Aldenham School

13+ Sample Paper

Subject: Science

Time allowed: 60 minutes

Instructions:

1. Answer all the questions on the paper.
2. You should spend approximately 20 minutes on each of the three sections (Chemistry, Biology and Physics)

Marks: Section A _____ / 28

Section B _____ / 29

Section C _____ / 36

Overall Percentage: _____

SECTION A: CHEMISTRY

Q1.

(a) The table below shows the melting points of four metals.

metal	melting point, in °C
gold	1064
mercury	–37
sodium	98
iron	1540

(i) Which metal in the table has the highest melting point?

.....

1 mark

(ii) Which metal in the table has the lowest melting point?

.....

1 mark

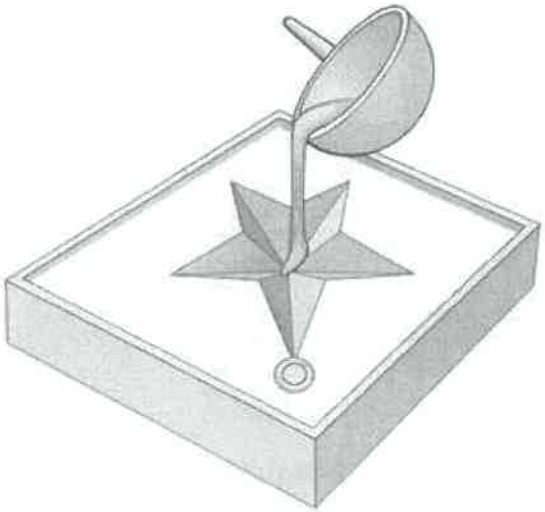
(b) Gold can be a gas or a liquid or a solid.

Choose from these words to fill the gaps below.

When gold is heated from room temperature to 1070°C, the gold changes from a ..... to a ..... .

1 mark

(c) 5 g of gold is melted and all of it is poured into a mould to make a pendant as shown below.



melted gold is poured into a mould

gold pendant

What is the mass of the gold pendant?

..... g

1 mark

(d) The table below shows how the four metals react with oxygen when heated in air.

metal	reaction when heated in air
gold	no change
mercury	slowly forms a red powder
sodium	bursts into flames straight away
iron	very slowly turns black

(i) Which is the most reactive metal in the table?

.....

1 mark

(ii) Which is the least reactive metal in the table?

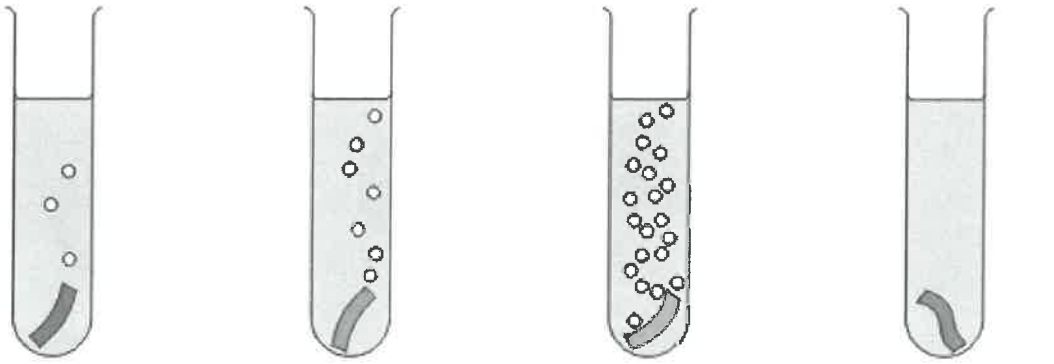
.....

1 mark

Q2.

(a) Ruth put a piece of a different metal in each of four test tubes.

She poured 10 cm3 of hydrochloric acid onto each metal.



iron + hydrochloric acid

zinc + hydrochloric acid

magnesium + hydrochloric acid

copper + hydrochloric acid

Look at the diagrams above.

(i) How do these show if a metal reacts with the acid?

.....

1 mark

(ii) On the lines below, put the four metals in the order of how strongly they react with the acid.

most reactive .....

.....

.....

least reactive .....

1 mark

(b) Choose the name of a metal from the box below to answer each question.

copper	iron	magnesium	zinc

(i) Which metal from the box is used for electrical wires?

.....

1 mark

(ii) Which metal from the box goes rusty?

.....

1 mark

Q3.

An alloy is a mixture of elements.
The table shows the mass of each element present in 100 g of five different alloys, bronze, solder, steel, stainless steel and brass.

alloy	mass of each element in 100 g of alloy							
	lead (g)	tin (g)	copper (g)	zinc (g)	carbon (g)	iron (g)	chromium (g)	nickel (g)
bronze		4	95	1				
solder	62	38						
steel					1	99		
stainless steel						70	20	10
brass			67	33				

(a) Which alloy in the table above contains an element which is a non-metal?

.....

1 mark

(b) Which two alloys in the table contain only two metals?

..... and .....

1 mark

(c) Another alloy called nichrome contains only the elements chromium and nickel.
100 g of nichrome contains 20 g of chromium.

How much nickel does it contain?

..... g

1 mark

(d) Before 1992, two-pence coins were made of bronze.
Steel rusts but bronze does not rust.

(i) Why does bronze not rust?
Use information in the table above to help you.

.....

.....

1 mark

(ii) Rusting requires water and a gas from the air.
Give the name of this gas.

.....

1 mark

Q4.

Jessica was investigating the rusting of iron. She set up five experiments as shown below, and left the test-tubes for three days.

A

iron nail in distilled water

B

iron nail in tap water which has been boiled to remove dissolved gases

C

iron nail and a chemical to absorb water vapour

D

iron nail in sea water

E

iron nail in vinegar

Jessica wrote the following results in her book.

Test–tube	observation
A	nail slightly rusty
B	nail still shiny
C	nail still shiny
D	nail very rusty
E	nail slightly rusty, bubbles of gas seen

Question 4 continues on the following page

(a) Explain why the nails had not rusted in test-tubes B and C.

in test-tube B .....

.....

in test-tube C .....

.....

2 marks

(b) In test-tube E the iron nail reacted with the vinegar.

(i) Is vinegar acidic, alkaline or neutral?

.....

1 mark

(ii) When the iron reacted with the vinegar, bubbles of gas were formed.
What gas was formed?

.....

1 mark

(c) Before putting the iron nail in test-tube D, Jessica weighed the nail.
After three days she dried and weighed the nail and the rust which had formed.

(i) How did the total mass of the nail and rust compare to the mass of the nail at the beginning?

.....

1 mark

(ii) Give the reason for your answer.

.....

.....

1 mark

(d) Jessica concluded that the presence of salt in the water made the nail rust more quickly.
Explain why she drew that conclusion from her experiments.

.....

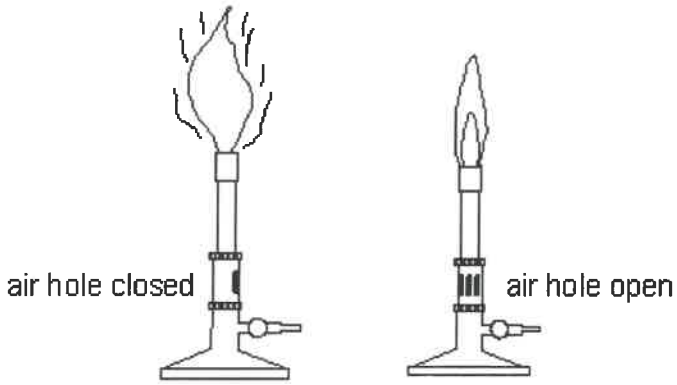
.....

.....

1 mark

Q5.

The diagrams show two Bunsen burners. One burner has the air hole closed, and the other has the air hole open.



(a) Explain why opening the air hole of a Bunsen burner makes the flame hotter.

.....

.....

1 mark

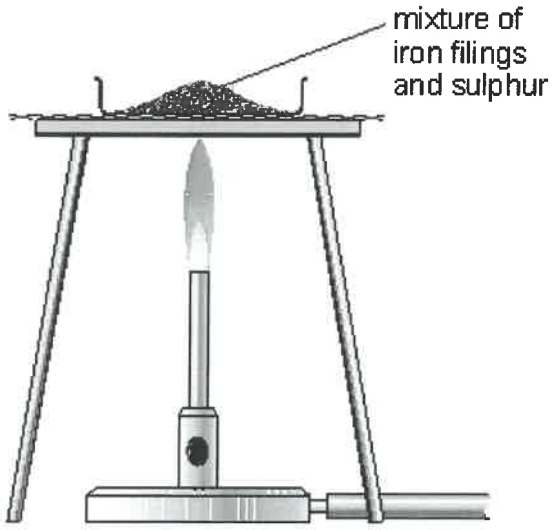
(b) Natural gas is methane, CH4. It is burned in a Bunsen burner.
Complete the word equation for the chemical reaction in the clear blue flame.

methane + ... → ..... + ...

2 marks

Q6.

A teacher mixed iron filings with sulphur on a metal tray.
She heated the mixture in a fume cupboard.
Sulphur is yellow. Iron filings are grey.



The mixture glowed very brightly. The teacher turned off the bunsen burner.
The glow spread through the mixture.
When the mixture cooled, a black solid called iron sulphide was left.

(a) From this information, give one way you can tell that a chemical reaction took place.

.....

.....

1 mark

(b) What type of substance is each of the chemicals involved in this reaction?
Choose from:

metallic element	mixture	non-metallic element	compound

iron .....

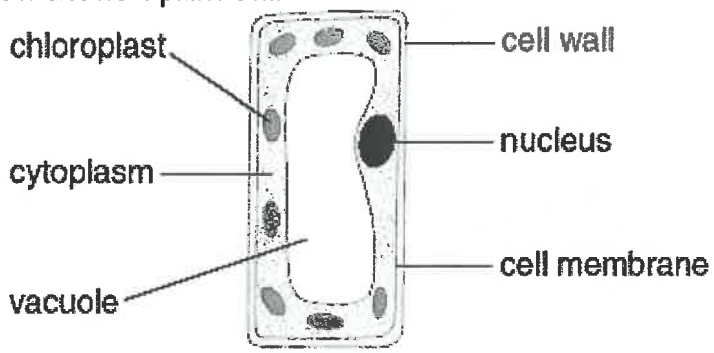
sulphur .....

iron sulphide .....

2 marks

SECTION B: BIOLOGY

Q1. The diagram below shows a plant cell.



(a) In which part of a plant would you find this type of cell?

.....

1 mark

(b) (i) Give the function of the nucleus.

.....

.....

1 mark

(ii) Give the function of the chloroplasts.

.....

.....

1 mark

(iii) Give the function of the cell wall.

.....

.....

1 mark

(c) Give the names of **two** labelled parts that are **not** present in animal cells.

1. .....

2. .....

1 marks

(d) Tick **one** box in each row to show whether the statement is true for photosynthesis **or** for respiration.

statement	photosynthesis	respiration
carbon dioxide is produced		
light is needed		
it occurs in plants and animals		
oxygen is produced		

2 marks

maximum 7 marks

Q2. This question involves the topic of reproduction.

(a)

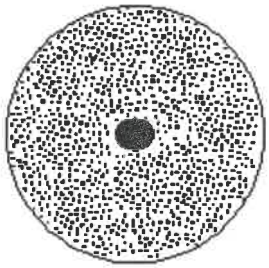
A

(i) What is the name of cell A?

.....

1 mark

(b)



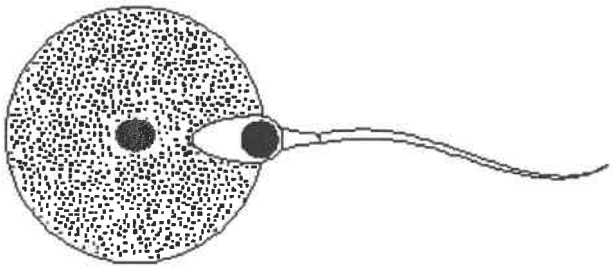
B

(ii) Where is cell B produced?

.....

1 mark

(c)



C

not to scale

What process is shown in C?

.....

1 mark

(d) The diagram shows a baby developing inside its mother.

(i) Which word means an unborn baby?

.....

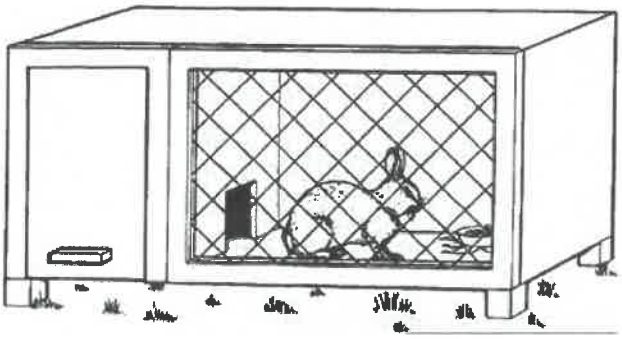
1 mark

(ii) Where does the unborn baby develop?

.....

1 mark

Q3. Andrew put his rabbit's cage on the grass.



A week later, the grass under the cage had turned yellow.

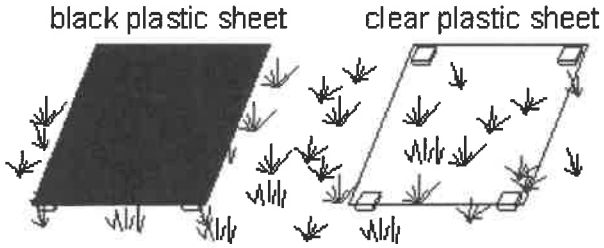
(a) Give **one** reason why the grass had turned yellow.

.....

.....

1 mark

(b) Andrew wanted to test why the grass had turned yellow. He put two sheets of plastic just above another patch of grass. One sheet was black and the other sheet was clear.



A week later, the grass under the black sheet was yellow. The grass under the clear sheet was green.

(i) Explain why he used the clear plastic sheet as well as the black sheet.

.....

.....

1 mark

(ii) Andrew left the black sheet there for several more weeks.
What happened to the grass under it?

.....

.....

1 mark

(c) Tick the boxes by **two** things which **both** rabbits **and** grass plants can do.

they eat ☐

they grow ☐

they move from place to place ☐

they reproduce ☐

they breathe in and out ☐

1 marks
Maximum 4 marks

Q4. Sharon is riding her horse. She is wearing a riding hat.

(a) Give the name of **one organ** the riding hat protects.

.....

1 mark

(b) The horse is a mammal.
Give **one** fact about horses that shows they are mammals.

.....

1 mark

(c) When the horse is running, some of its organs do more work.
Draw a line from each organ to show what it does.
Draw only **two** lines.

organ	what the organ does
heart	It takes in oxygen faster.
	It moves the bones faster.
lung	It digests food faster.
	It pumps blood faster.

1 mark

(d) The drawing shows a horsefly.

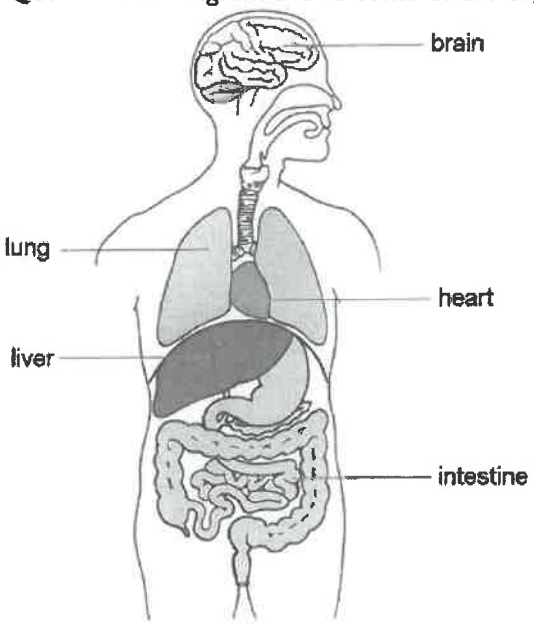
(i) The horsefly is an insect.
Female horseflies bite horses and feed on their blood.
Male horseflies feed on plants.
Draw a line from each horsefly below to the word that describes the way it feeds.
Draw only **two** lines.

horsefly	**describing word**
female horsefly	herbivore
	carnivore
	producer
male horsefly	prey

1 mark

maximum 4 marks

Q5. The diagram shows some of the organs of the human body.



(a) The heart pumps blood around the body.

(i) What useful gas does the blood take in from the air in the lungs?

.....

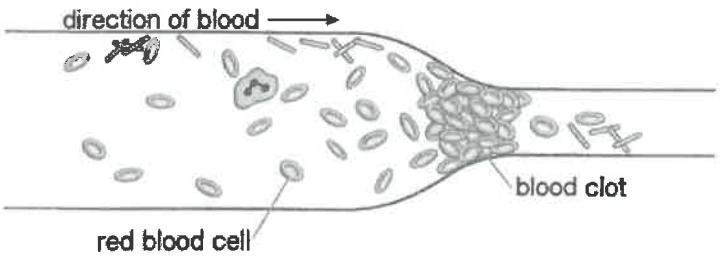
1 mark

(ii) What useful substance does the blood take in from the intestine?

.....

1 mark

(b) Blood vessels carry blood to organs of the body.
Sometimes a blood clot forms in a blood vessel as shown below.



a blood vessel *not to scale*

A blood clot may stop an organ working properly.
Give **one** reason for this.

.....

.....

1 mark

(c) Rahma cut his foot on a piece of glass. A scab formed over the cut.
Give **one** way a scab protects the body.

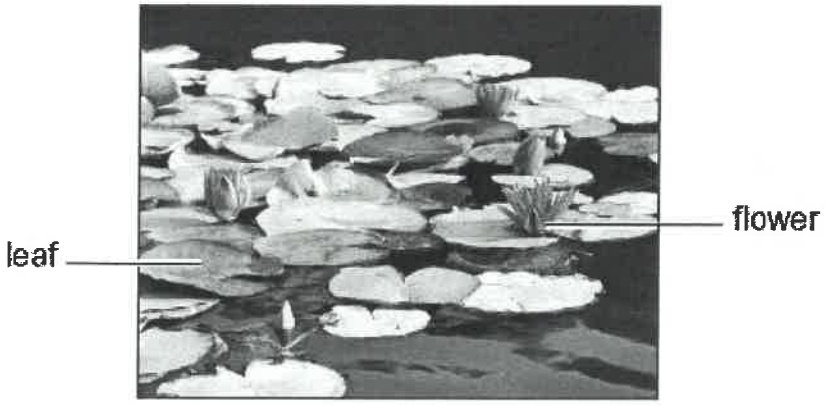
.....

.....

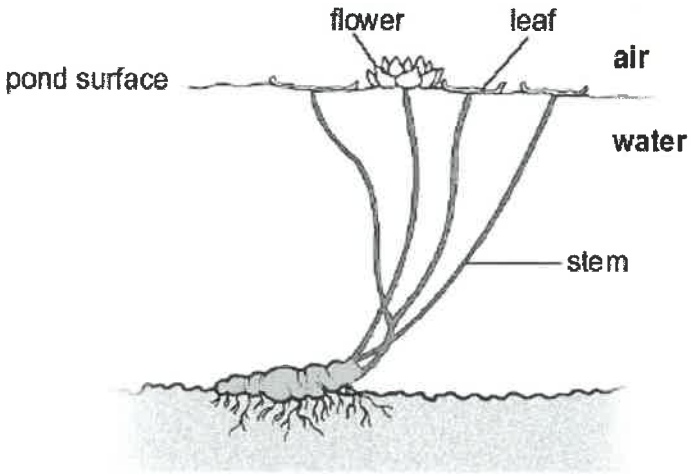
1 mark
maximum 4 marks

Q6.

The photograph below shows some water lilies in early summer.



This diagram shows a water lily plant.



(a) Water lilies do **not** grow well in moving water.
Suggest a reason for this.

.....

.....

1 mark

(b) During the winter, many water lily plants do **not** grow new leaves.
Suggest **one** reason why the plants do **not** grow new leaves in the winter.

.....

1 mark

(c) (i) Give **one** way water lily plants are adapted to live in water.

.....

1 mark

(ii) Explain how this adaptation helps the water lily to grow in water.

.....

.....

1 mark

(d) In the summer, water lilies produce large yellow flowers.
The flowers float on the surface of the pond.

Suggest **one** way these colourful floating flowers help the water lily to reproduce.

.....

.....

1 mark

(e) When water lilies cover the pond surface with leaves, the pond does not get as hot during the day.
Explain why the pond does **not** get as hot.

.....

.....

1 mark

maximum 6 marks

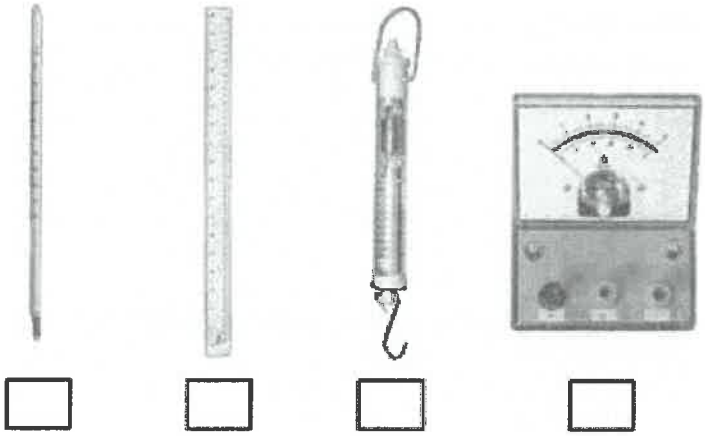
SECTION C: PHYSICS

Q1. Lee blew across the top of paper tubes to make sounds.

He investigated how changing the length of a tube affects the pitch of the sound.

(a) What equipment could he use to measure the length of the tubes?

Tick the correct box.



1 mark

(b) The photograph below shows the different lengths of tubes Lee used.

Suggest **one** way his test might **not** have been fair.

.....

.....

1 mark

(c) Lee made a prediction.

Which of these statements is a prediction?
Tick the correct box.

The tubes were made of paper. ☐

The pitch of the sound is how high or low it is. ☐

The longer tube will make a lower sound. ☐

The sound is caused by the vibration of air. ☐

1 mark

(d) Lee blew across the ends of 3 different lengths of tube and compared the pitch of the sound produced.

His results5 are shown below.

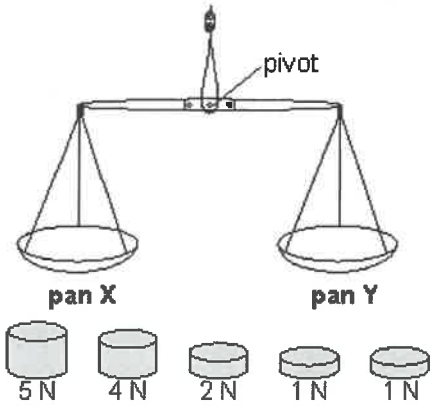
Length of the tube, in cm	*pitch of the sound*
5	*high*
25	*medium*
50	*low*

Which length of tube made the sound with the highest pitch?

..... cm

1 mark
Maximum 4 marks

Q2. Ellie has a set of scales and some weights as shown below.



Ellie puts two weights in pan X and one weight in pan Y. The scales balance.

(a) Which weights could be in pans X and Y?

pan X: ..... and .....

pan Y: .....

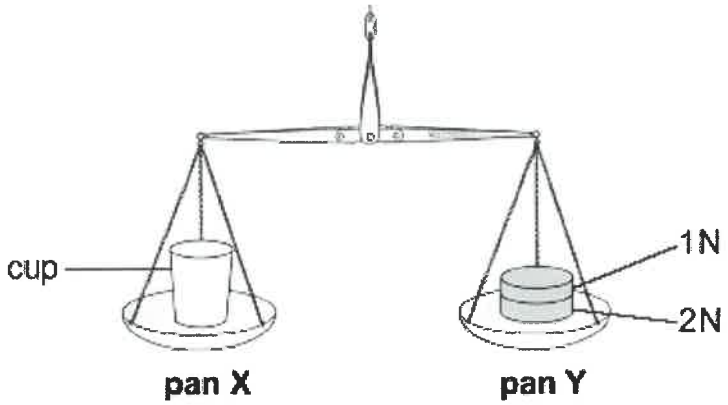
1 mark

(b) Ellie removes all the weights from the scales.
She then puts a cup on pan X.
In which direction will pan Y move?

.....

1 mark

(c) She puts weights into pan Y so the scales balance.

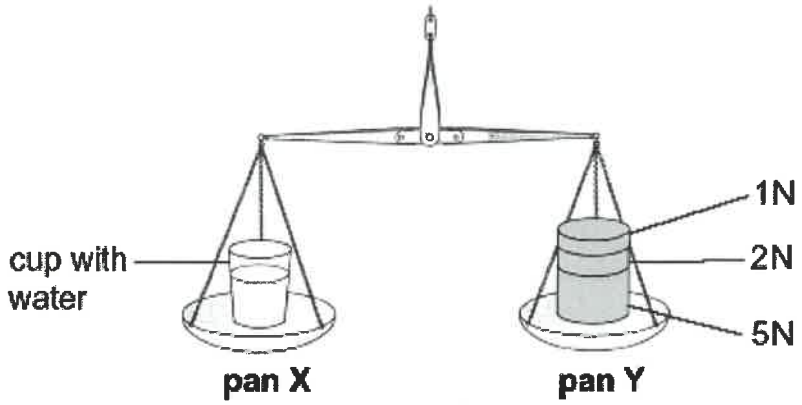


How much does the cup weigh?

..... N

1 mark

(d) Ellie puts some water in the cup.
She then adds some more weights to pan Y to make the scales balance.



(i) How much do the cup **and** water weigh?

..... N

1 mark

(ii) How much does the water weigh?

..... N

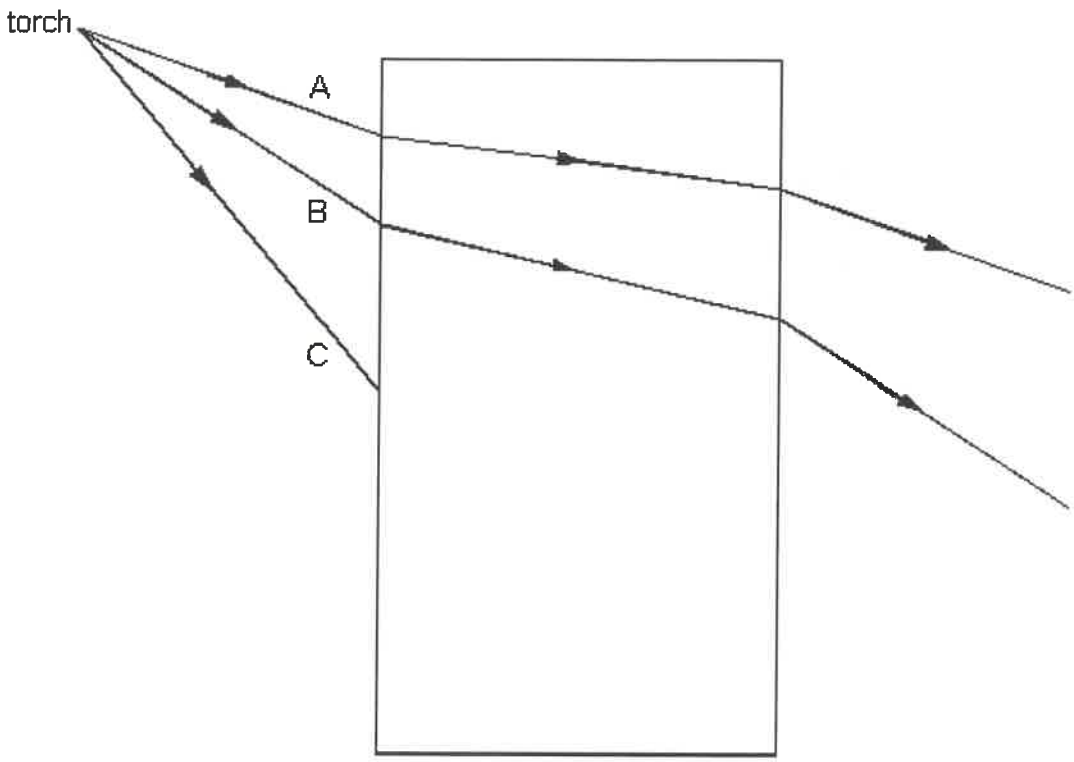
1 mark
maximum 5 marks

Q3. (a) When light travels from air to glass, it changes direction.
What is the name of this effect?

.....

1 mark

(b) The diagram below shows three rays of light A, B and C striking a glass block.



The paths of A and B have been drawn.

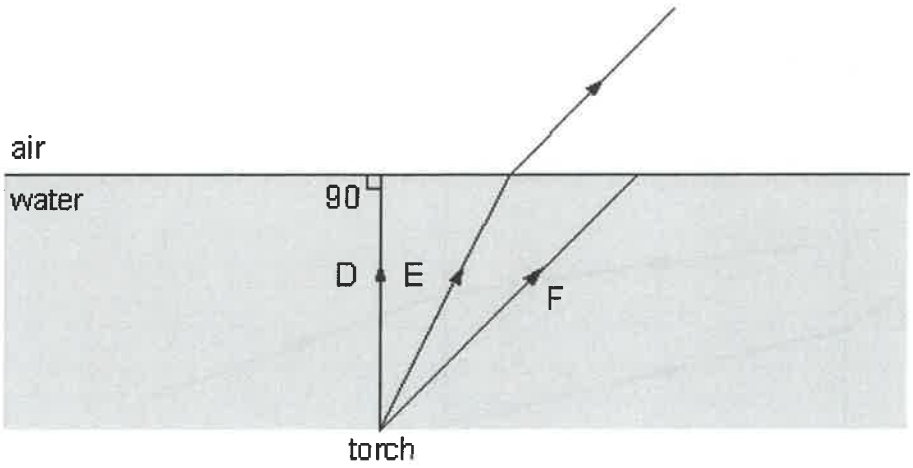
Continue ray C to show its path through the block and out the other side.
Use a ruler.

2 marks

(c) The diagram below shows three rays of light, D, E and F, from a torch placed under water.

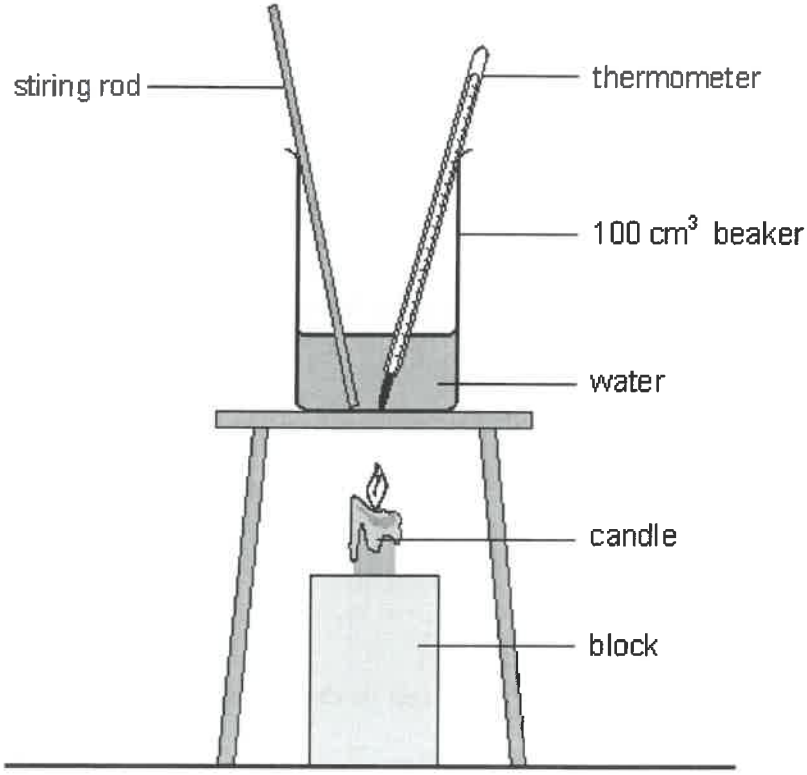
The path of ray E is shown as it leaves the water and enters the air.

Continue the paths of D and F as they pass through the air.
Use a ruler.



2 marks
maximum 5 marks

Q4. Luke investigated the heating of water. He predicted that the rise in temperature would depend on the volume of water.
The diagram shows the apparatus he used.



Luke recorded his results in a table as shown below.

beaker	volume of water, in cm^3	temperature at start, in °C	temperature after 2 minutes, in °C
A	25	18	30
B	50	18	24
C	75	18	22

(a) Why did Luke need to know the temperature of the water at the beginning and at the end of the experiment?

.....

.....

1 mark

(b) Did Luke's results support his prediction? Explain your answer.

.....

.....

1 mark

(c) Luke stirred the water during the experiment. How did this make his results more reliable?

.....

.....

1 mark

(d) Which of the following statements about the energy transferred to the beakers is correct?
Tick the correct box.

Much more energy went into beaker 'A' because its temperature increased the most. ☐

The same amount of energy went into all three beakers. ☐

Beaker 'C' received the most energy because there was more water to heat. ☐

1 mark

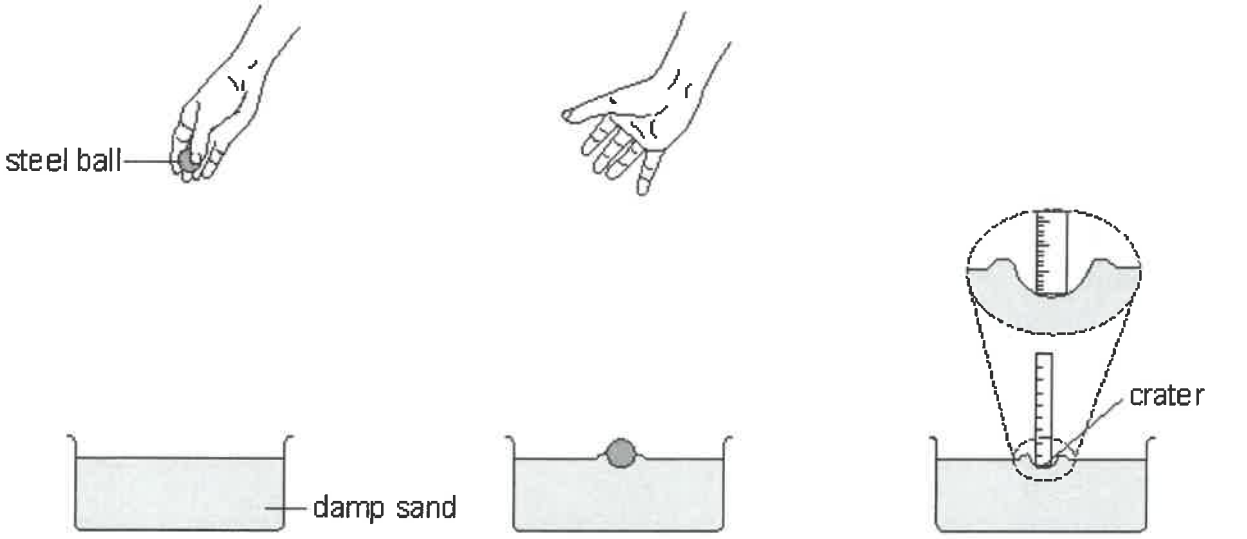
(e) After a time, all three beakers cooled down to room temperature.
What happened to the thermal energy in the beakers as they cooled down?

.....

.....

1 mark
Maximum 5 marks

Q5. Jack and Aneesa dropped a steel ball into trays of damp sand.
They measured the depth of the craters made by the steel ball.



not to scale

Their results are shown in the table below.

height the ball was dropped from (cm)	depth of crater (cm)		
	Jack's results		Aneesa's results
10	1.1	1.2	0.8
20	1.4	1.5	1.4
30	1.6	1.6	1.5
40	1.8	1.7	1.8
50	2.0	2.1	2.1

(a) Use information in the table to answer the questions below.

(i) What was the independent variable that Jack and Aneesa changed in their investigation?

.....

1 mark

(ii) Why was Jack's investigation better than Aneesa's?

.....

1 mark

(b) Look at the results in the table.
What is the relationship between the height the ball was dropped from and the depth of the crater?

.....

.....

1 mark

(c) Aneesa said that they made sure the investigation was fair.

Suggest **two** variables they must have kept the same to make their investigation fair.

1 .....

2 .....

2 marks

(d) (i) Jack removed the steel ball using his fingers. Then he measured the depth of the crater.
Aneesa said he should use a magnet instead of his fingers.

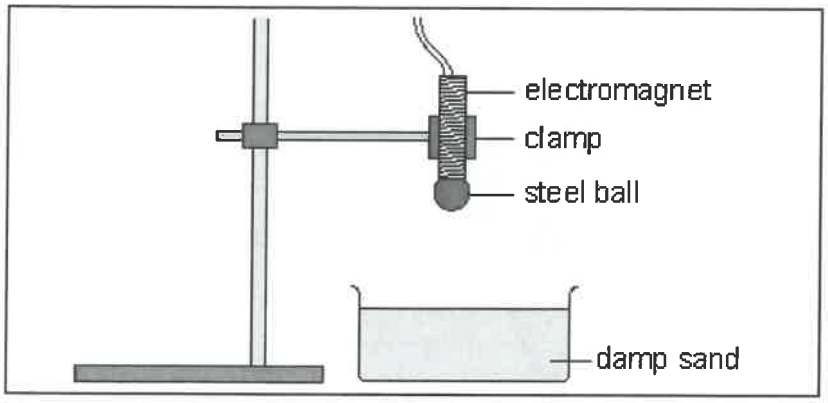
Explain why using a magnet to remove the ball would improve the investigation.

.....

.....

1 mark

(ii) Jack said that the ball could be dropped using an electromagnet instead of dropping it by hand.



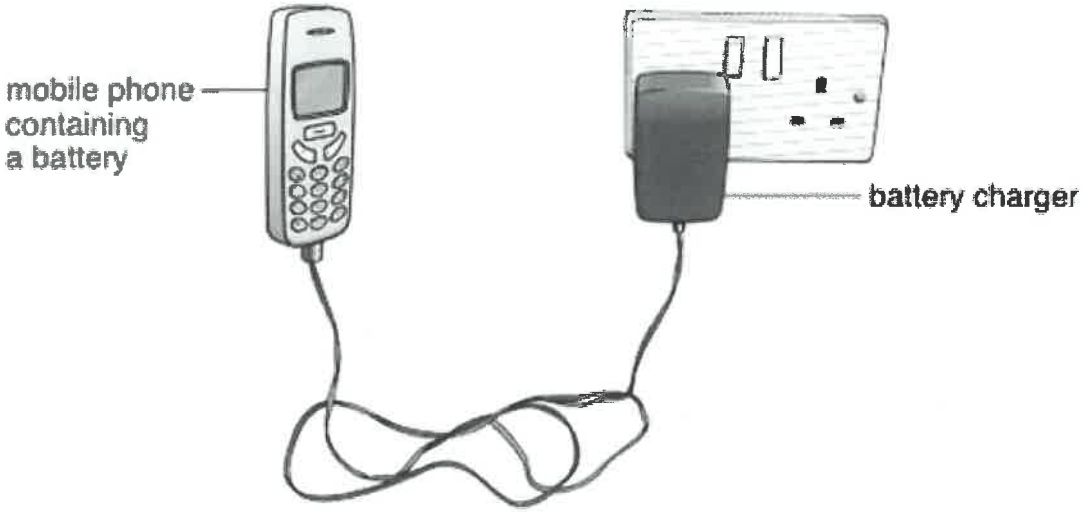
Explain why this would improve the investigation.

.....

.....

1 mark
maximum 7 marks

Q6. (a) Jacqui has a mobile phone. Energy is stored in the battery of the phone. The drawing shows the battery being charged.



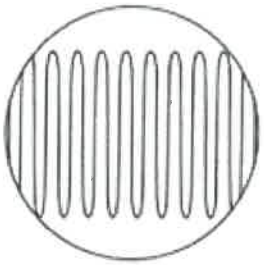
(i) Which energy transfer takes place in the battery as it is being charged?
Tick the correct box. (1 mark)

chemical to sound	☐	sound to thermal	☐
electrical to chemical	☐	thermal to electrical	☐

(ii) When the battery is fully charged, Jacqui unplugs the phone. What energy transfer takes place when the phone rings?
Tick the correct box. (1 mark)

- chemical to electrical to sound ☐
- electrical to chemical to sound ☐
- kinetic to electrical to sound ☐
- thermal to electrical to sound ☐

(b) Jacqui can change the ring tone of her phone. The diagrams below show the patterns made by four sound waves on an oscilloscope screen. They are all drawn to the same scale.



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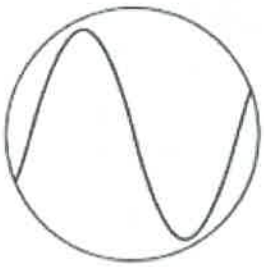
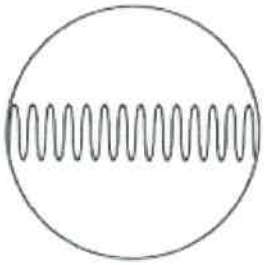
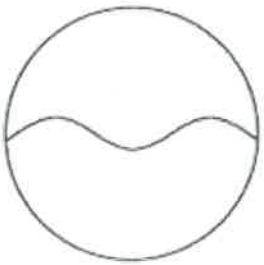


Q



R



S

Write the letter of the sound that matches each of the descriptions below (3 marks)

(i) A loud sound with a low pitch _____

(ii) A quiet sound with a high pitch _____

(iii) A loud sound with a high pitch _____

Q7. Sunita puts on a special pair of glasses as shown below. The glasses have coloured filters in them.

(a) Sunita looks at a lamp through the green filter. The lamp gives out white light but appears to be green. Explain how this is possible. (2 marks)

(b) Sunita looks at a red lamp.

(i) What colour will the red lamp appear to be if she looks through a red filter?

Explain your answer. (1 mark)

(ii) What colour will the lamp appear to Sunita if she looks through a green filter?

Explain your answer. (2 marks)

END OF PAPER