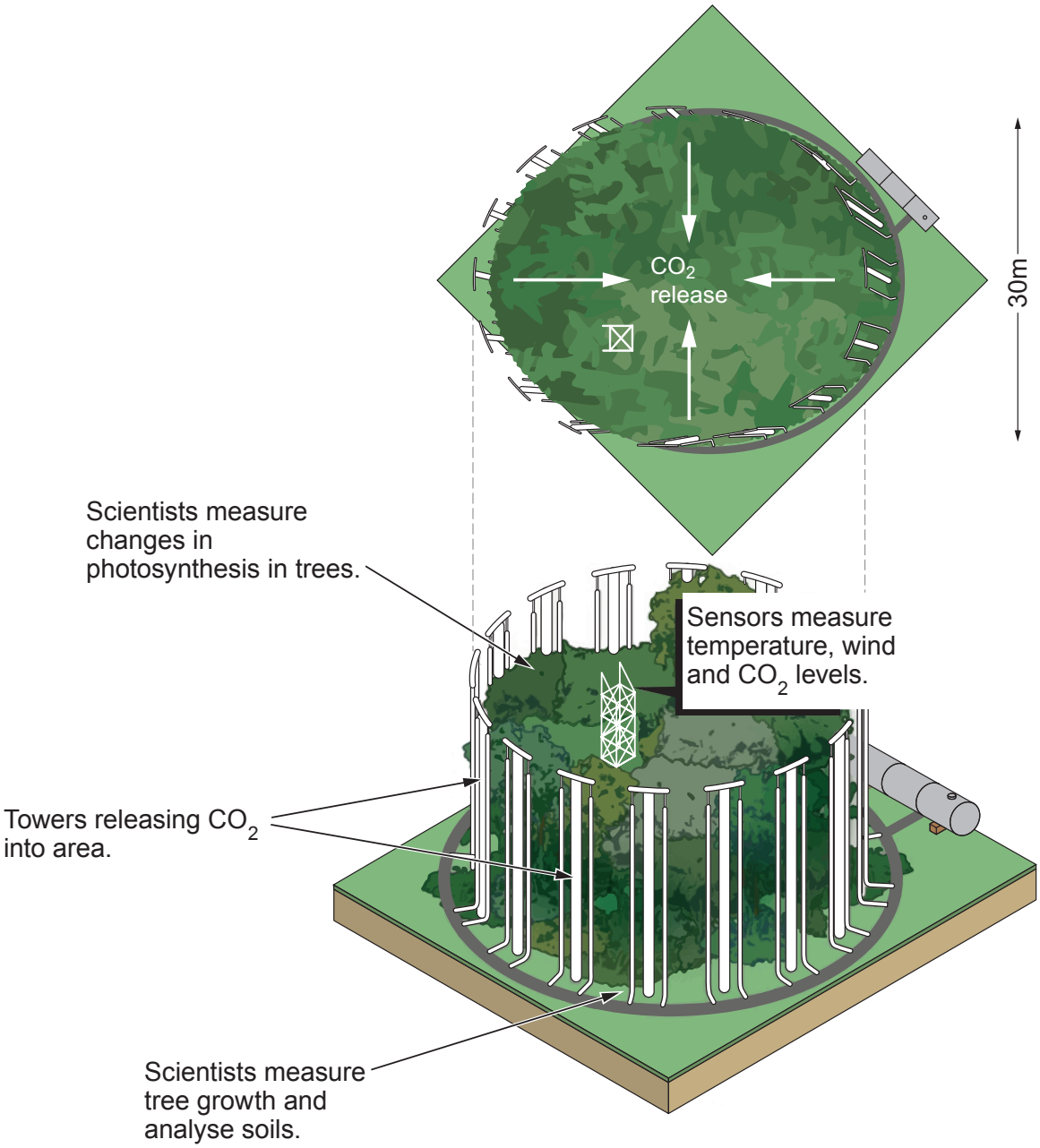
© WJEC CBAC Ltd.

9. The concentration of carbon dioxide (CO_2) in the atmosphere has risen from a mean of 315 parts per million (ppm) in 1959 to a current mean of 385 ppm. It is predicted that the concentration of CO_2 will continue to rise to between 500 and 1000 ppm by the year 2100.

Most of our current knowledge on plant responses to CO_2 concentrations in the atmosphere is based on experiments carried out in greenhouses.

Free-air carbon dioxide enrichment (FACE) experiments have been carried out around the world to study the effects of increased CO_2 levels on photosynthesis in plants outside greenhouses. This will enable scientists to make conclusions about the effect of increased concentrations of CO_2 in the future.

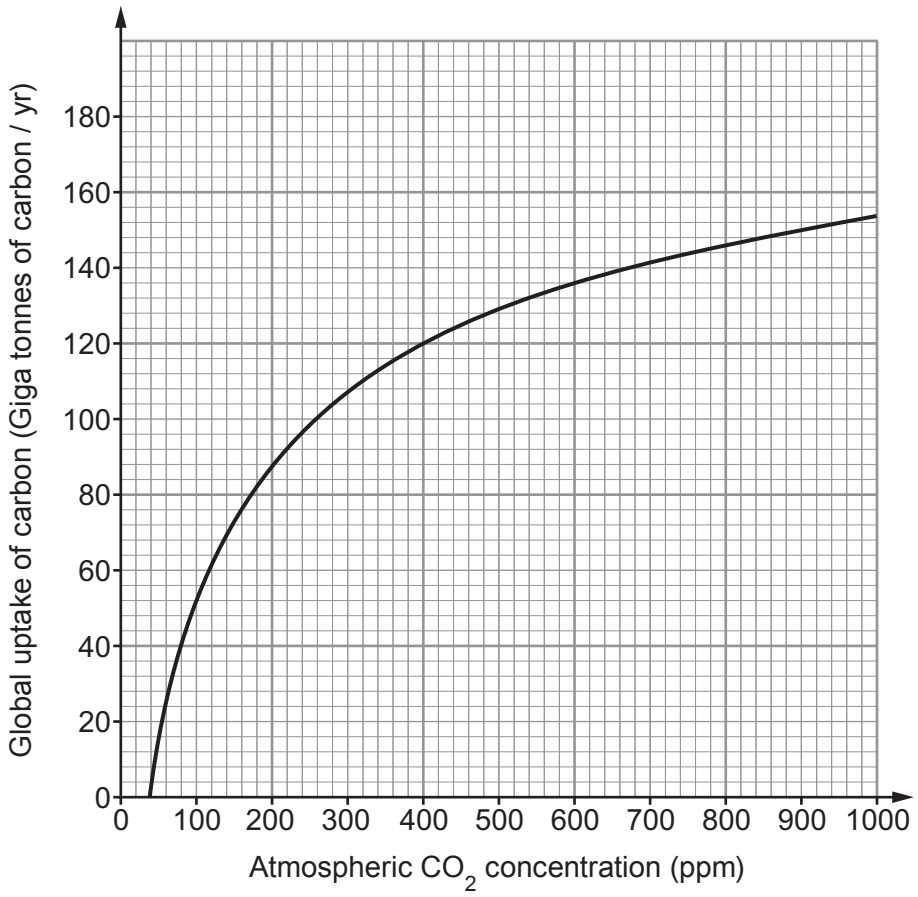
Figure 1 – Illustration of a FACE experiment – aerial view (above), side view (below)



© WJEC CBAC Ltd.

Scientists have used the results of many FACE experiments to predict the mass of CO_2 taken in by plants each year. **Graph 1** shows the effect of atmospheric CO_2 concentration on annual global uptake of carbon.

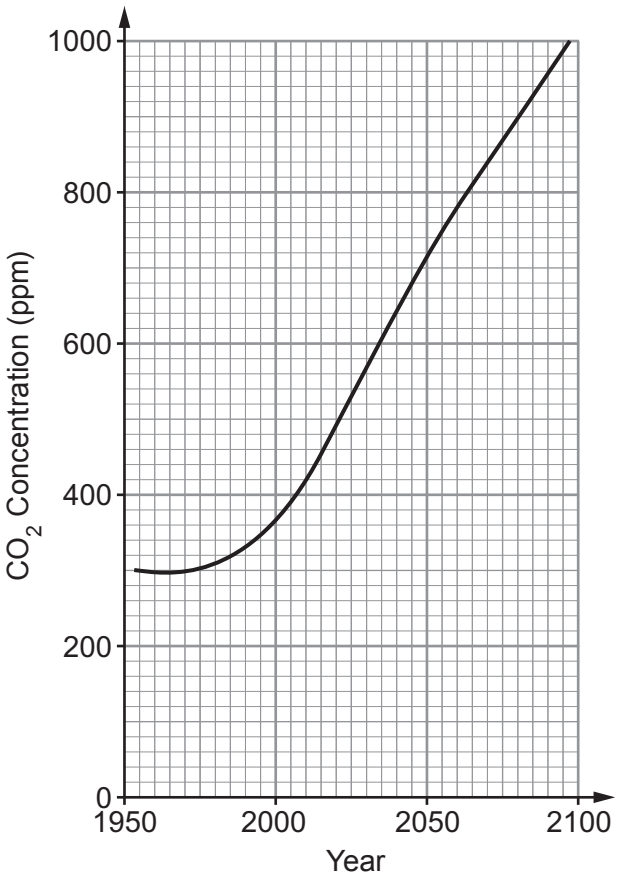
Graph 1



© WJEC CBAC Ltd.

The International Panel on Climate Change (IPCC) uses many different computer models to predict how CO_2 concentration in the atmosphere will change over time. The results of one of these models is shown in **Graph 2**.

Graph 2



© WJEC CBAC Ltd.

Examiner only

(a) (i) Write the word equation for photosynthesis. [2]

.....

(ii) State the name of **one** molecule made in plants from glucose. [1]

.....

(b) (i) Using both **Graphs 1** and **2**, estimate the predicted global uptake of carbon in 2080. [1]

.....

(ii) Suggest an explanation for the shape of **Graph 1** between 400 and 800 ppm. [1]

.....

.....

(c) (i) State how scientists increased the validity of their conclusions about the global changes to CO_2 concentrations in the atmosphere. [1]

.....

.....

(ii) Suggest why it is important that scientists use FACE experiments on plant growth to study the effects of increasing CO_2 concentrations instead of similar experiments in greenhouses. [1]

.....

.....

7

END OF PAPER

© WJEC CBAC Ltd.

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

© WJEC CBAC Ltd.