The King's School Canterbury

Sixth Form Entrance 2017

Biology

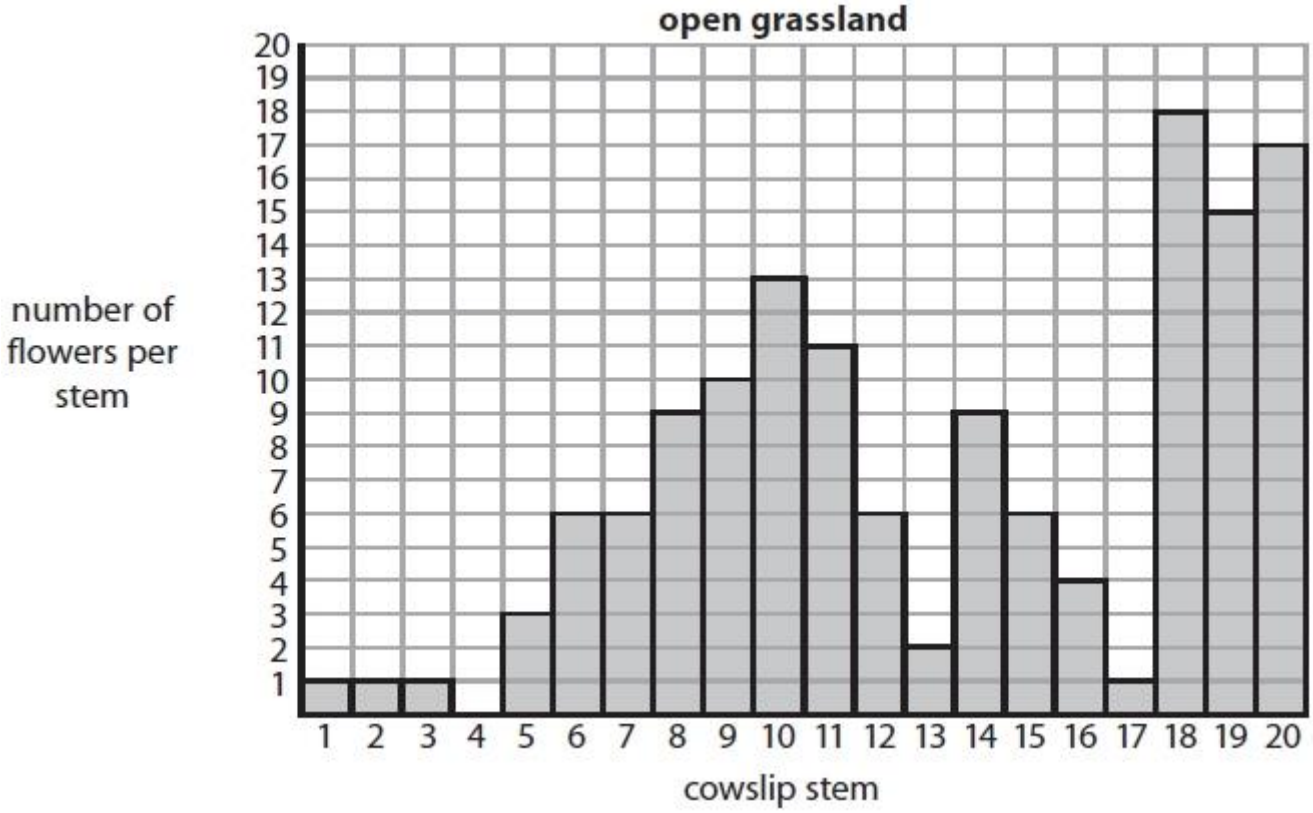
1 hour

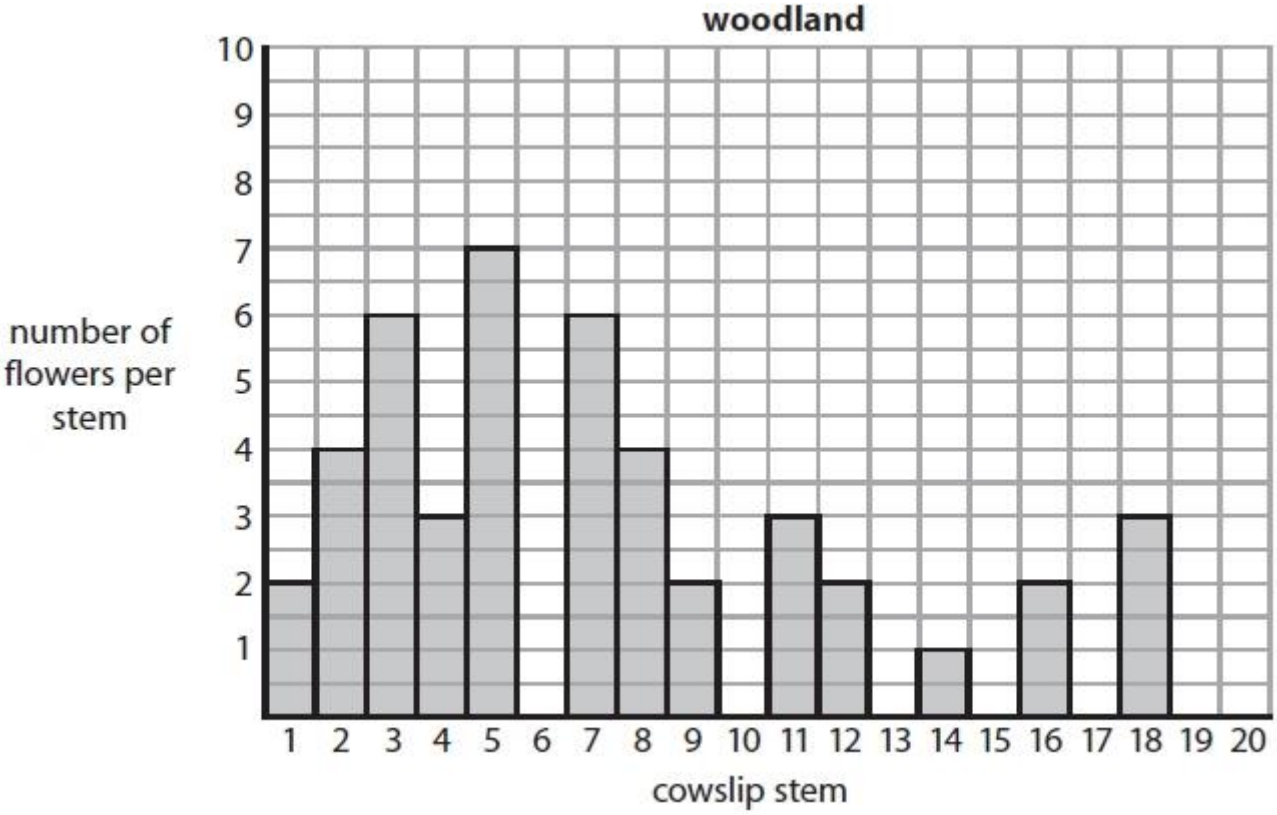
Name (Capital letters): ……

Present school: ……

1. Cowslips are flowering plants. Each cowslip stem can produce different numbers of flowers.

The graphs show the number of flowers on 20 stems of cowslip growing in open grassland and 20 stems of cowslip growing in woodland.





(a) In the open grassland, 60% of cowslips have stems with five or more flowers.

Use the information from the graph to calculate the percentage of cowslips in the woodland that have stems with five or more flowers.

(2)

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(b) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(3)

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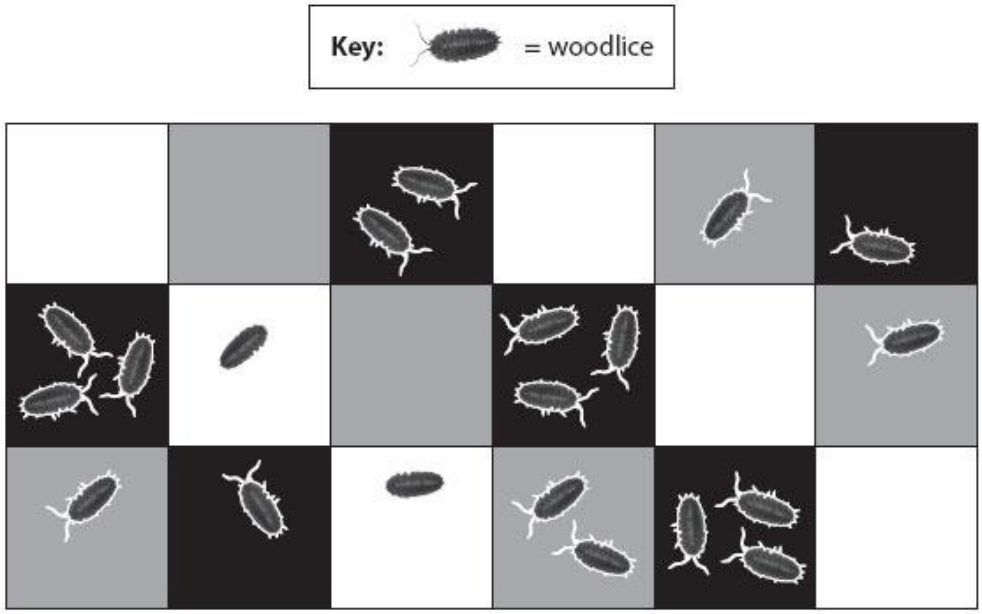
(Total for Question 1 = 5 marks)

2. Woodlice are small animals that live in and under rotting wood.

20 woodlice were taken from a pile of logs in a forest and placed in the centre of a tray. The tray had black, dark grey and white squares painted on the bottom.

The diagram shows where the woodlice were 30 minutes later.



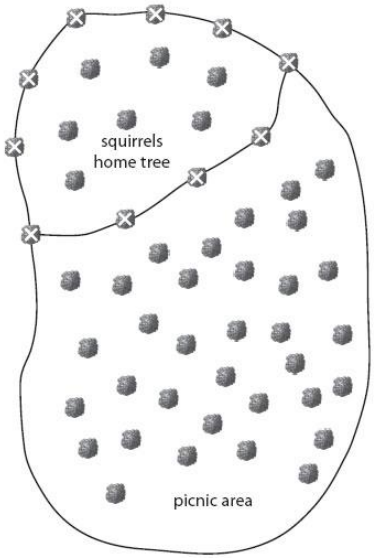
(a) Calculate the percentage of woodlice found on the black squares.

(2)

.....%

(b) A pair of squirrels in a forest were studied for four months.

The map shows part of the forest including the area where the squirrels lived.



(i) The squirrels were observed to urinate regularly on particular trees. The trees on which they urinated are marked on the map with an X.

Explain how this behaviour benefits the squirrels.

(3)

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(ii) The squirrels being studied ran away from people. Other squirrels that lived by the picnic area did not run away.

Suggest **two** reasons for this change in behaviour for the squirrels in the picnic area.

(2)

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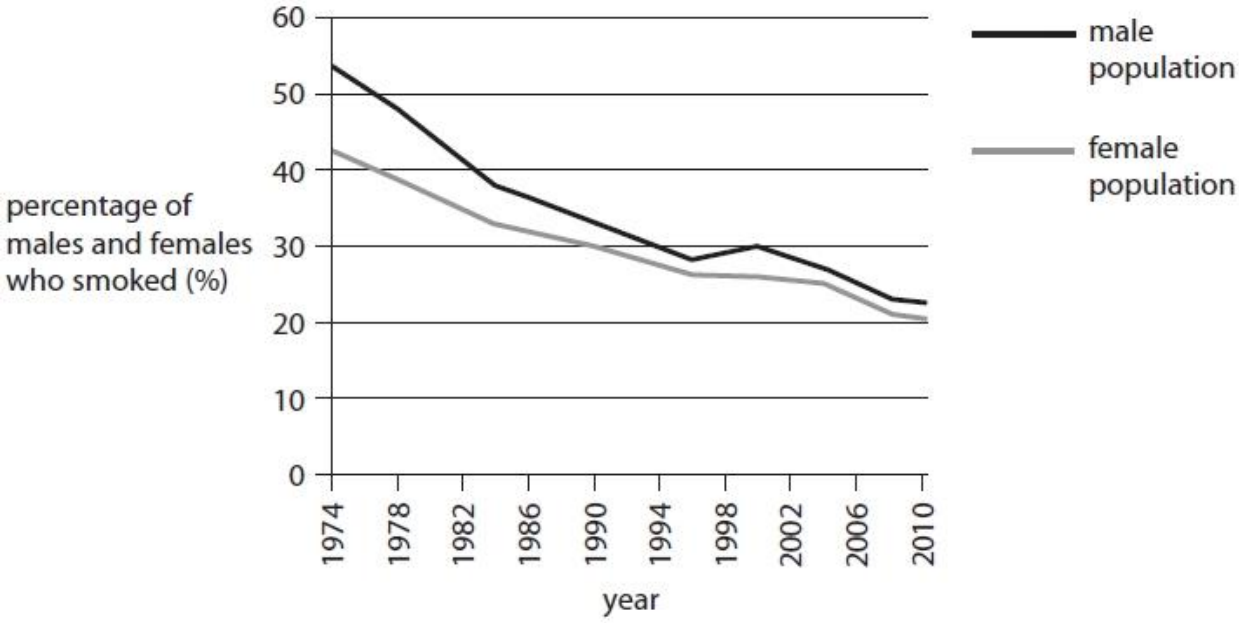
(Total for Question 2 = 7 marks)

3. The graph shows some data about smoking tobacco in the UK.



(a) Compare the percentage of males who smoked tobacco from 1990 to 2010 with the number of females who smoked during the same period.

(4)

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(b) Suggest **two** reasons why smoking tobacco has decreased in the UK.

(2)

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(Total for Question 3 = 6 marks)

4. The photograph shows a mammal called a mountain hare.

©Author: Alan Wolfe

Mountain hares eat plants.

Foxes, cats and eagles are predators that eat mountain hares.

(a) (i) Use this information to draw a food web.

(2)

(ii) Give the name used to describe animals that eat plants.

(1)

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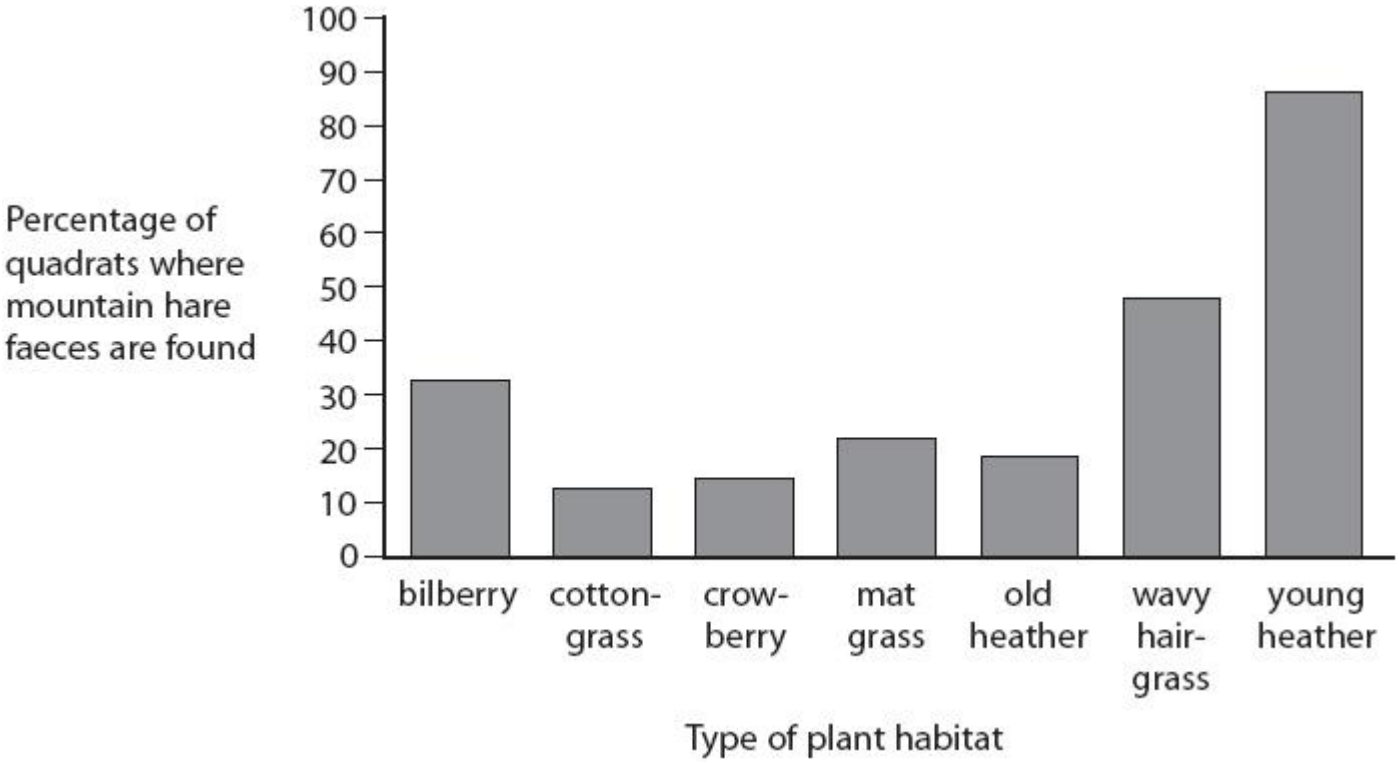
(b) Scientists want to find out which type of plant habitat mountain hares prefer.

They use quadrats to sample seven habitats.

Each habitat contains a different type of plant.

The scientists calculate the percentage of quadrats in each habitat where mountain hare faeces are found.

The graph shows the results.



(i) Name the type of plant habitat that the mountain hares like best.

(1)

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(ii) Suggest three reasons why mountain hares may prefer to eat the plants in some habitats rather than plants in other habitats.

(3)

1 .....

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2 .....

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3 .....

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(c) The scientists use 700 quadrats in one plant habitat and find that 224 quadrats contain mountain hare faeces.

(i) Calculate the percentage of quadrats containing mountain hare faeces in this habitat. Show your working.

(2)

percentage of quadrats = ... %

(ii) Name the type of plant habitat where the scientists collected these results.

(1)

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(d) The scientists use a large number of quadrats to make sure the data collected is reliable.

Describe a procedure they should follow to make sure the data collected using quadrats is valid.

(1)

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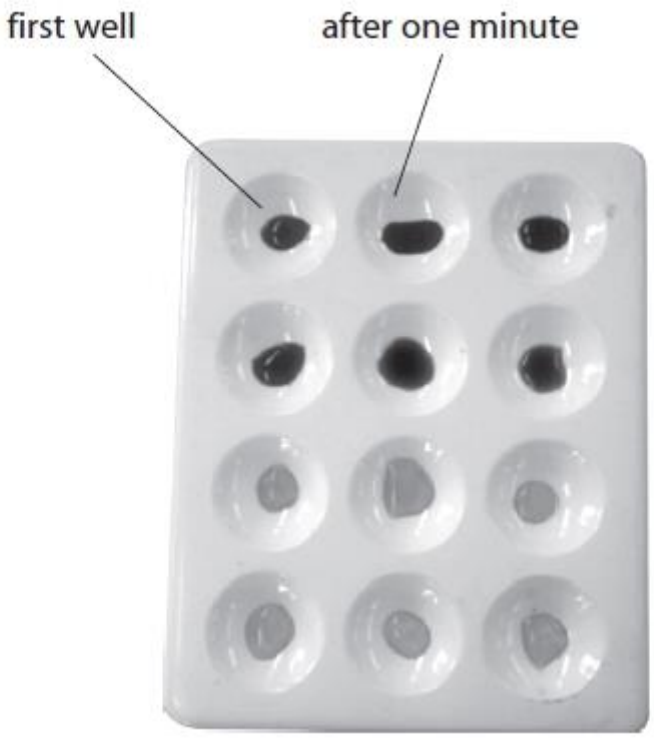
(Total for question 4 = 11 marks)

5. A student investigates the effect of temperature on the rate of starch digestion by amylase. He carries out the first trial of his investigation at a room temperature of 20°C.

He carries out the following steps in his investigation

1 He puts one drop of iodine suspension into each of 12 wells on a spotting tile.
2 He then takes up 10 cm^3 of 10% starch suspension into a syringe.
3 He adds one drop of the starch suspension from the syringe to the first well in the spotting tile and records the colour change.
4 He rinses the outside of the syringe with water from a tap.
5 He then takes up exactly 5 cm^3 of 5% amylase suspension into the same syringe containing the 10% starch suspension.
6 He starts a stopwatch.
7 He then rocks the syringe containing the mixture gently backwards and forwards for one minute.
8 He adds one drop of the mixture from the syringe to the next well in the spotting tile and records the colour change.
9 He repeats this at intervals of one minute until he has added starch and amylase mixture to all of the wells.
10 He then repeats steps 1–9 but this time he uses iodine, amylase and starch suspension that have been stored in a water bath at 40°C.
11 He also keeps the syringe containing the mixture in the water bath at 40°C between drops.

The photograph shows his results for 20°C at the end of the experiment when all the wells have mixture added.



(a) (i) Give one safety precaution the student should take when carrying out this investigation.

(1)

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(ii) How many minutes do the samples of mixture added to the spotting tile in the photograph represent?

(1)

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(b) Explain the purpose of the following steps in the student's experiment.

(i) step 4

(1)

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(ii) step 7

(1)

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(iii) step 11

(1)

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(c) (i) Identify two variables that the student controls in his experiment.

(2)

1 .....

2 .....

(ii) Name the independent variable that the student is investigating.

(1)

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(d) Using the photograph, explain how many minutes it took for the reaction to be completed at 20°C.

(3)

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(e) The results for the spotting tile at 40°C would be different from the trial carried out at 20°C.

(i) Describe how the appearance of the results will be different.

(2)

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(ii) Explain the difference in the appearance of the results.

(2)

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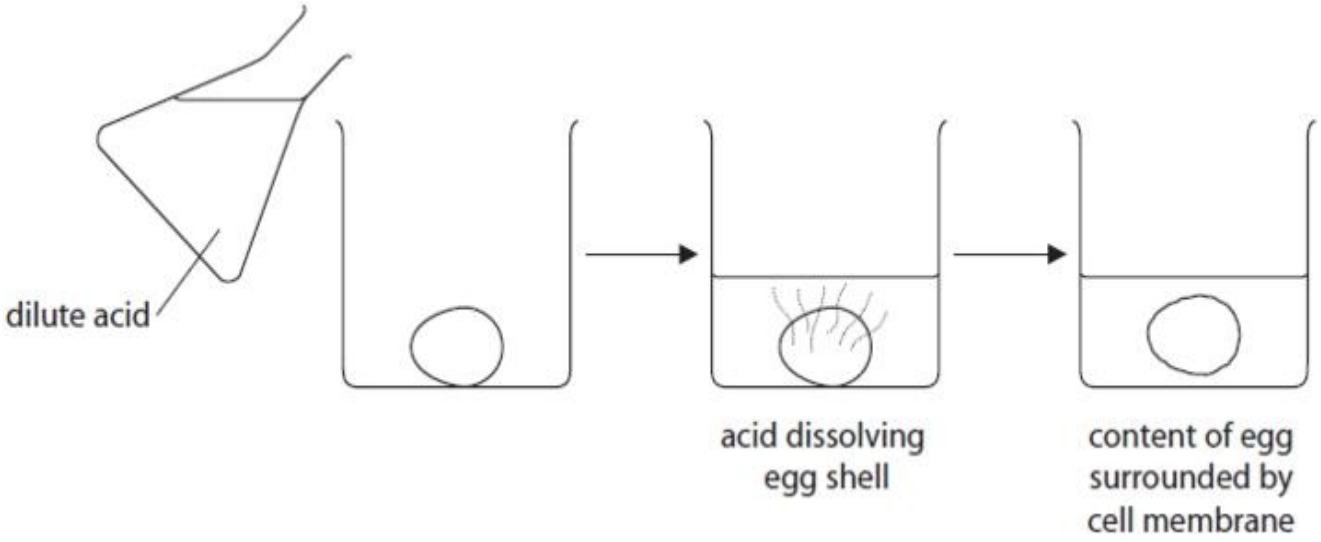
(Total for question 5 = 15 marks)

6. A chicken egg is a single cell protected by a shell on the outside.

A student puts three chicken eggs into dilute acid and leaves them for three days.

The acid dissolves the egg shells, leaving the contents of the eggs surrounded by the cell membrane.

The diagram shows the student's method.

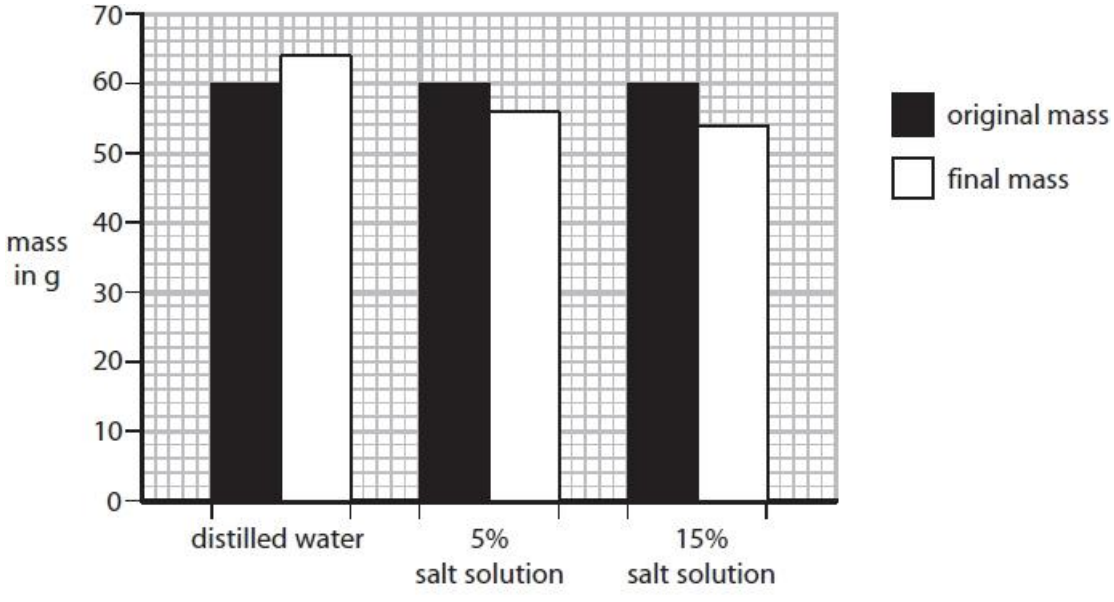


The student removes the eggs from the dilute acid and uses water to wash the surface acid away.

The student then uses the eggs for this osmosis experiment.

- he measures the mass of each egg
- he then puts one egg into a beaker containing distilled water
- he puts another egg into a beaker containing 5% salt solution
- he puts a third egg into a beaker containing 15% salt solution
- after 15 minutes he removes each egg from its beaker and measures its mass again

(a) The bar graph shows the results obtained by the student from the osmosis experiment.



Bar graph 1

(i) Name the dependent variable in this experiment.

(1)

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(ii) Explain the result for the egg placed in distilled water.

(2)

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(b) The student calculates the percentage change in mass for the eggs placed in distilled water and in 5% salt solution.

(i) Use the data from graph 1 to calculate the percentage change in mass for the egg placed in 15% salt solution. Show your working.

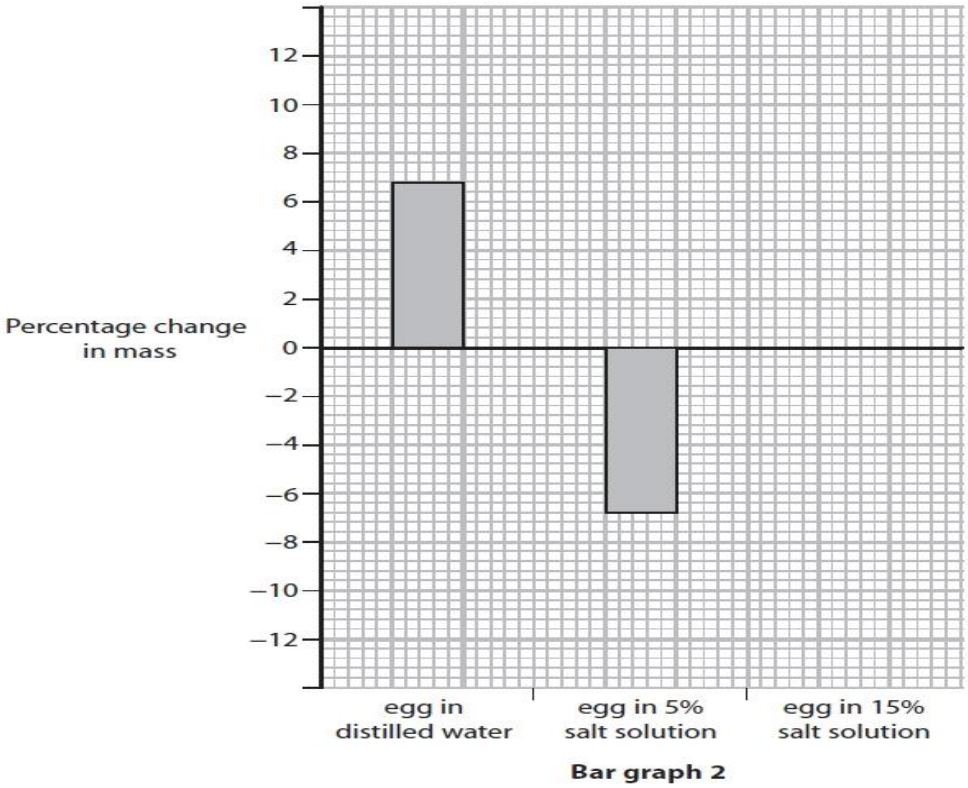
(2)

Percentage change in mass = ... %

(ii) The student plots the percentage change in mass on graph 2.

Complete the bar graph to show the percentage change in mass for the egg placed in 15% salt solution.

(1)



Bar graph 2

(c) Give one way in which osmosis differs from diffusion.

(1)

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(Total for question 6 = 7 marks)

7. Global warming may affect the number of insect pests by increasing their ability to produce offspring.

An experiment was carried out to find out the effect of different air temperatures on the ability of insects to produce offspring.

Five tubes were set up at an air temperature of 16 °C. Each tube contained a male and a female insect and some food. This procedure was repeated at air temperatures of 25 °C, 30 °C, 35 °C and 45 °C.

The insects were allowed to mate and the number of offspring they produced after two weeks was counted.

The table shows the results.

Temperature in °C	Number of offspring in each tube					Total number of offspring
	Tube 1	Tube 2	Tube 3	Tube 4	Tube 5	
16	14	17	14	15	12	72
25	88	92	95	100	87	462
30	39	36	90	40	36	241
35	19	17	15	22	16	89
45	0	0	0	0	0	0

(a) Identify the anomalous result in the table and suggest a reason for the anomaly.

(2)

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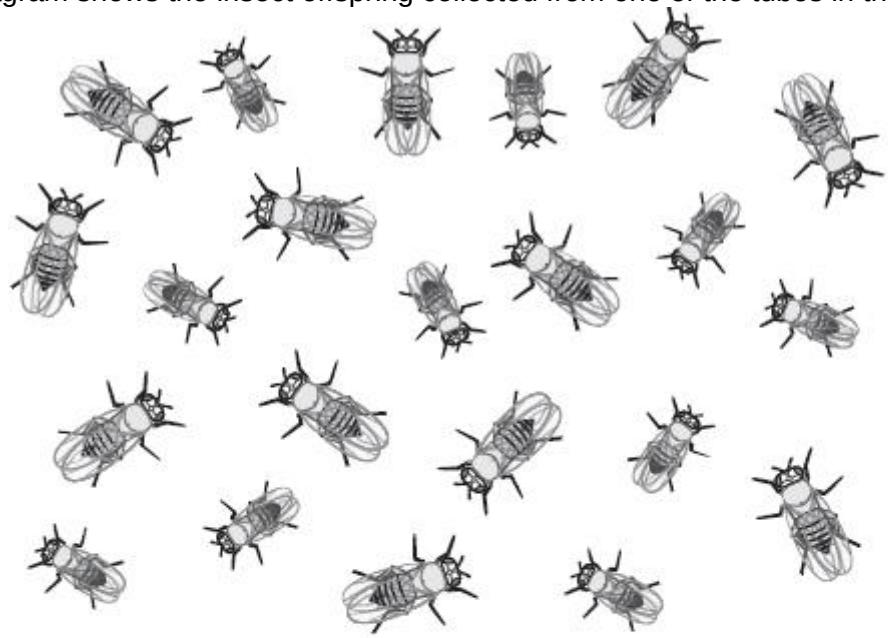
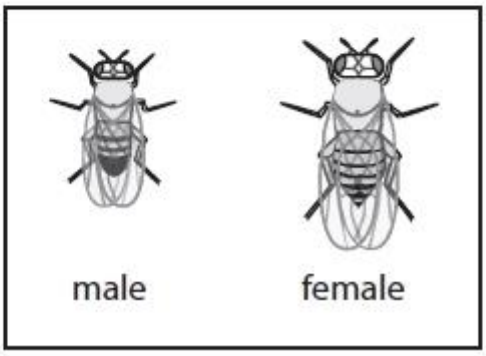
(b) The diagram shows the insect offspring collected from one of the tubes in the experiment.





(i) Use the key to count the number of male and female offspring in this tube.

(1)

number of males .....

number of females .....

(ii) Which tube did these insect offspring come from?

(1)

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(c) Explain why the results in the table are reliable.

(2)

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(d) Describe the results in the table and write a conclusion for this experiment.

(3)

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(Total for question 7 = 9 marks)

The King's School Canterbury

Sixth Form Entrance 2015

BIOLOGY

1 hour

Name: .....

Present School: .....

Mark	Processed mark	Grade

1. Biotechnology is a branch of science in which microorganisms and biomolecules are used by humans.

(a) Give the name of a type of microorganism.

(1)

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(b) Describe what is meant by the term **microorganism**.

(1)

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(c) Suggest **two** ways in which humans use microorganisms.

(2)

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Biomolecules could include lipase, which breaks down fat, and an enzyme that converts glucose to fructose.

(d) (i) Suggest **two** ways in which humans could use lipase.

(2)

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(d) (ii) Frutose is sweeter than glucose. Suggest **two** reasons why humans may want to use fructose rather than glucose.

(2)

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(Total for Question 1 = 8 marks)

2. Some rice farmers use ducks in the rice fields as shown in the photograph.

The ducks help the rice plants to grow because they eat insects and weeds in the rice fields.

(a) (i) Suggest how the ducks eating the insects helps the rice plants to grow.

(1)

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(a)(ii) Explain how the ducks eating weeds helps rice plants to grow.

(2)

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(b) Explain why faeces from the ducks helps rice plants to grow.

(2)

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(c) The ducks stir up the soil in the rice field with their feet, which increases the oxygen content of the soil.

Suggest how increasing the oxygen content of the soil helps rice plants to grow.

(2)

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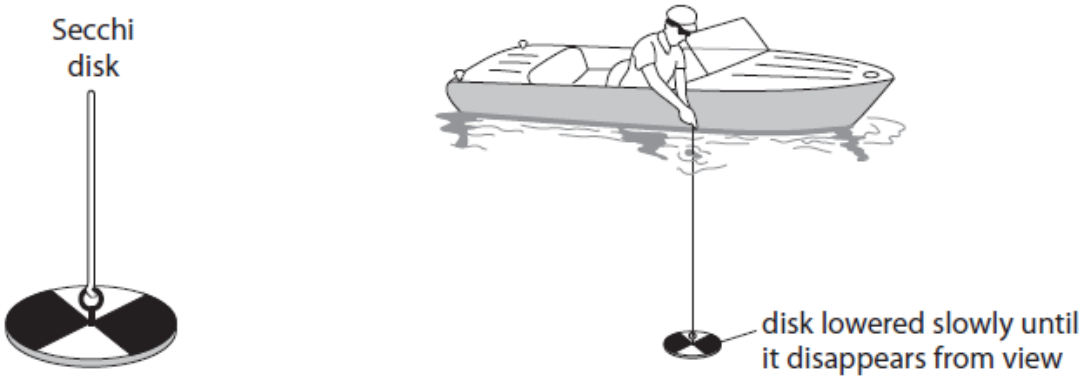
(Total for Question 2 = 7 marks)

3. Water in lakes can become polluted if too much phosphate is leached from the soil. The polluted water becomes very cloudy because of the growth of lots of microscopic plants called algae.

It is possible to find out how polluted water is by using a black and white disk called a Secchi disk. The following technique is used.

- the disk is lowered into the water using a rope
- the disk is lowered into the water until it can no longer be seen
- the depth when the disk is no longer seen is measured

The diagrams show a Secchi disk and the way in which it is used.



Scientists used Secchi disks to test the pollution level of four lakes.

The table shows the results.

Lake	Depth at which Secchi disk can no longer be seen in metres
A	7.0
B	3.9
C	3.3
D	4.4

(a) They concluded that lake C was the most polluted with phosphate.

Suggest **two** reasons why this conclusion may **not** be correct.

(2)

1. .....

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2. .....

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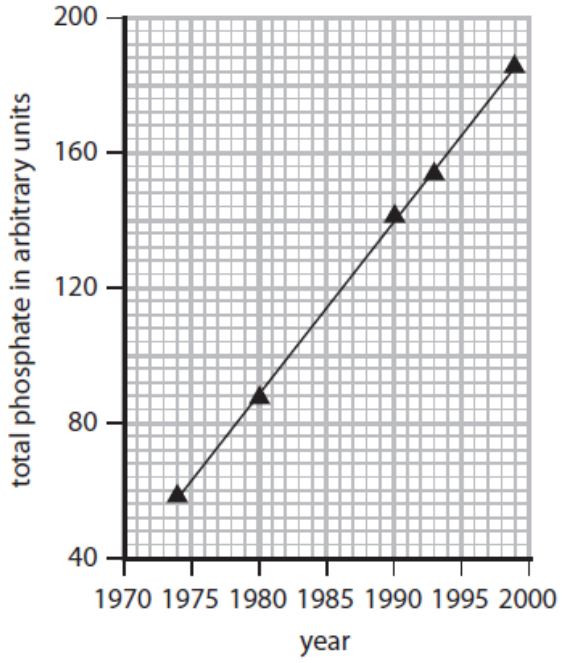
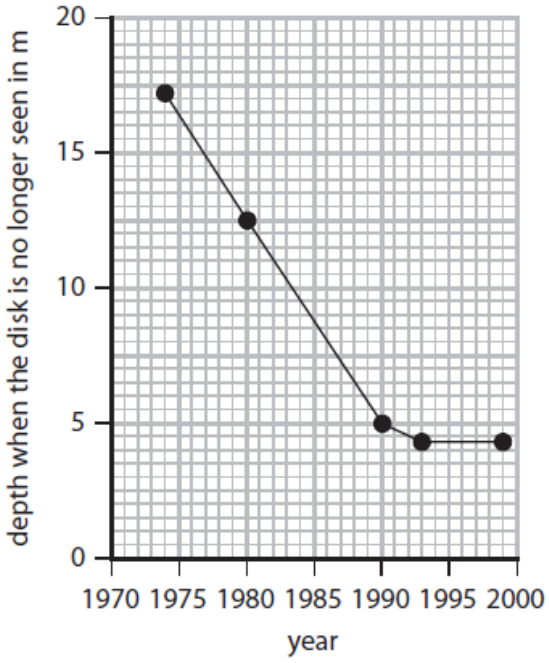
(b) The graph shows changes in the level of phosphate and Secchi depth measurements, for one of the lakes over a 25-year period.





Using both graphs, describe the relationship between phosphate levels and Secchi depth.

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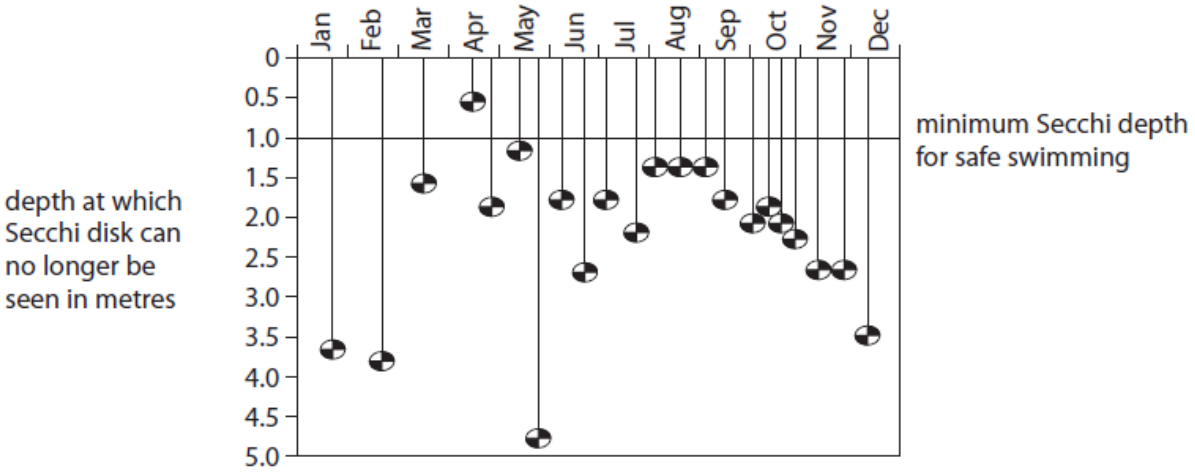
(c) Seawater is sometimes polluted by raw sewage. This water also becomes cloudy and is not safe for humans to swim in.

A scientist used Secchi disks to measure pollution in seawater at a beach during a year.

The graph shows the depth at which he could no longer see the Secchi disk.



(i) How many times during the year was the Secchi disk used to measure pollution?

(1)

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(ii) In which month were most depth measurements taken?

(1)

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(d) Water may not be safe for swimming in at this beach.

The scientist concluded that the only month when the water was not safe for swimming was April.

(i) Give a reason to support this conclusion.

(1)

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(ii) Suggest a reason to reject this conclusion.

(1)

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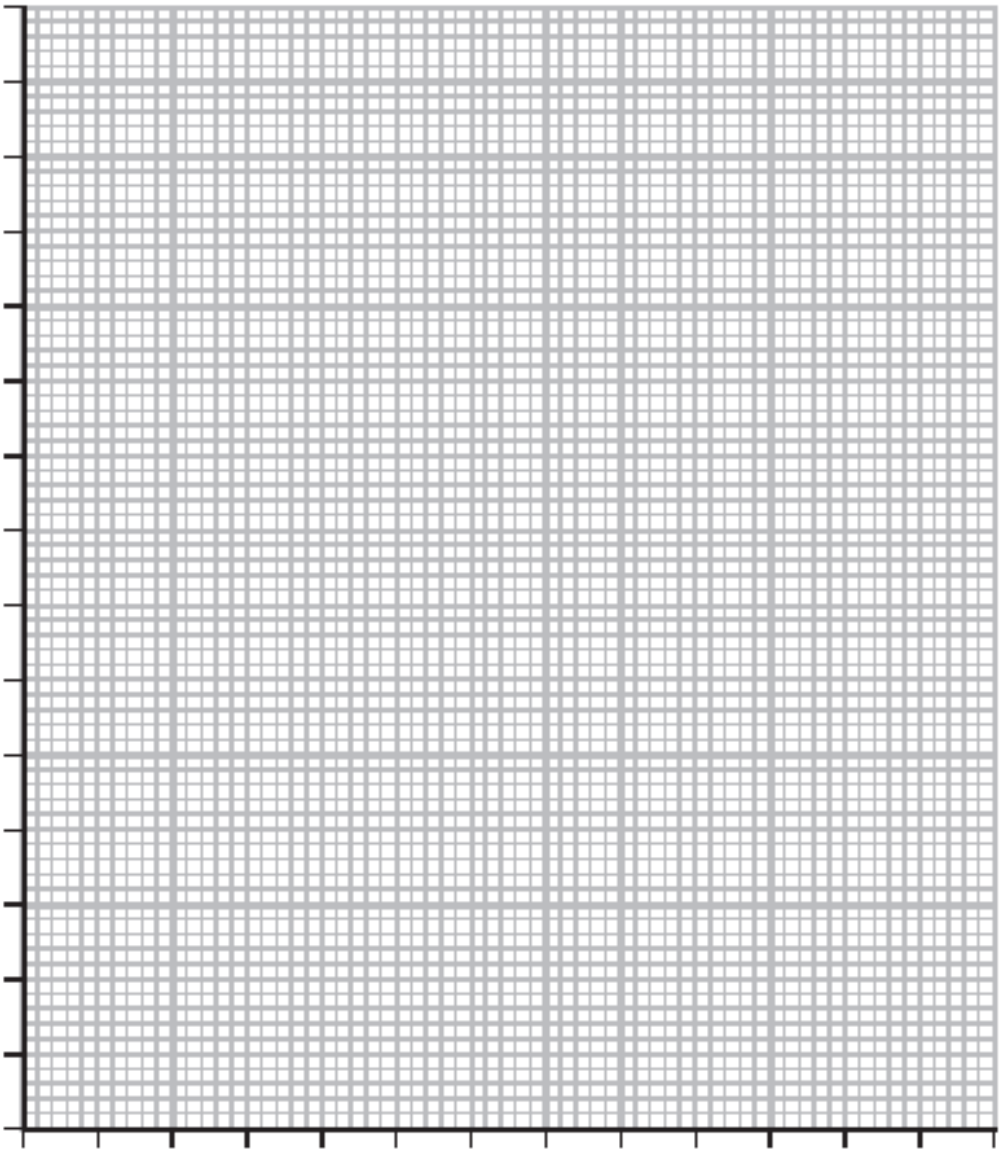
(Total for Question 3 = 8 marks)

4. The data shows the number of heart attacks in men and women of different ages from 1969 to 1998 in one area in England.

Year	**Number of heart attacks per 100 000 people**	
	Men aged 40–44	**Women aged 40–44**
1969–73	125	13
1974–78	135	15
1979–83	116	11
1984–88	86	6
1989–93	68	9
1994–98	48	9

(a) Plot a bar graph to show the data in the table.

(6)



(b) Describe how the data differs for men and women.

(2)

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(c) Give an explanation for the change in the number of heart attacks from 1969 to 1998.

(1)

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(d) Suggest why reducing the blood supply to the heart muscle cells can cause a heart attack.

(3)

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(Total for Question 4 = 12 marks)

5. Farmers in Asia add fertiliser to their crops to increase the yield.

Fertilisers usually contain nitrate, phosphate and potassium.

The table shows the farmers' crop yield when the crops are given a fertiliser lacking one of these three minerals.

A figure of 100% is the maximum yield with all three minerals given.

Crop	Yield (%)			
	No nitrate	**No phosphate**	**No potassium**	**All three minerals added**
lowland rice	**73**	**97**	**99**	**100**
barley	**52**	**66**	**72**	**100**
rye	**44**	**70**	**68**	**100**
wheat	**46**	**69**	**72**	**100**
upland rice	**46**	**66**	**90**	**100**
potato	**47**	**47**	**70**	**100**

(a) (i) State the mineral that has the greatest effect on crop yield.

(1)

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(ii) Explain why this mineral has the greatest effect on crop yield.

(2)

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(b) Which crop is most affected by the lack of potassium?

(1)

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(c) Suggest why the minerals had different effects on lowland rice and upland rice.

(1)

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(d) The yield is the mass of the useable part of the crop and is measured in kg per m^2.

The yield is often measured in dry mass rather than fresh mass.

(i) Suggest why dry mass is used.

(1)

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(ii) Suggest how the dry mass of 10 kg of fresh potato tubers could be determined.

(2)

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(e) The table gives data as a percentage of the yield with all minerals present.
Explain why a percentage is used rather than changes in kg per m^2.

(2)

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(f) A farmer grew another crop with all three minerals added. The maximum yield obtained was 12 kg per m^2. He grew the same crop with no nitrate and the yield was 5 kg per m^2.

Calculate the percentage of the maximum yield when the crop was grown with no nitrate.

Show your working.

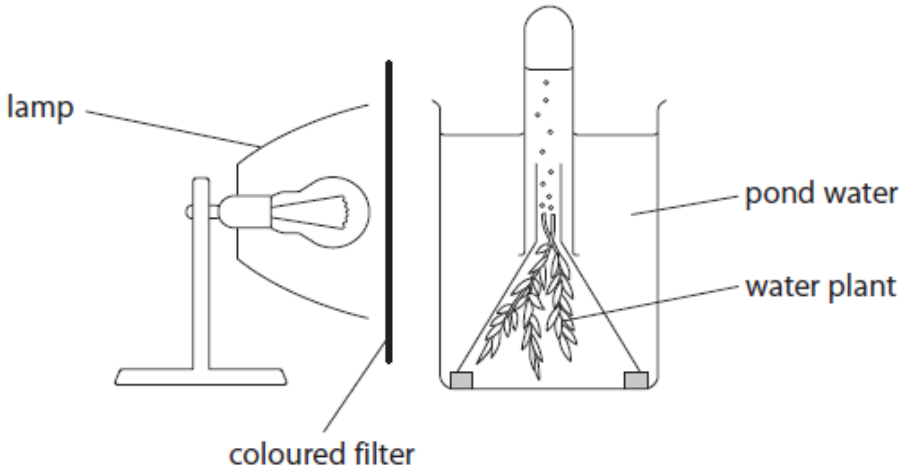
(2)

Answer ..... %

(Total for Question 5 = 12 marks)

6. A student carries out an experiment to investigate the effect of changing the colour of light on the rate of photosynthesis in a water plant.

She sets up the apparatus shown.



(a) (i) Name the gas given off during photosynthesis.

(1)

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(ii) Explain how the student should control two variables in her investigation.

1. .....

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2. .....

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(b) The table shows the results the student obtained from her investigation.

Colour of light	**Number of gas bubbles released in one minute**			
	trial 1	**trial 2**	**trial 3**	**average**
Red	23	26	25	
Blue	19	18	21	19
Green	12	16	6	14

(i) Complete the table by calculating the average rate of photosynthesis for red light.

(1)

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(ii) Explain whether the results for each colour are reliable.

(2)

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(c) Suggest why there is a difference in the average rate of photosynthesis between blue light and green light.

(2)

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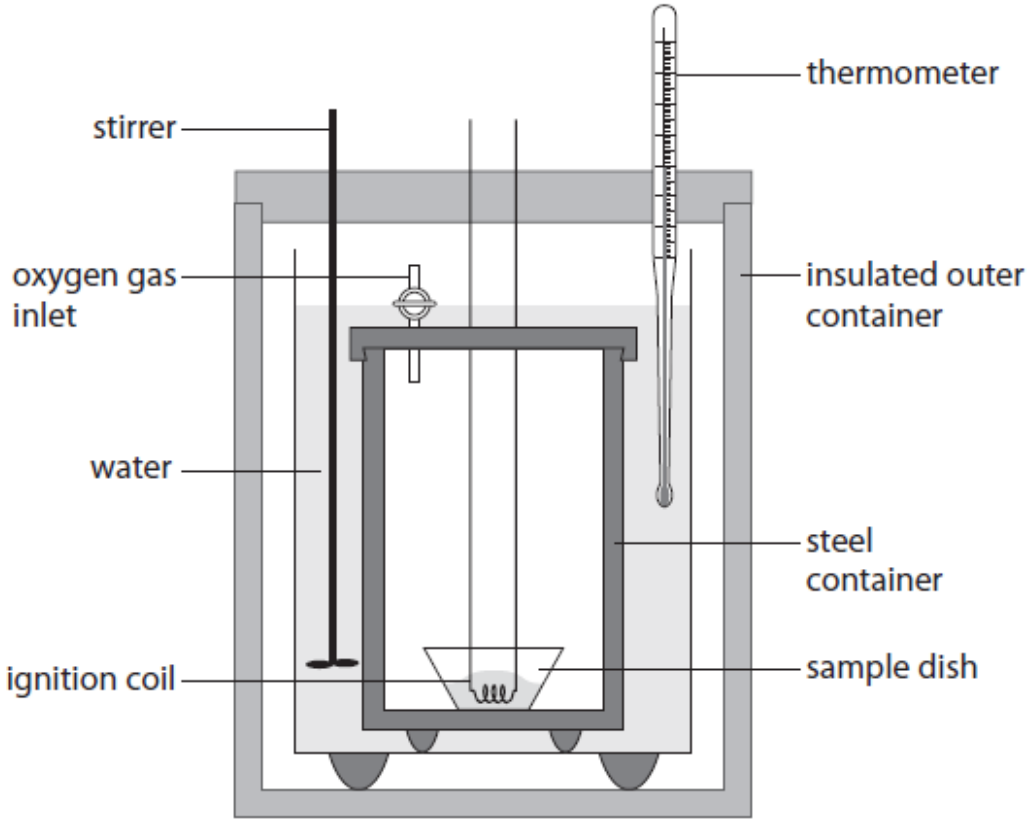
(Total for Question 6 = 6 marks)

7. A calorimeter is a piece of apparatus used to calculate the energy content of a food sample.

The diagram shows a calorimeter.



Food is placed in the dish and burnt in air with high levels of oxygen.
The temperature rise of the water is measured using the thermometer.
The energy content of the food is measured in joules per gram of food.

(a) (i) The oxygen gas inlet allows the food to burn in air with high levels of oxygen.

Suggest why this gives a more accurate value of the energy content than burning food in normal air.

(1)

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(ii) Suggest why the calorimeter has an insulated outer container.

(2)

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(b) Table 1 shows the mass of fat in five different types of food. The mass is measured in grams of fat per 100 grams of each food.

Type of food	**Mass of fat in grams per 100 grams**
A	0.1
B	2.5
C	7.4
D	27.2
E	30.9

Table 1

A student measures the energy content of the five different foods.

Table 2 shows her results.

Reading	**Energy content of food in joules per gram**				
	food A	**food B**	**food C**	**food D**	**food E**
1	227	1717	5325	7567	11 200
2 272	272	1960	4400	6650	10 300
3 280	280	1570	3696	5680	12 205
Mean	260	1749	4474	6632	11 235

Table 2

The student wrote three conclusions in her notebook.

(i) The student is wrong to believe that 'the energy in food is all contained in fat'.
Name two other large insoluble molecules in food that contain energy.

(2)

1. .....

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2. .....

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(ii) Explain whether the student's results support her conclusion that food with more fat contains more energy.

(1)

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(iii) The student states that her results are reliable because she did not get an anomaly.
What is meant by the term **anomaly**?

(1)

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(Total for Question 8 = 7 marks)

THE KING'S SCHOOL, CANTERBURY

SIXTH FORM ENTRANCE EXAMINATION

2014-2015

BIOLOGY

1 Hour

Name (Capital Letters): .....

Present School: …….

Answer ALL the questions

TOTAL MARK = 60

If you know the name of the examination board and the title of the biology course you are currently studying e.g. AQA Biology, Edexcel, OCR Gateway or 21st Century Science, IGCSE write it below. Indicate if you are doing Triple Science (i.e. you will get separate grades in Biology, Chemistry and Physics) or Double Science.

Board_____ Course_____ Triple/Double _____

1. Organisms are adapted to maximize their survival chances.

(a) Describe and explain two adaptations of a flower to maximize its chances of pollination by an insect.

(4)

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(b) The arctic fox is a warm-blooded animal with a thick fur coat that lives in very cold conditions, as shown in the photograph below.

(i) Suggest why arctic foxes have short legs and short ears.

(2)

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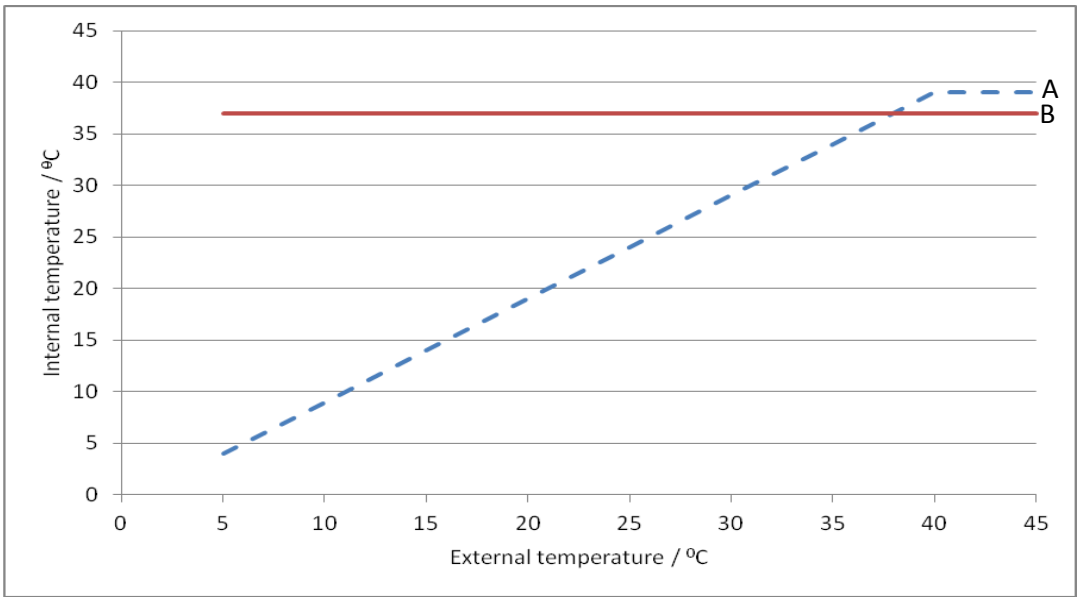
The graph below shows the effect of varying external temperature on the internal body temperature of two different organisms, A and B.



(ii) Suggest which of the two organisms, A and B, would be the arctic fox. Give a reason for your answer.

(2)

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(iii) Compare the effect of varying external temperature on the internal body temperature of organism A with organism B.

(3)

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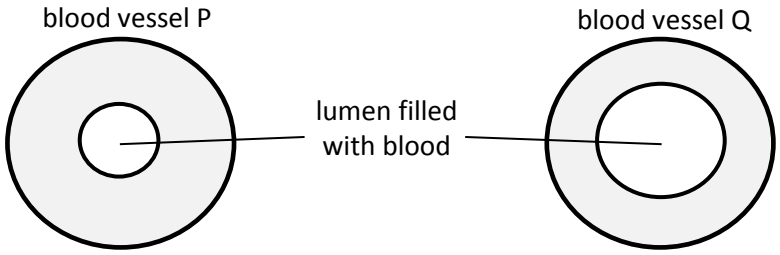
(Total for Question 1 = 11 marks)

2. The circulatory system is one of several organ systems found in animals.

(a) The diagram below shows two blood vessels P and Q.



(i) Which of these two blood vessels carries blood at the higher pressure. Give a reason for your answer.

(2)

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(b) A pulse was recorded in one of these blood vessels.

(i) Place a tick (✓) in the box that correctly completes the sentence.

This blood vessel with the pulse was

(1)

☐ an artery

☐ a vein

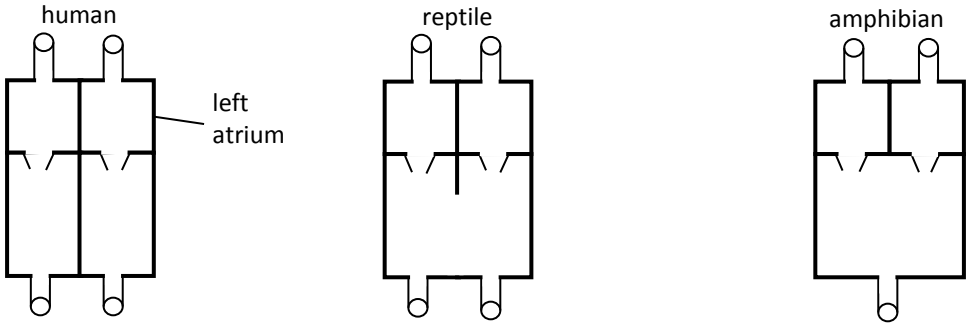
☐ a capillary

(ii) The pulse rate in the blood vessel was recorded as 90 per minute when the organism, was at rest. If the rate doubled during exercise, how long would each pulse last? Show your working.

(1)

Answer: …… seconds

(c) The diagram below shows a human heart, a reptile heart and an amphibian heart.



(i) Suggest why the human heart is considered more efficient than the reptile heart.

(3)

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(ii) Suggest why the two atria of the amphibian heart should contract alternatively rather than together.

(1)

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(iii) State why the atrium labelled on the human heart is described as the left atrium.

(2)

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(iv) Explain why this atrium should contract before the left ventricle?

(1)

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(d) The human heart can partially refill as it relaxes after contraction. Suggest an explanation for how the relaxing heart causes partial refill with blood.

(3)

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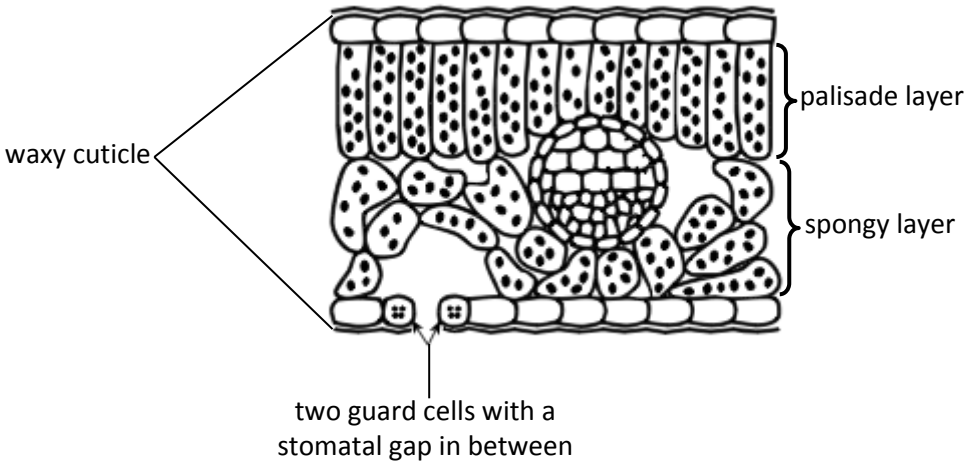
(Total for Question 2 = 14 marks)

3. (a) The diagram below shows a section through a leaf.



(i) The palisade layer contains cells with many chloroplasts. The spongy layer contains cells with a few chloroplasts. Suggest two reasons why cells in the spongy layer contain chloroplasts.

(2)

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(ii) Suggest why each of the following plants has a thick waxy cuticle.

(3)

A cactus in the desert: ……

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A tropical rainforest plant: ……

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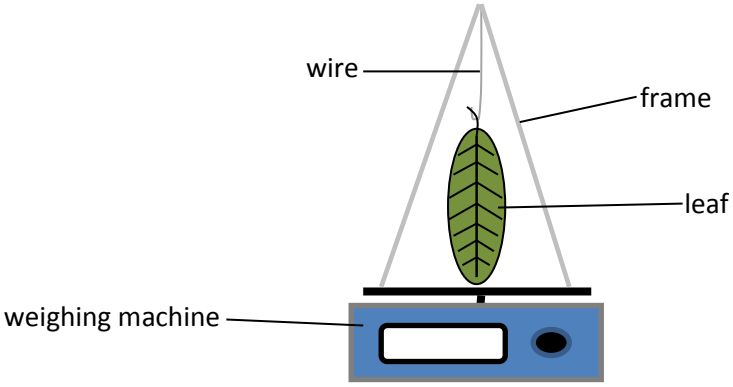
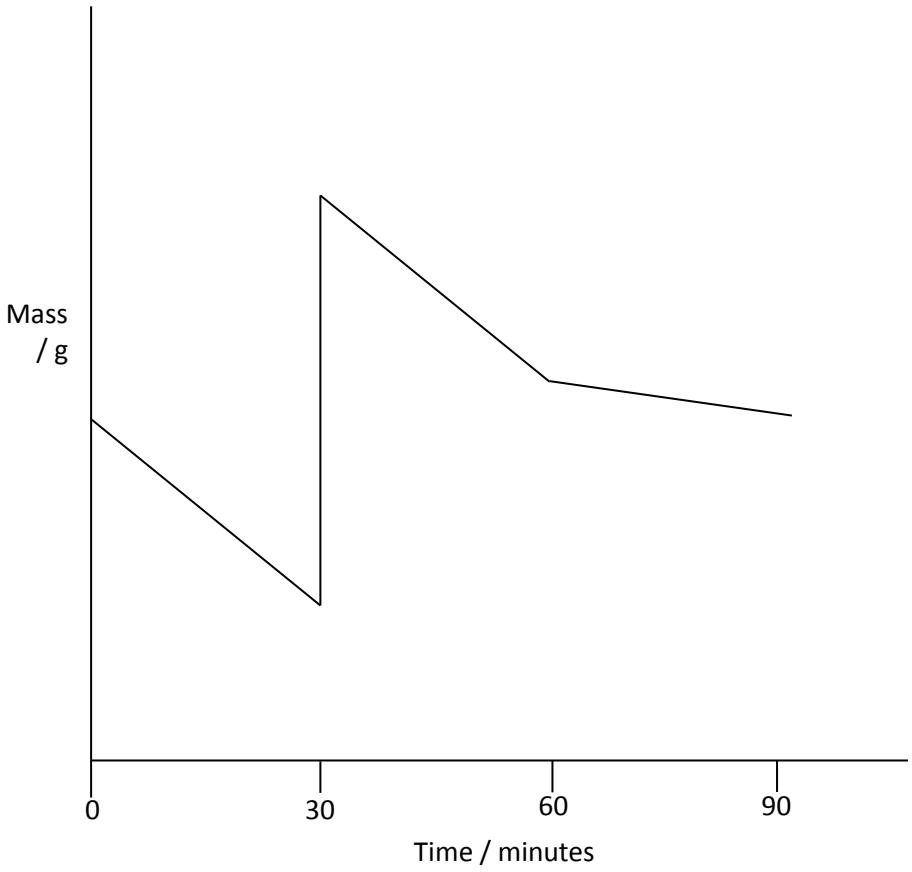
(b) The diagram below shows the arrangement of apparatus used by a student.



The weighing machine constantly recorded the mass of the apparatus on it.

After 30 minutes, petroleum jelly (Vaseline) was spread over the upper surface of the leaf and the apparatus left for a further 60 minutes.

The results are shown in the graph below.



(i) State the dependent variable in this investigation.

(1)

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(ii) Using your own knowledge and the diagram of the leaf section, suggest why the mass dropped between 0 and 30 minutes.

(2)

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(iii) The student noted that after 60 minutes, the light intensity decreased due to the sun going behind a cloud. Suggest two reasons why this caused the loss of mass to decrease.

(2)

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(c) (i) On the graph (previous page), draw the likely result for this investigation if the petroleum jelly had been spread on the lower surface of the leaf rather than the upper surface.

(3)

(ii) Explain your answer to part (i) below.

(2)

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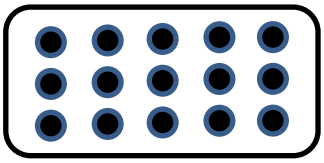
(Total for Question 3 = 15 marks)

4. A student investigated the breakdown of starch by the enzyme found in human saliva called amylase. She investigated it in three different conditions as shown in the table below.

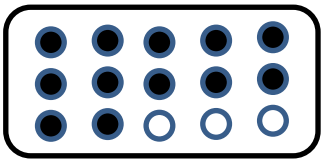
Test tube	Mixture in test tube	Temperature / ^{0}C
1	Starch only	20
2	Starch and amylase	20
3	Starch and amylase	35

Every minute, the student removed a drop of the mixture from test tube 1 and added it to iodine solution on a spotting tile, starting at the top left. She repeated this for test tubes 2 and 3.

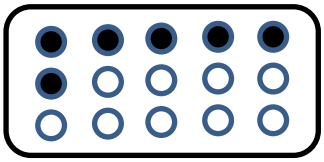
The results are shown in in the diagrams below:



Test tube 1



Test tube 2



Test tube 3

(a) State the effect of amylase on starch. Give evidence for your answer.

(3)

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(b) What do the results suggest about the effect of temperature on the activity of amylase?

(1)

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(c) State the name given to test tube 1 and describe its function

(2)

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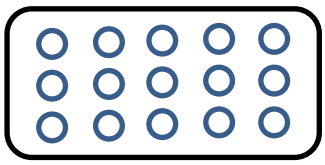
(d) A fourth test tube was set-up with a mixture of starch and amylase but the temperature was 70^0C.

(i) Complete the diagram below to show the results.

(1)



(ii) Explain your answer to part (i).

(2)

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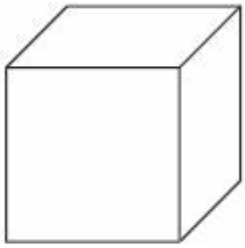
(Total for Question 4 = 9 marks)

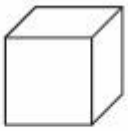
5. A student investigated the effect of size on the movement of molecules.

He cut three different sized cubes from a block of clear agar jelly.

Cube A was 2 × 2 × 2 cm. Cube B was 1 × 1 × 1 cm and cube C was 0.5 × 0.5 × 0.5 cm.



cube A



cube B

cube C

The student wore safety glasses and placed the cubes in a beaker of red dye solution for five minutes.

He then poured the solution into another beaker, washed the surface of the cubes and dried them with blotting paper.

He then cut each cube in half and examined the newly cut surfaces.

Diagram 1 shows what the cubes looked like.

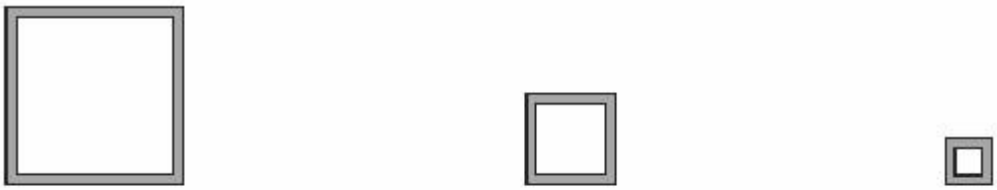


Diagram 1

(a) Why did he wear safety glasses?

(1)

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(b) Explain how the red dye molecules entered the jelly.

(2)

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(c) Use a ruler to measure the distance the red dye has entered each cube in diagram 1.

(1)

…… mm

(d) (i) Calculate the surface area of cube A.

(2)

surface area = …… unit ……

(ii) Calculate the volume of cube A.

(2)

volume = …… unit ……

(e) The student was told by his teacher that the cubes have different surface area to volume ratios.

Complete the table by putting one tick (✓) in each row to show whether the statement applies to cube A, B or C.

(3)

	Cube A	Cube B	Cube C
largest surface area			
largest surface area to volume ratio			
greatest proportion of cube coloured red			

(Total for question = 11 marks)

Total for paper = 60 marks