Emanuel School

13+ Entrance Exam

SCIENCE

TIME ALLOWED = One Hour

Name: .....

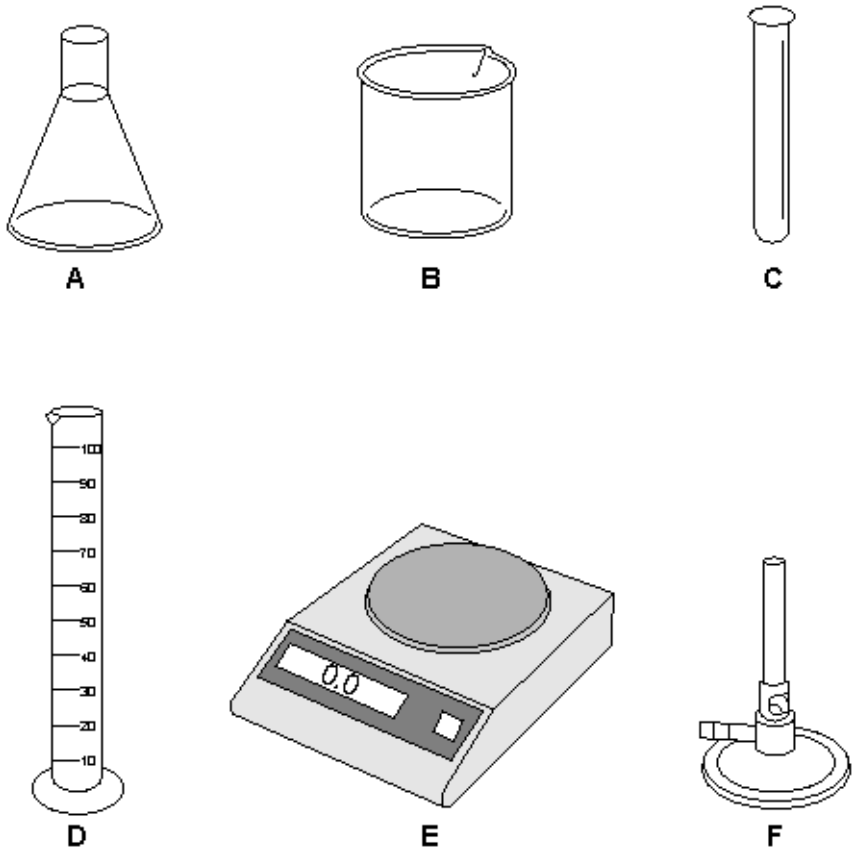
School: .....

INSTRUCTIONS:

- The test is 1 hour long and is out of 80 marks.
- You will need: a pen, a pencil, a ruler, a rubber and a calculator.
- The test starts with easier questions.
- Try to answer all the questions.
- The number of marks available for each question is given in the margin. You should not write in this margin.
- Do not use any rough paper.
- Check your work carefully.
- Ask the teacher if you are not sure what to do.

Good luck!

1. The diagram below shows six pieces of equipment.



(a) Linda investigates how quickly sugar dissolves in water.

(i) Which piece of equipment does she use to weigh 5 g of sugar?
Tick the correct box.

A	B	C	D	E	F
☐	☐	☐	☐	☐	☐

1 mark

(ii) Which piece of equipment does she use to measure out 90 cm^3 of water?
Tick the correct box.

A	B	C	D	E	F
☐	☐	☐	☐	☐	☐

1 mark

(b) Linda heats the water in a beaker.

(i) Which piece of equipment shown is a beaker?
Tick the correct box.

A	B	C	D	E	F
☐	☐	☐	☐	☐	☐

1 mark

(ii) Which piece of equipment shown is used to heat water?
Tick the correct box.

A	B	C	D	E	F
☐	☐	☐	☐	☐	☐

1 mark

(c) Linda adds 5 g of sugar to the hot water.

(i) She measures the time it takes for the sugar to dissolve.
The equipment used for timing is **not** shown in the diagram.

What piece of equipment is used to measure the time taken?

.....

1 mark

(ii) The equipment used to measure the temperature of the water is **not** shown in the diagram.

What piece of equipment is used to measure temperature?

.....

1 mark

maximum 6 marks

2. Joanne burnt four different crisps.

She predicted that the bigger the crisp, the longer it will burn.



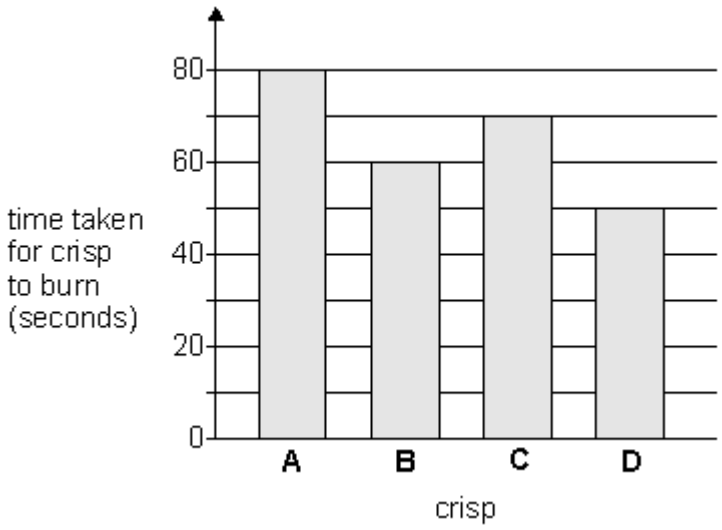
(a) Look at the picture above. What did Joanne wear to protect herself?

.....

1 mark

(b) Joanne measured the time taken for each crisp to burn completely.

The bar chart shows Joanne's results.



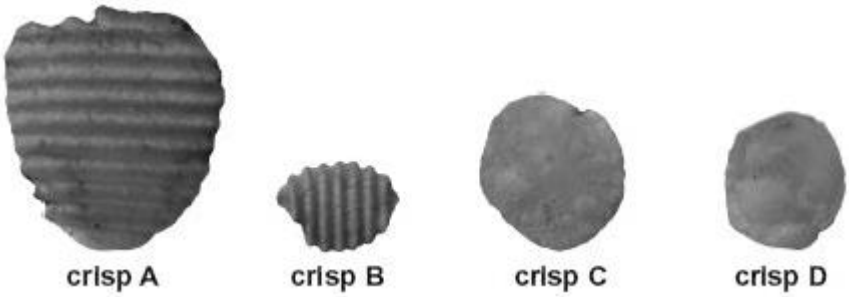
Look at the bar chart.

How much time did crisp D take to burn?

..... seconds

1 mark

(c) The crisps Joanne used in her investigation are shown below.



(i) Joanne predicted that the bigger the crisp, the longer it will burn.

Do the results support Joanne's prediction?

Tick one box.

yes ☐ no ☐

Use Joanne's results to explain your answer.

.....

.....

1 mark

(ii) How can you tell that Joanne did **not** carry out a fair test?

.....

1 mark

(d) Joanne wrote some conclusions for her investigation.

Decide whether each conclusion is **true**, **false**, or you **cannot tell**.

Tick the correct box for each conclusion.

conclusion	true	false	cannot tell
Two crisps took the same amount of time to burn.	☐	☐	☐
The smallest crisp burnt for the shortest time.	☐	☐	☐
Two of the crisps burnt with flames of the same size.	☐	☐	☐

3 marks

maximum 7 marks

3. The drawing below shows a mole. Moles dig tunnels through soil.



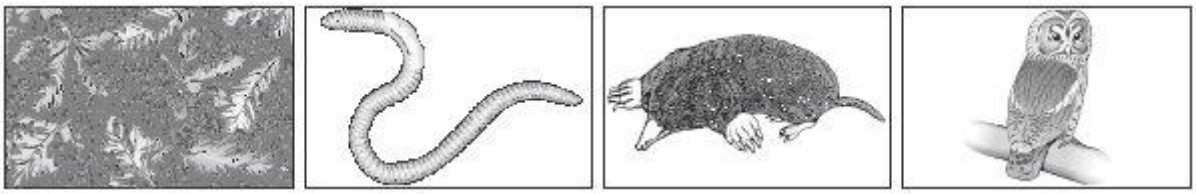
(a) Give **one** way a mole is suited for digging through soil.

.....

.....

1 mark

(b) Moles are part of the food chain shown below.



plant remains → worm → mole → owl

not to scale

(i) Which living thing in this food chain do moles eat?

.....

1 mark

(ii) Which living thing in this food chain is a predator of moles?

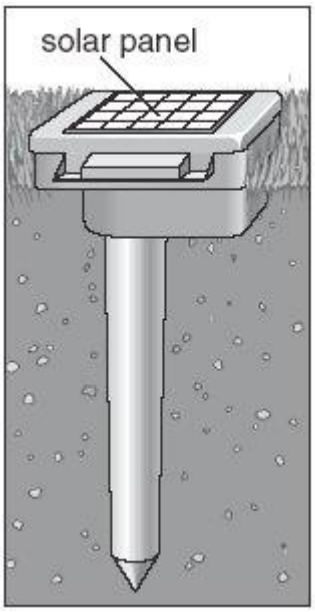
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1 mark

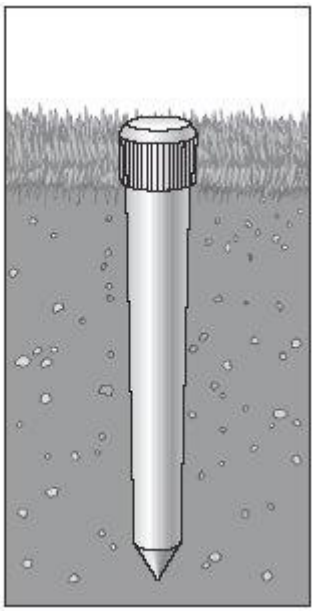
(c) Some people use mole-scarers to get rid of moles from their gardens.

Two different mole-scarers are shown below.

They both produce sounds that scare moles away.



solar-powered mole-scarer



battery-powered mole-scarer

(i) Where does the energy come from for the solar-powered mole-scarer?

.....

1 mark

(ii) Suggest **one** reason for using a solar-powered mole-scarer instead of a battery-powered mole-scarer.

.....

.....

1 mark

(iii) Some gardeners use poison to kill moles.

Suggest **one** reason for using a mole-scarer rather than poison to get rid of moles.

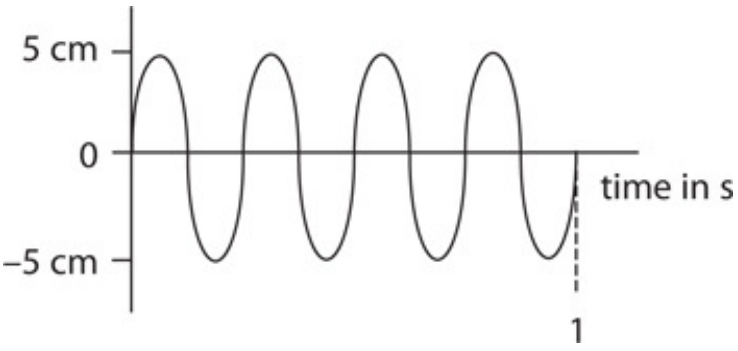
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1 mark

maximum 6 marks

4. The diagram shows a sound wave.



(a) State the amplitude of this sound wave.

- ☐ 0.25 second
- ☐ 1 second
- ☐ 10 centimetres
- ☐ 5 centimetres

1 mark

(b) The sound wave above is:

- ☐ A longitudinal wave
- ☐ A transverse wave
- ☐ Neither longitudinal nor transverse
- ☐ It depends on which medium it travels through

1 mark

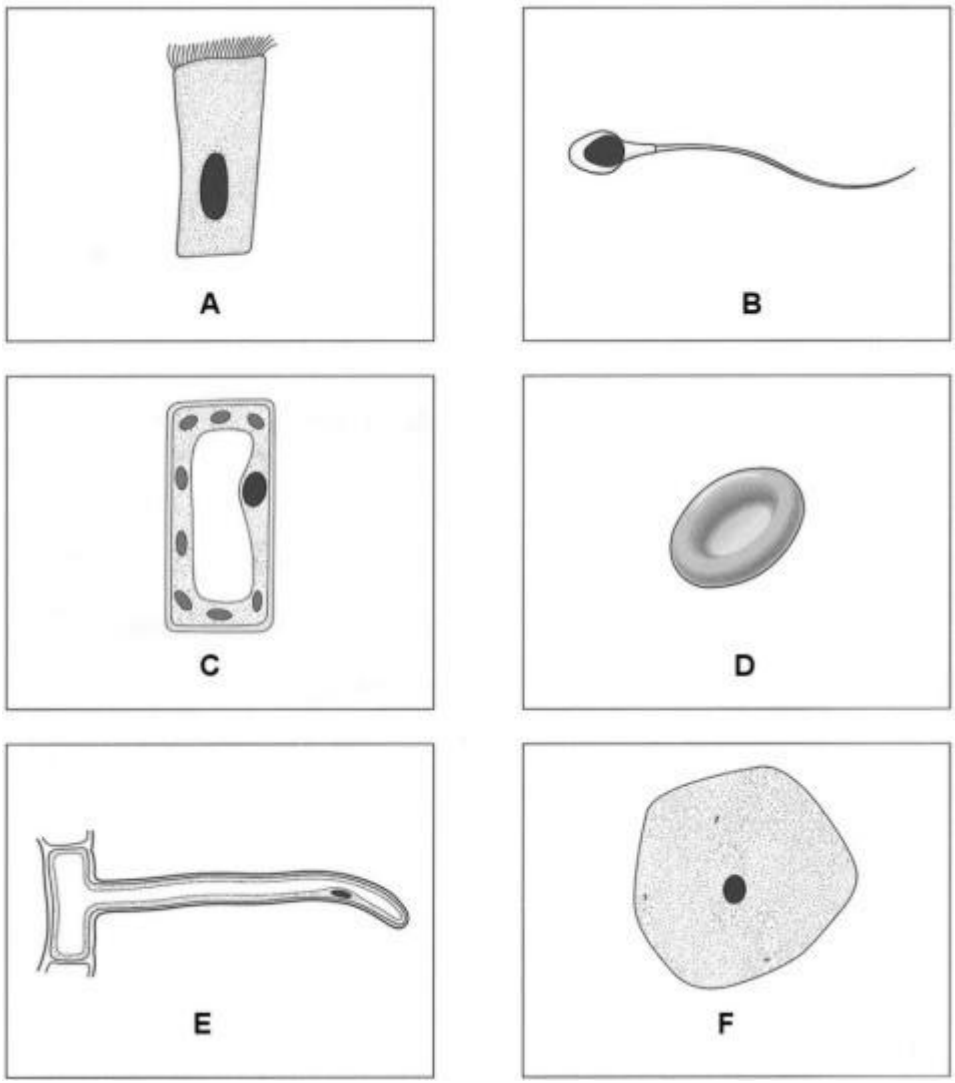
(c) Alasdair is considering what media sound waves can travel through. He is aware of a vacuum, fluids (gases and liquids) and solids as being the three media he has read about. Sound waves can travel:

- ☐ only in a vacuum
- ☐ only in fluid media
- ☐ only in solid and fluid media
- ☐ in all of the media: vacuum, fluids and solids

1 mark

maximum 3 marks

5. The diagram below shows six cells.



(a) (i) Give the letters of the **two** plant cells in the diagrams.

..... and .....

1 mark

(ii) Which **one** of these plant cells contains chloroplasts?
Give the letter.

.....

1 mark

(iii) Give the function of chloroplasts.

.....

.....

1 mark

(b) (i) Give the letter of the ciliated cell.

.....

1 mark

(ii) In which part of the body are ciliated cells found?

.....

1 mark

(iii) What is the function of ciliated cells in this part of the body?

.....

.....

1 mark

(c) Give the letter of the cell which transfers genetic information from father to offspring.

.....

1 mark

maximum 7 marks

6. Mina wants to find the mass of her school bag.

She has a weighing scale, as shown, marked in kilograms.



The weighing scale is not working properly.

With nothing hanging from it, still shows a reading.

NOTE: The picture is for reference only. You do not need to be able to read the measurement it shows.

a) Mina decides to check the weighing scale but she has no accurate weights.



Instead, she puts some tins of beans in a plastic bag and hangs it from the scale.

Her readings are shown in the table.

Number of tins of beans	1	2	3	4	5	6
Scale reading (in kg)	1.9	2.3	2.8	3.7	3.5	3.9

i) What is the dependent variable in this investigation?

.....

1 mark

ii) Draw a graph to show how the scale reading varies with the number of tins of beans. Note that both your axes should start at 0.

4 marks

iii) Circle the anomalous point on your graph.

1 mark

(b) Mina notices that the label on each tin says 'contains 0.4 kg of beans'. Deduce from the graph what the scale is reading when there is nothing hanging from it.

.....

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3 marks

(c) When she puts her school bag onto the scale it reads 5kg. How heavy is Mina's bag really?

.....

1 mark

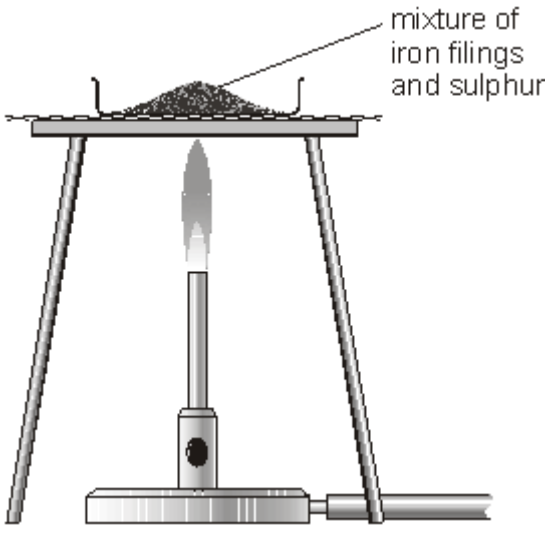
maximum 10 marks

7. 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

(c) Raj held a magnet near to each of the three chemicals.

By each chemical in the table, write **yes** or **no** to show if the chemical was magnetic.

One has been done for you.

chemical	**Was the chemical magnetic?**
sulphur	
iron	
iron sulphide	no

1 mark

(d) (i) When iron is heated with sulphur, iron sulphide is formed.

Give the name of the solid formed when **zinc** is heated with sulphur.

.....

(ii) Some fossil fuels contain sulphur.

When fuels burn, sulphur reacts with oxygen.

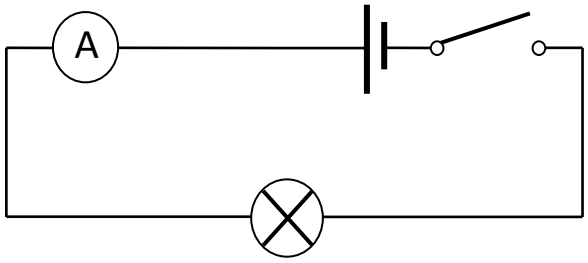
Complete the word equation for this reaction.

sulphur + oxygen → .....

2 marks

maximum 6 marks

8. Dom sets up the circuit below. He wants to investigate the characteristics of electrical current.



(a) Jenny says that it is good that Dom has put the ammeter in the position shown because if he had connected it between the lamp and switch, the current would have been used up by the lamp and would be a lot less to measure.

Is Jenny right? Explain the physics underlying your decision.

.....

.....

.....

.....

2 marks

(b) The circuit is known as a 'series' circuit.

Dom decides to add another identical light bulb into the circuit.

He first places the new light bulb in *series* with the first and measures the current in the ammeter with the switch closed.

(i) How would the ammeter reading compare to the reading in the original circuit? Explain your reasoning.

.....

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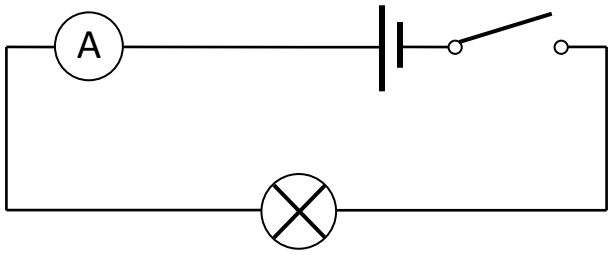
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2 marks

He then decides to move this bulb so it is in parallel with the original bulb instead.

(ii) Add the new bulb to the diagram below:



1 mark

(iii) How would the ammeter reading compare in to the original circuit?

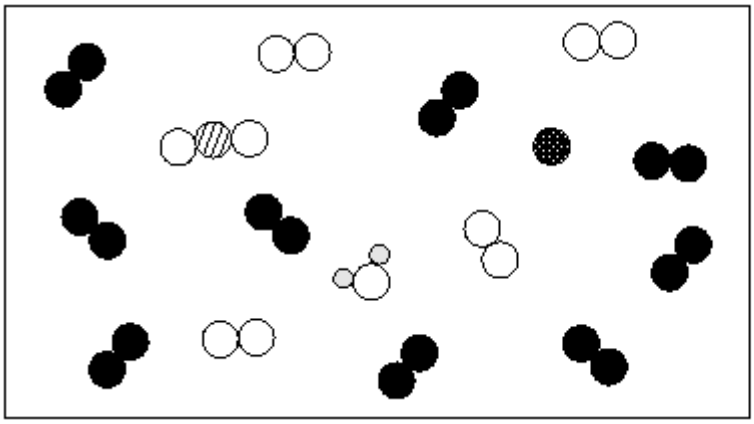
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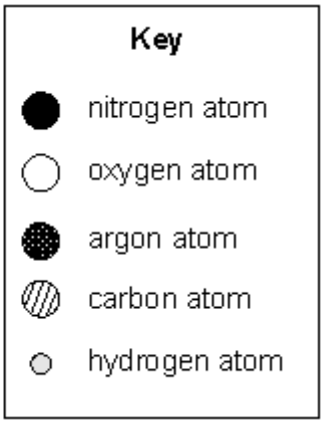
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1 mark

maximum 6 marks

9. The diagram below represents the particles found in air.





(a) Complete the following table. Use the diagram and key above to help you.

name	symbol	chemical formula
argon		Ar
nitrogen		
oxygen		O_2
		

3 marks

(b) Air is a **gas** at room temperature.

What evidence in the particle diagram on the previous page above shows this?

.....

1 mark

(c) A sample of air in a balloon is cooled.

Complete the sentences below using words from the box.

You may use each word more than once.

increases	**decreases**	**stay the same**

When the air is cooled, the volume of the air ..... and

the mass of the air ..... .

When the air is cooled, the density of the air ..... .

1 mark

(d) In 1902, the scientist Carl von Linde cooled air to produce **liquid oxygen**.

The table below shows the melting points and boiling points of four substances that are found in air.

substance	**melting point (°C)**	**boiling point (°C)**
argon	–189	–186
oxygen	–218	–183
nitrogen	–210	–196
water	0	100

Before Linde, scientists tried to produce **liquid air** by cooling it to –190°C.

Give a reason why liquid air was not produced.

.....

.....

1 mark

maximum 6 marks

10. The drawings show identical twins, Sara and Helen, and their parents.



father



mother



Sara



Helen

(a) (i) Sara and Helen have blue eyes like their mother.

Describe how genetic information is passed on from a parent to a child.

.....

.....

.....

.....

2 marks

(ii) Sara and Helen have brown hair like their father and blue eyes like their mother.

Why do children have characteristics of both parents?

.....

.....

1 mark

(b) Sara and Helen are identical twins.

Why do they have identical characteristics?

.....

.....

1 mark

(c) Sara now spends a lot of her time working outdoors in a hot country.
Helen now works in an office in England.

The table shows information about three human characteristics.

characteristic	**Is it identical for Sara and Helen?**
eye colour	yes
skin colour	no
weight	no

Explain why their eye colour is identical but their weight and skin colour are **not** identical.

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.....

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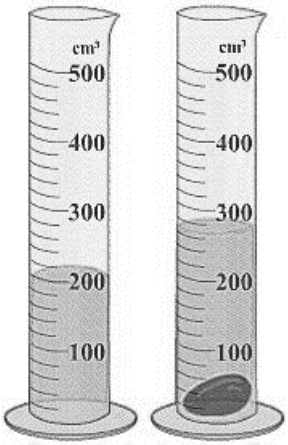
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2 marks

maximum 6 marks

11. Andy is investigating density. He takes a small pebble and measures its volume using water in a measuring cylinder.



Without the pebble, the volume reading is 200cm^3.

With the pebble, the volume reading is 260cm^3.

(a) Calculate the volume of the pebble in cm^3.

.....

.....

1 mark

(b) Its mass is found to be 72g. Find the density of the pebble in g/cm^3.

.....

.....

.....

.....

Density = ... g/cm^3

3 marks

(c) Concentrated glucose solution has a density of 1.4 g/cm^3. **State** whether or not the pebble would float in concentrated glucose solution, and **explain your answer**.

.....

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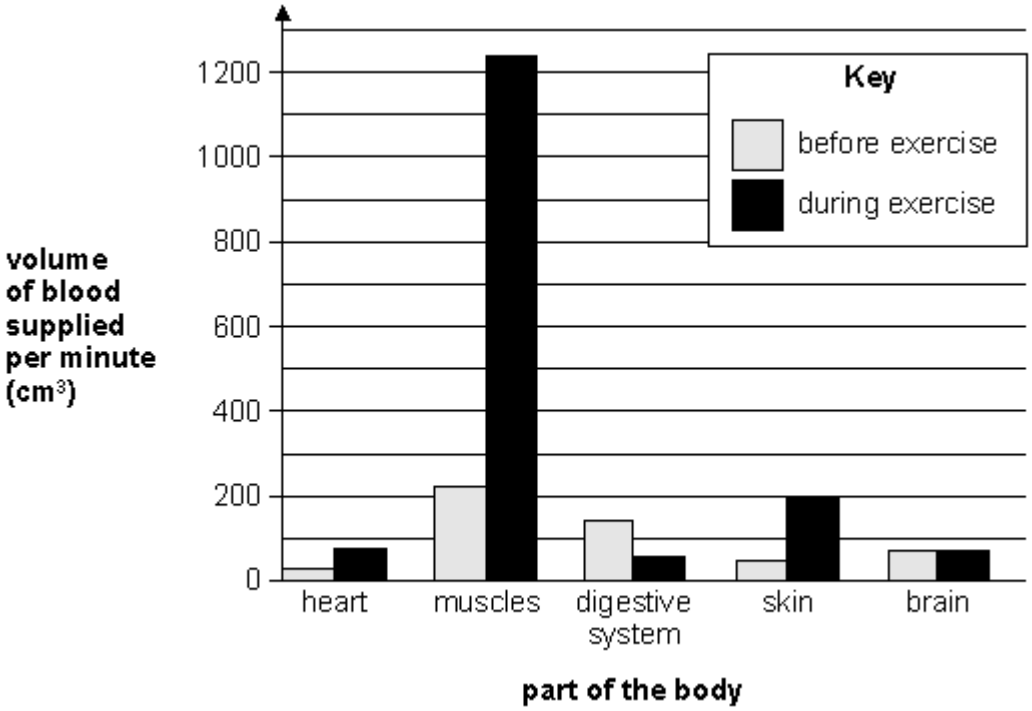
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2 marks

maximum 6 marks

12. When people exercise, the volume of blood per minute needed to supply different parts of the body changes.

This is shown in the bar chart below.



(a) Explain why muscles need **more** blood during exercise. Give **three** reasons.

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.....

.....

3 marks

(b) Look at the bar chart.

Suggest why you should not go for a long run just after eating a meal.

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1 mark

(c) Why is it important that the blood supply to the brain stays constant?

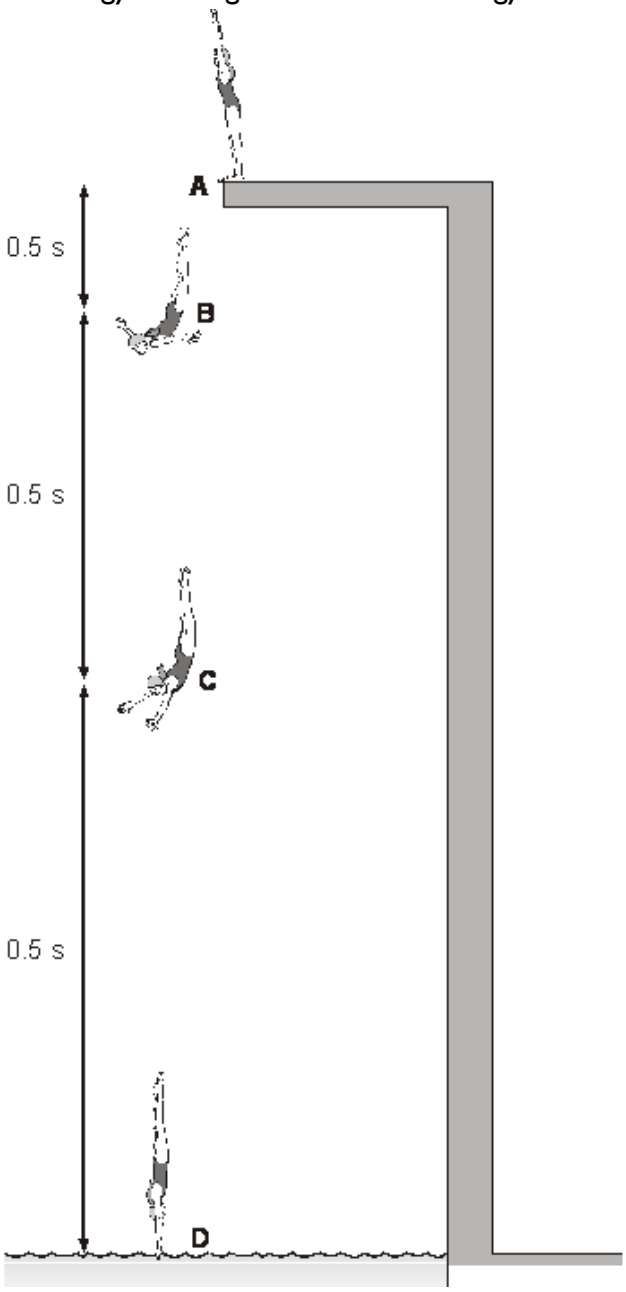
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1 mark

maximum 5 marks

13. The drawings below show Caroline diving into a swimming pool.
As she falls, gravitational potential energy is changed into kinetic energy.



(a) Why does Caroline have **no** kinetic energy at A?

.....

.....

1 mark

(b) The table shows Caroline's gravitational potential energy and kinetic energy at four stages of the dive.

stage of the dive	total energy (kJ)	gravitational potential energy (kJ)	Kinetic energy (kJ)
A	8	8	0
B	8	7	1
C	8	4	4
D	8	0	

(i) Write the missing kinetic energy value for stage D in the table.

1 mark

(ii) As Caroline falls there is **no** loss of energy to the air.

How do the energy values for stages A, B, C and D show this?

.....

.....

1 mark

(c) (i) Give the name of the force that causes Caroline to speed up as she falls.

.....

1 mark

(ii) Caroline takes 0.5 s to fall from A to B **and** from B to C **and** from C to D.

How can you tell from the drawings that she is speeding up as she falls?

.....

.....

1 mark

(d) When Caroline enters the water she slows down.

Give the name of the force that slows her down.

.....

1 mark

maximum 6 marks

End of Paper