

# THE KING'S SCHOOL, CANTERBURY



## Entrance Examinations (14+)

### SCIENCE

2012-13

One Hour

This paper contains 13 questions on biology, chemistry and physics.

Attempt as many questions as you can, and do not worry if you have not covered all the topics in your school.

There are 82 marks available

You should show each step in your working and all rough work should be done on this paper.

You may use a calculator.

**COMMUNICATING WITH ANYBODY ELSE DURING THE EXAM, DIRECTLY OR OTHERWISE (E.G. BY PHONE) MAY CAUSE YOUR APPLICATION TO BE REJECTED.**

NAME:.....

AGE:.....

PRESENT SCHOOL:.....

Total...../82

.....%

1. Underline the word or phrase which best completes each of the following sentences.

a) Which of these is found in plant cells but NOT in animal cells?

**nucleus**                      **cytoplasm**                      **membrane**                      **chloroplast**

b) Which of these is NOT a type of blood vessel?

**tendon**                      **artery**                      **capillary**                      **vein**

c) Antibiotics are known to be effective at fighting:

**bacteria**                      **viruses**                      **cancer**                      **fungal growth**

d) Which of the following is NOT found in cigarette smoke:

**tar**                      **uranium**                      **nicotine**                      **carbon monoxide**

e) Hydrogen:

**relights a glowing splint**    **burns with a 'pop'**    **turns limewater milky**    **is purple**

f) What is the most likely pH of the contents of your stomach?

**8**                      **1**                      **5**                      **13**

g) Which of the following mixtures could be separated using filtration?

**oil and water**                      **salt and pepper**  
**volcanic and coastal sand**                      **iron filings and lead powder**

h) The percentage of the Earth's atmosphere which is oxygen is approximately:

**2%**                      **20%**                      **50%**                      **85%**

i) A device which can be used to measure the **current** in a circuit, and the way of connecting it is:

**ammeter in series**                      **voltmeter in series**  
**voltmeter in parallel**                      **ammeter in parallel**

j) As a liquid is boiling its particles:

**gain kinetic energy**                      **move faster**                      **gain potential energy**                      **get bigger**

k) the speed of the fastest human sprinter is approximately:

**2 m/s**

**10 m/s**

**20 m/s**

**90 m/s**

l) heat energy is transferred through a vacuum by:

**conduction**

**convection**

**radiation**

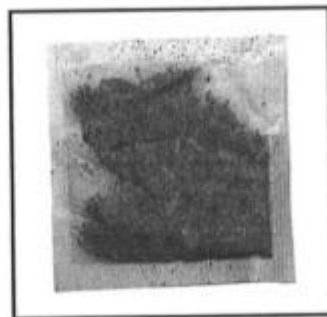
**evaporation**

maximum 12 marks

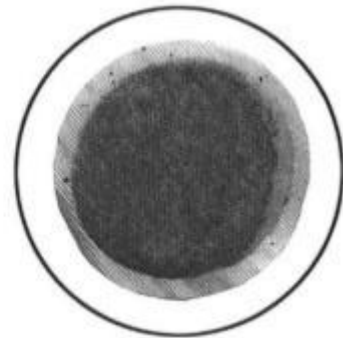
**Q2.** Tea bags are made in different shapes.



**triangle**



**square**



**circle**

Some pupils want to find out which shape of tea bag lets tea dissolve most quickly. They make two plans for their investigation as shown below.

FIRST PLAN  
*We will use 3 tea bags and 3 beakers*

SECOND PLAN  
*Collect three beakers.*  
*Collect three different tea bags.*  
*Put one tea bag in each beaker.*  
*Add 150 cm<sup>3</sup> of water at 65°C.*  
*Keep the temperature of the water the same.*  
*Measure the time taken for the tea to dissolve.*  
*Find out which is the quickest for making tea.*

(a) How is the second plan better than the first plan?

.....  
 .....

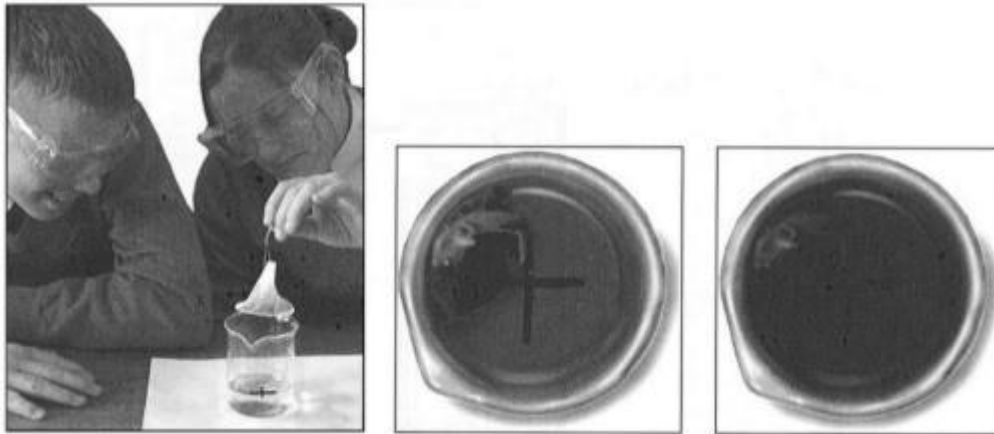
1 mark

(b) Why should they take care when they add hot water at 65°C to the tea bags?

.....  
 .....

1 mark

(c) Craig and Danielle drew a cross on some paper. They put each beaker, in turn, over the cross. They poured hot water into the beaker, dropped in the tea bag and watched the water change colour.



To see which shape of tea bag let the tea dissolve the quickest, they measured the time until the liquid was too dark for them to see the cross.

How did the cross help to make their test more accurate?

.....

1 mark

(d) (i) They recorded their measurements in a table as shown below.

shape of tea bag	time taken until cross cannot be seen (minutes)
triangle	8
square	15
circle	10

Which part of their investigation was recorded in the table?  
Tick the correct box.

explanations	<input type="checkbox"/>	results	<input type="checkbox"/>
conclusions	<input type="checkbox"/>	plans	<input type="checkbox"/>

1 mark

(ii) Give the **three** shapes of tea bags in the order in which the tea dissolved.  
Use the table above to help you.

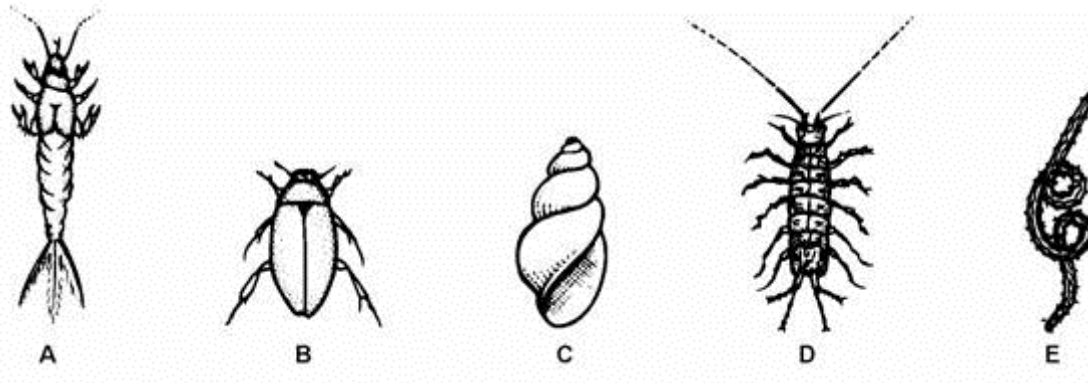
quickest \_\_\_\_\_ slowest

1 mark

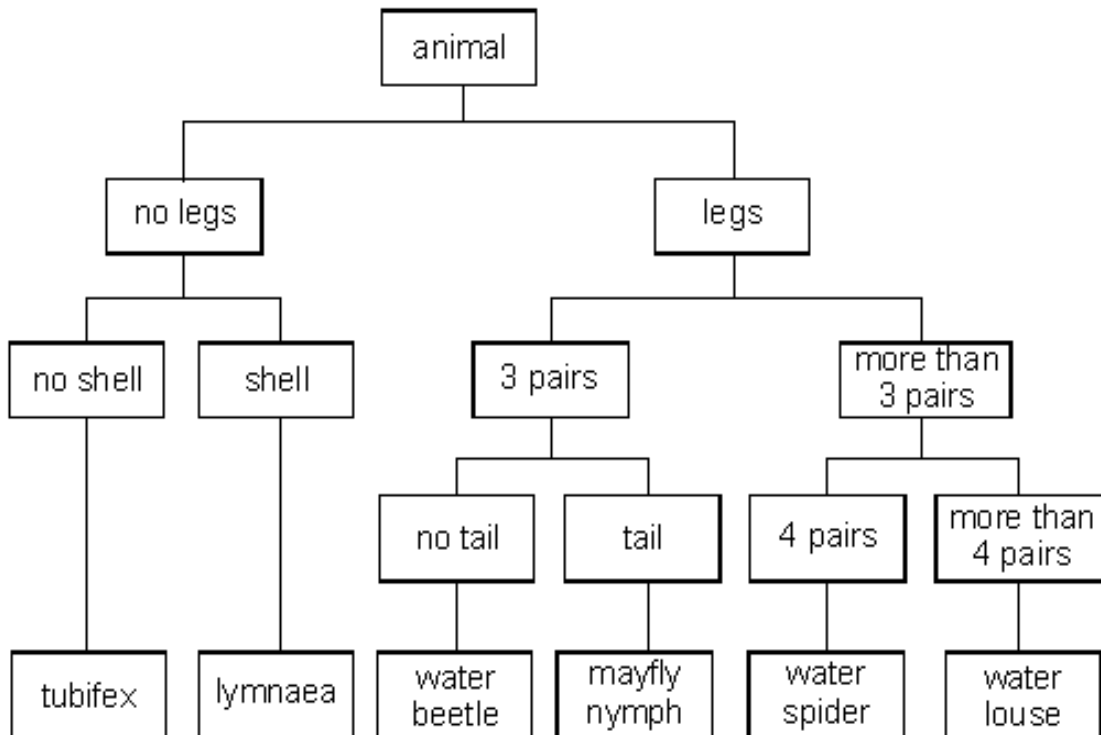
maximum 5 marks

**QUESTION 3 IS ON THE NEXT PAGE**

**Q3.** The animals shown below live in different parts of a river.



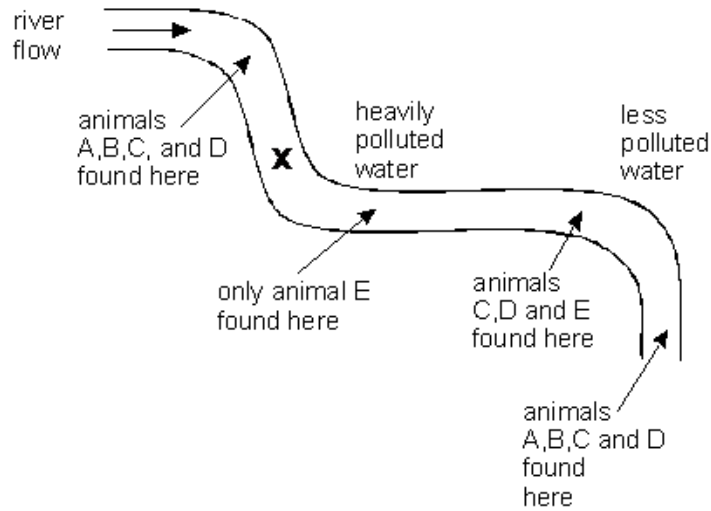
(a) Use the key to identify animals **A**, **B** and **C**.



- (i) Animal **A** is a .....
- (ii) Animal **B** is a .....
- (iii) Animal **C** is a .....

3 marks

- (b) The diagram shows a river. Sewage pollutes the river at X. The amount of pollution gets less as you go down the river from X. The animals A, B, C, D and E were found living in the river at the places shown.



- (i) Which animal survives best in polluted water? Give the **letter** of the animal.

.....

1 mark

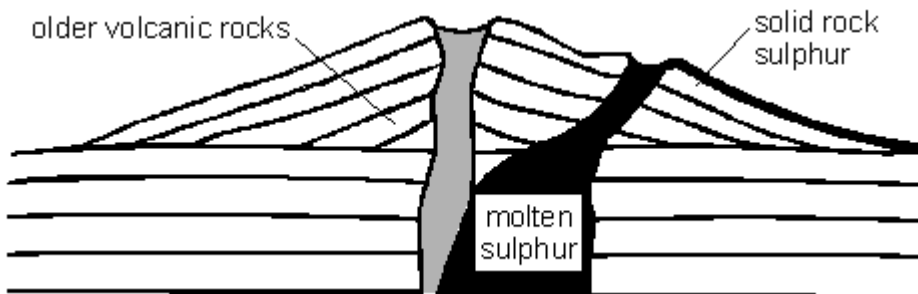
- (ii) **Two** of the animals cannot live in polluted water. Give the **letters** of these two animals.

..... and .....

2 marks

Maximum 6 marks

- Q4.** A Japanese volcano erupted in 1936. Molten sulphur poured out of the volcano. When it cooled it formed rock sulphur.



- (a) (i) Which word describes molten rock that is underground? Choose from **lava** or **magma** or **oil**.

.....

1 mark

- (ii) Which type of rock do volcanoes produce? Choose from **igneous** or **metamorphic** or **sedimentary**.

.....

1 mark

(b) Sulphur is a **non-metallic** element. It is yellow and melts at 115°C.

Complete the sentences about sulphur.

(i) Sulphur is a poor conductor of

.....

1 mark

(ii) At 115°C sulphur changes from

a ..... into a .....

2 marks

(c) Sulphur burns in air to form an oxide.

What gas in the air reacts with sulphur when it burns?

.....

1 mark

Maximum 6 marks

**Q5.** (a) Diagram 1 shows a light bulb **X**, a piece of card and a white screen. Two light rays have been drawn from the bulb to the screen.

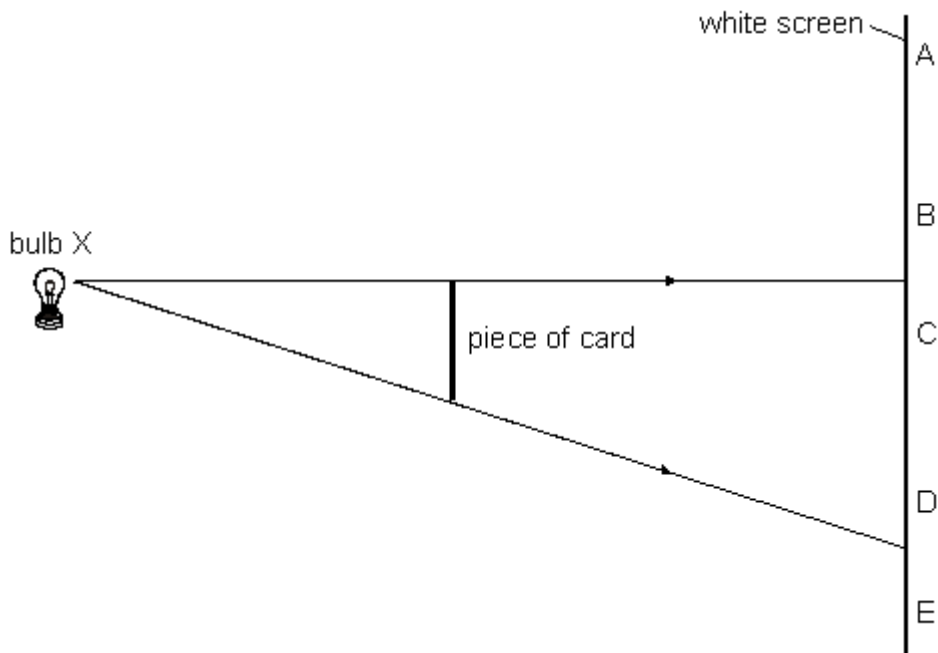


diagram 1

Five points, A, B, C, D and E, have been labelled on the screen.

Give the letter of **one** point which is in shadow.

.....

1 mark



(b) Bulb Y is added. Diagram 2 shows two light rays from each bulb.

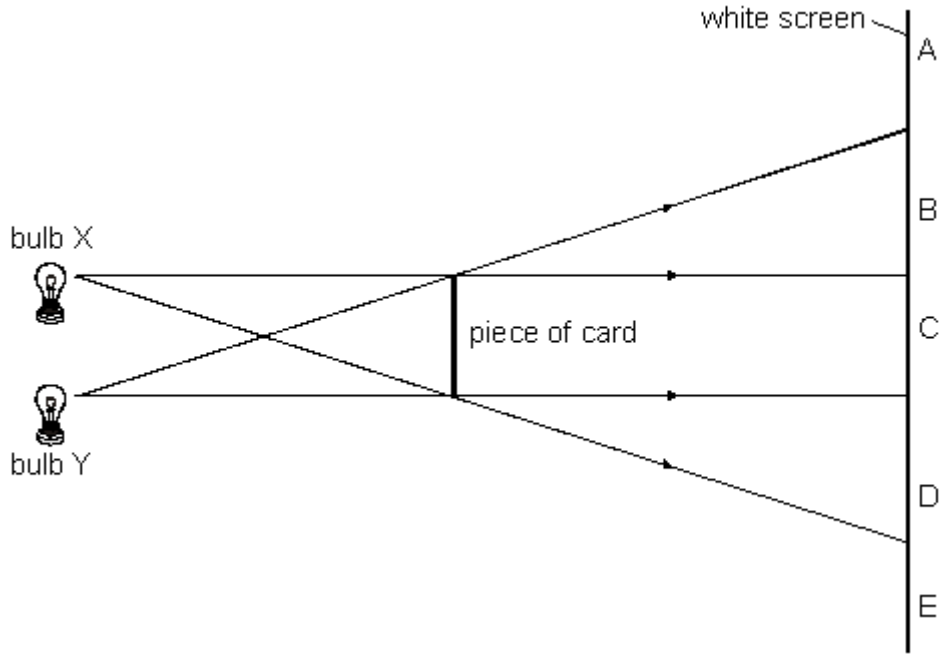


diagram 2

Look at diagram 2.

- (i) Which point on the screen will be in the darkest shadow?  
Give the letter. .... 1 mark
  
- (ii) Give the letter of **one** point on the screen which will be lit up by **both** bulbs.  
..... 1 mark
  
- (iii) Which point on the screen will be lit up by bulb **X only**?  
Give the letter. .... 1 mark

- (c) Bulb Y is connected in parallel with bulb X. Draw a circuit diagram below to show how the two bulbs and the battery are connected.

1 mark

Maximum 5 marks

**Q6.** Spots may be caused by bacteria in the skin. A researcher investigated the effect of spot-lotion on bacteria.

- (a) He grew bacteria on the surface of jelly in a Petri dish.

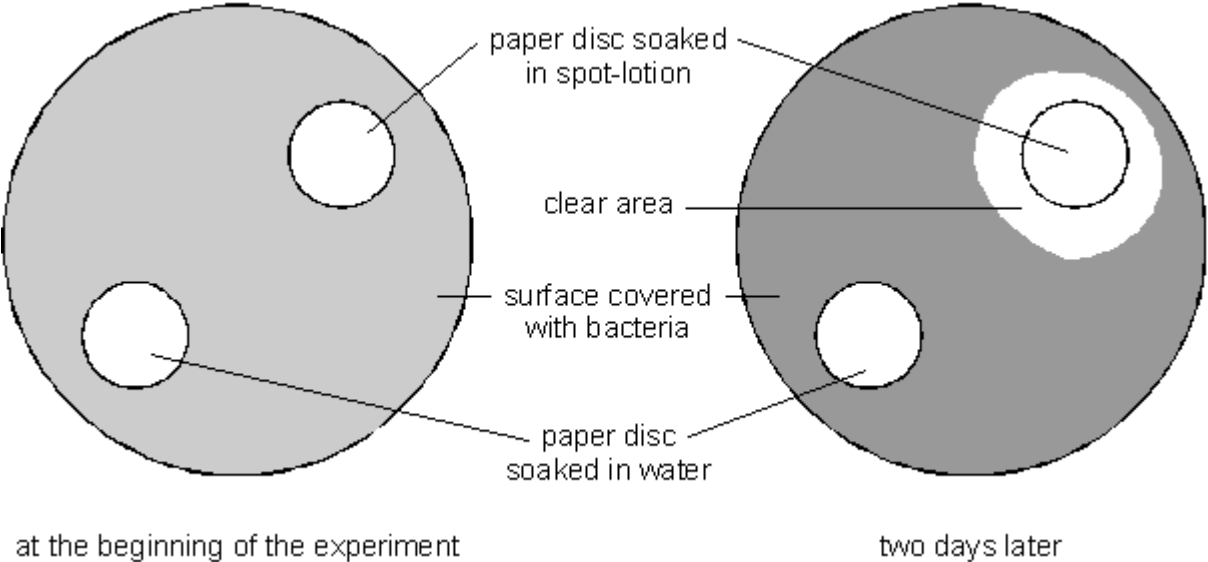
At what temperature would the bacteria reproduce quickly?

Tick the correct box.

100°C	<input type="checkbox"/>	4°C	<input type="checkbox"/>
37°C	<input type="checkbox"/>	-15°C	<input type="checkbox"/>

1 mark

(b) The researcher placed two small paper discs onto the surface of the jelly. One disc had been soaked in spot-lotion. The other disc had been soaked in water. The diagrams below show the jelly at the beginning of the experiment and two days later.



Suggest what had happened to the bacteria in the clear area around the paper disc soaked in spot-lotion.

.....  
.....

1 mark

(c) What was the control in this experiment?

.....  
.....

1 mark

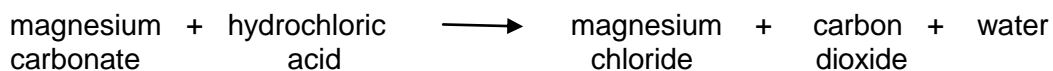
(d) Give **two** safety precautions the researcher should take to avoid contact with the bacteria.

1. ....  
2. ....

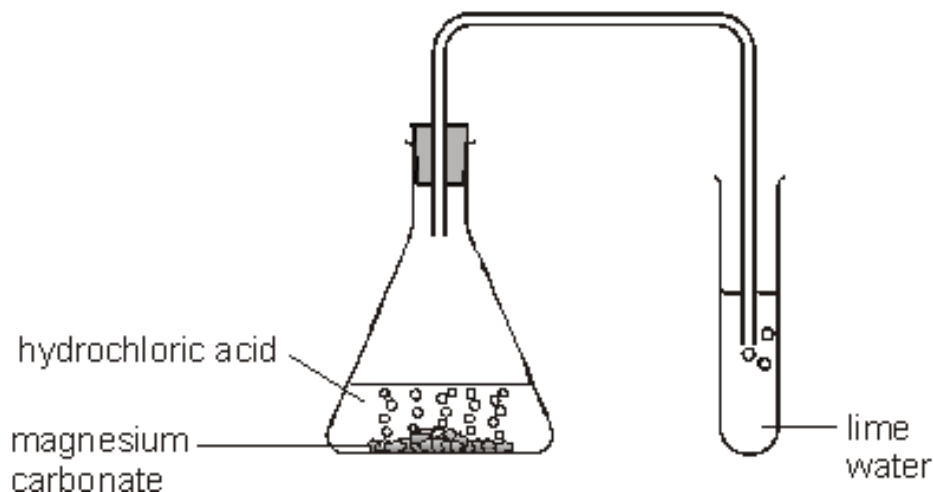
2 marks

Maximum 5 marks

**Q7.** The word equation for the reaction between magnesium carbonate and hydrochloric acid is shown below.



(a) Javier added hydrochloric acid to magnesium carbonate in a flask.



(i) Suggest the pH of hydrochloric acid.

.....

(ii) The carbon dioxide produced was bubbled through lime water.

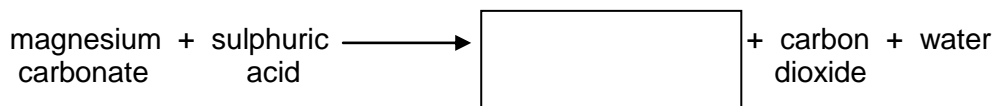
How would the lime water change?

.....

2 marks

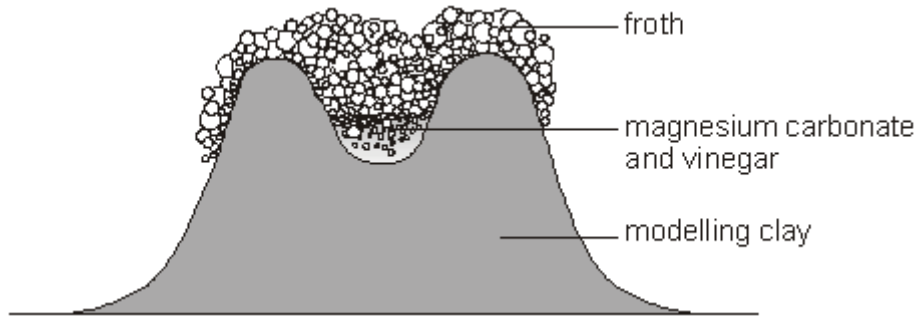
(b) Javier repeated the experiment by adding **sulphuric acid** to magnesium carbonate.

Complete the word equation for the reaction that took place.



1 mark

- (c) Javier made a model volcano.  
 He put magnesium carbonate into the model.  
 He added vinegar and a drop of washing-up liquid.



The mixture fizzed, and froth poured out of the model volcano.

- (i) The vinegar reacted with the magnesium carbonate.

Suggest the pH of vinegar.

.....

- (ii) The froth running down the side of the model represents part of a real volcano.  
 Give the name of this part.

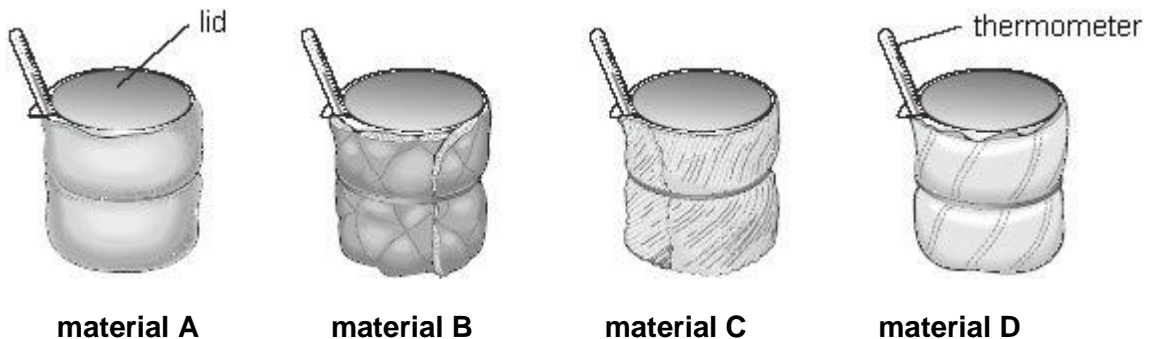
.....

2 marks

maximum 5 marks

**Q8.** A company has made a new material called 'Wellwarm'. They want to use 'Wellwarm' to make coats.

- (a) A scientist tested 'Wellwarm' to see how well it insulated a beaker of hot water. She tested 'Wellwarm' and three other materials as shown below.



She wrapped each beaker in a different material.

She recorded the temperature at the start and 20 minutes later.

- (i) What was the independent variable that the scientist **changed**?  
..... 1 mark
  
- (ii) What was the dependent variable that the scientist **measured** during the investigation?  
..... 1 mark

(b) The results of the investigation are shown below.

time (minutes)	temperature of water (°C) wrapped in			
	material A	material B	material C	material D
0	60	60	60	60
20	34	40	38	36

- (i) The scientist said that the 'Wellwarm' material is the best insulator. Which material was 'Wellwarm'? Use the results to help you. Tick the correct box.  
A       B       C       D  1 mark

- (ii) Use the evidence in the results table to explain your choice.  
.....  
..... 1 mark

(c) The company made a coat from each of the four materials they tested.



A person tested the different coats by wearing each one in a cold room.  
He measured the temperature inside each coat for 30 minutes.

Write down two **other** variables that should be controlled to make this a fair test.

1. .... 1 mark

2. .... 1 mark

(d) Write down one thing the scientists should do to make sure the person testing the coats is safe.

..... 1 mark

(e) Suggest **one** advantage of using a temperature sensor and data logger instead of a thermometer in this experiment.

.....  
..... 1 mark

maximum 8 marks

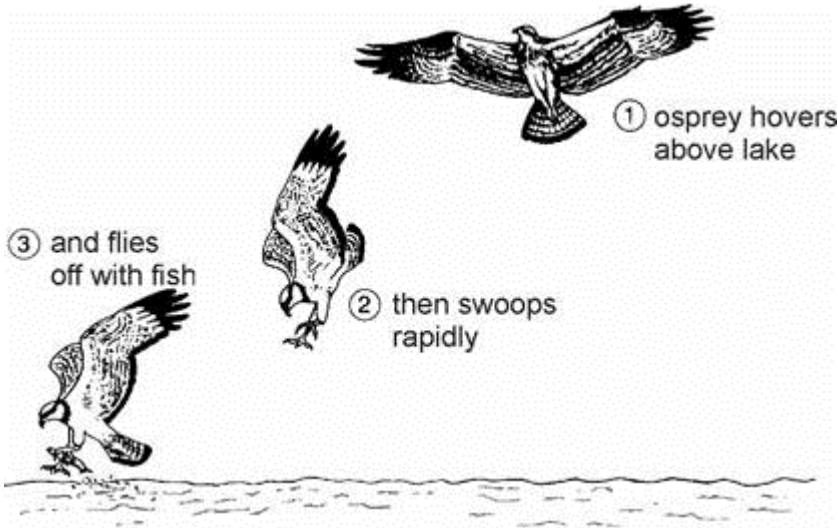
**Q9.** Ospreys can live in places where the weather is sometimes cold.



(a) Explain how an osprey's feathers insulate it in cold weather.

.....  
..... 1 mark

Ospreys hunt for fish by flying about 10 metres above the water. When they see a suitable fish, they dive swiftly on their prey. This is shown in the diagram below.



(b) (i) What is the advantage of hunting for fish from such a height?

.....  
.....

1 mark

(ii) Look at the diagrams above. Suggest **three** different features of ospreys which enable them to be successful at **catching** fish.

1. ....  
.....

2. ....  
.....

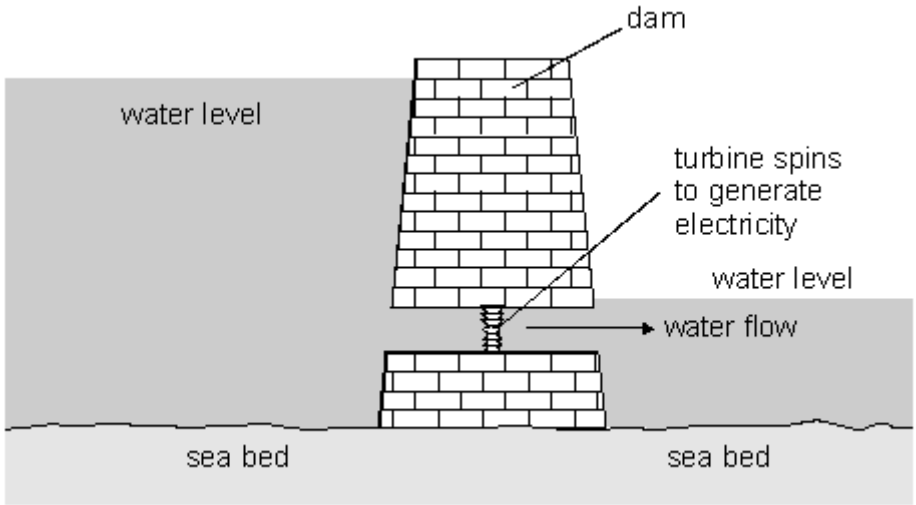
3. ....  
.....

3 marks

Maximum 5 marks



**Q10.** The tides can be used to generate electricity. A dam is built across a river estuary, as shown below.



(a) The water is higher on one side of the dam than on the other. As the water begins to flow through the dam it turns a turbine. The turbine generates electricity. Describe the useful energy changes which take place in this process.

.....  
.....  
.....  
.....

2 marks

(b) Explain why tides are classified as a renewable energy source.

.....  
.....

1 mark

(c) Give **one** way, **other** than from the tides, of generating electricity by using the sea.

.....

1 mark

(d) Apart from cost, give **one** advantage and **one** disadvantage of an oil-fired power station compared with a tidal power station.

advantage .....

.....

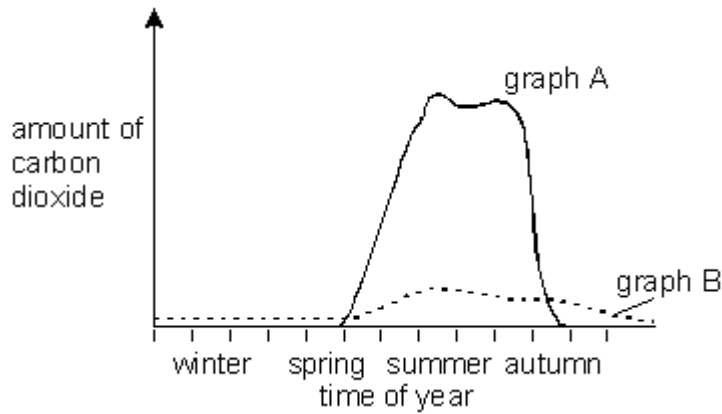
disadvantage .....

.....

2 marks

Maximum 6 marks

**Q11.** Plant cells use carbon dioxide in photosynthesis. Graph A below shows how the amount of carbon dioxide a tree takes in each day varies over one year.



(a) (i) Give **two** reasons why photosynthesis occurs most rapidly in the summer.

1 .....

2 .....

2 marks

(ii) Name the **two** substances produced in photosynthesis.

..... and .....

2 marks

(b) Trees which lose all their leaves in the autumn are described as deciduous. How can you tell from graph A that the tree being investigated is deciduous?

.....

1 mark

(c) Graph B above shows how the amount of carbon dioxide which the tree gives out each day varies over one year.

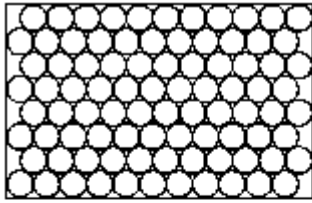
What is the name of the process in the tree which produces carbon dioxide?

.....

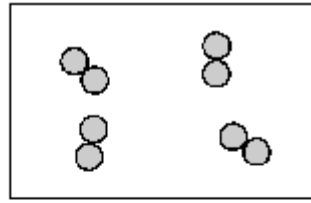
1 mark

Maximum 6 marks

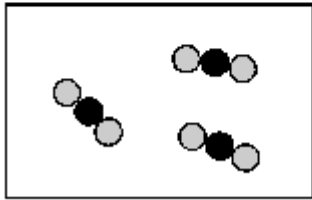
**Q12.** The diagrams represent the arrangement of atoms or molecules in four different substances, A, B, C and D.



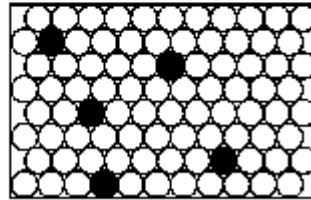
A



B



C



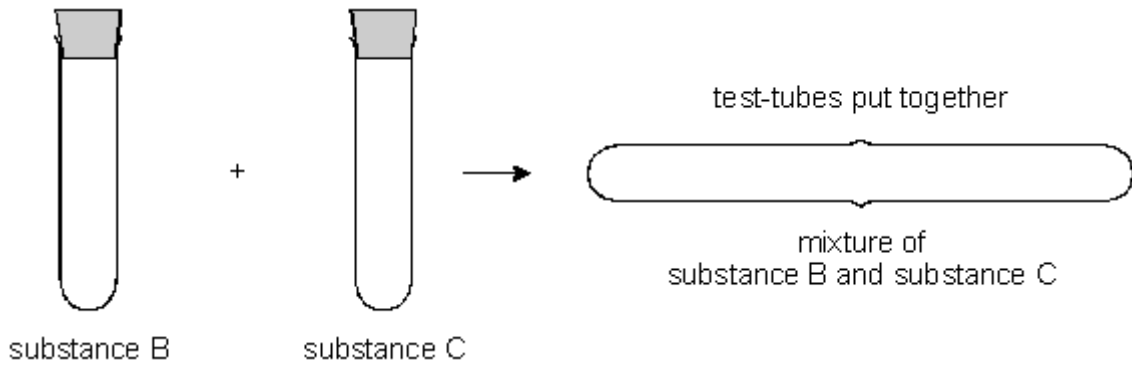
D

*not to scale*

Each of the circles, and represents an atom of a different element.

- (a) (i) Which substance is a compound?  
 .....  
 1 mark
- (ii) Which substance is a mixture?  
 .....  
 1 mark
- (iii) Which **two** substances are elements?  
 ..... and .....  
 1 mark
- (iv) Which **two** substances could be good thermal conductors?  
 ..... and .....  
 1 mark
- (v) Which substance could be carbon dioxide?  
 .....  
 1 mark

- (b) The following experiment was set up. Test-tubes containing substances B and C were placed together as shown. The substances did **not** react. They were left for five minutes.

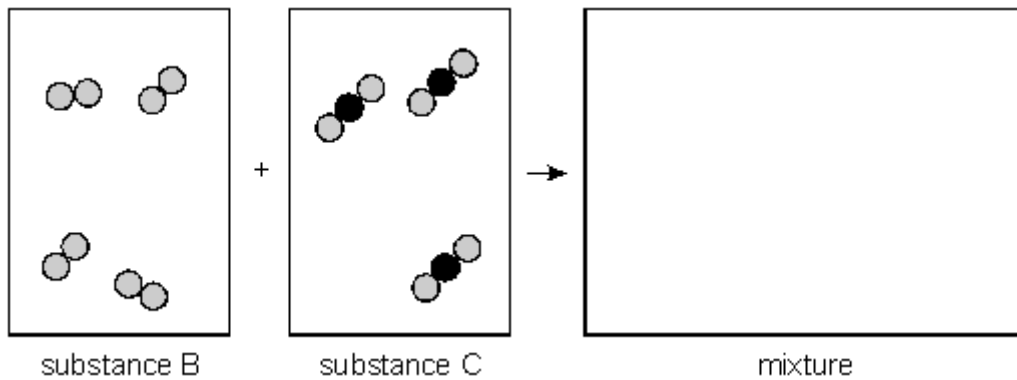


- (i) How many molecules are there in the mixture compared to the total number in substances B and C?

.....

1 mark

- (ii) Complete the diagram which is a model of this experiment.



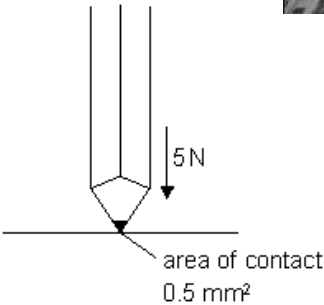
1 mark

Maximum 7 marks

**Q13.** Judi is doing her homework.



(a) When Judi writes,  
the pencil exerts a force of 5N on the paper.



*not to scale*

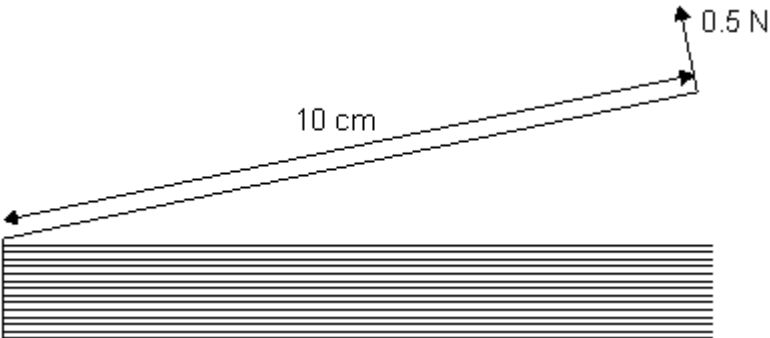
The area of the pencil in contact with the paper is  $0.5 \text{ mm}^2$ .

Calculate the **pressure** of the pencil on the paper.  
Show the formula you are going to use and give the unit.

.....  
.....

2 marks

(b) Judi puts a book on her desk.  
She lifts the cover up with her finger, using a force of 0.5 N.  
The cover is 10 cm wide.



Calculate the **turning moment** on the cover of the book.  
Show the formula you are going to use and give the unit.

.....  
.....

2 marks

- (c) Judi's book has an area of  $200 \text{ cm}^2$ .  
It exerts a pressure of  $0.05 \text{ N/cm}^2$  on the desk.

What is the weight of the book?  
Use the space below to show your working.

\_\_\_\_\_ N

2 marks

maximum 6 marks

**END OF EXAM**