

13+ ENTRANCE EXAMINATION



SOLIHULL

SAMPLE PAPER

SCIENCE

Read these instructions carefully

You have **one** hour in which to complete this examination.

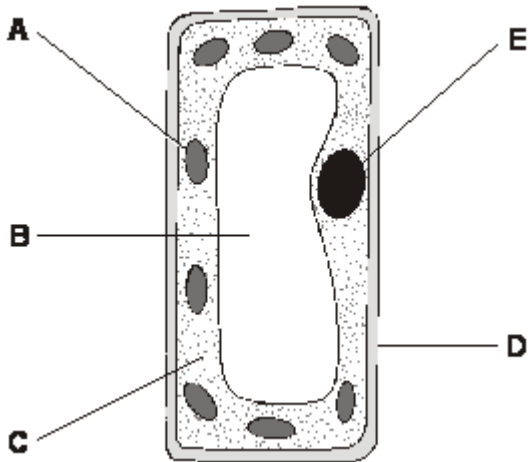
Attempt all questions.

You may use a calculator if you wish.

Write your answers in the spaces provided.

The marks awarded are next to each question.

Q1. The diagram shows a plant cell.



(a) Give the name of part A.

.....

Give the function of part A.

.....

.....

2 marks

(b) Give the name of part E.

.....

Give the function of part E.

.....

.....

2 marks

(c) Give the letters of **two** parts that are present in plant cells but **not** in animal cells.

..... and

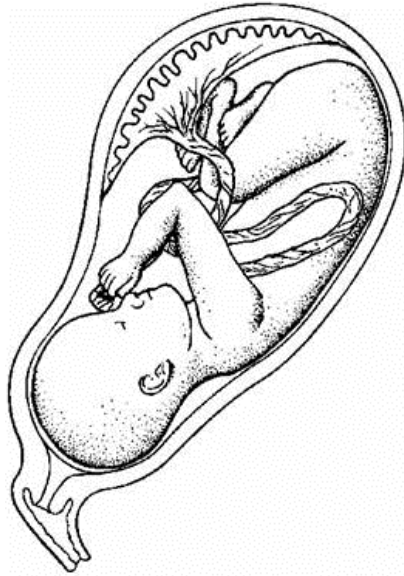
1 mark

(d) How can you tell that the cell in the diagram is from a leaf and **not** from a root?

.....

1 mark
maximum 6 marks

Q2. The drawing shows a baby inside its mother's uterus.



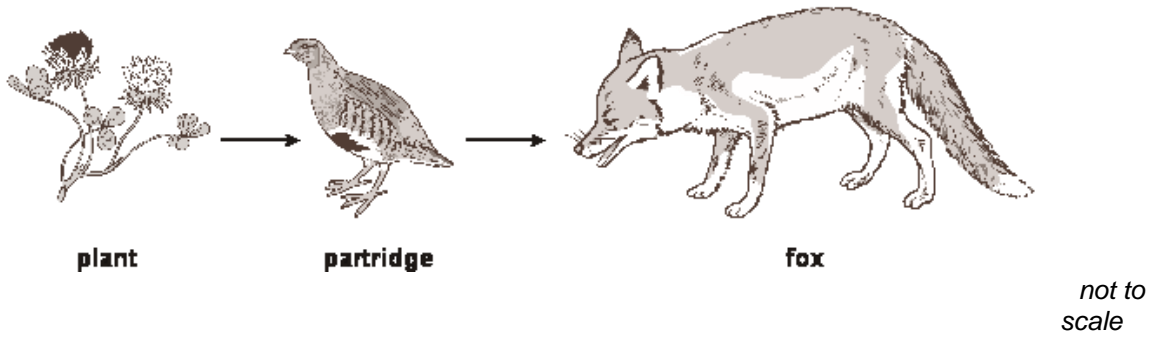
Some substances pass from the mother's blood to the baby's blood.
Other substances pass from the baby's blood to the mother's blood.

Which way, if any, do the substances in the table pass?
Tick **one** box in each row.

substance	passes from the mother's blood to the baby's blood	passes from the baby's blood to the mother's blood	does not pass between the mother's blood and the baby's blood
poisons from cigarette smoke			
oxygen			
digested food			
carbon dioxide			

4 marks

Q3. The drawings show part of a farmland food chain.



(a) State a scientific word that describes the fox in this food chain
.....

1 mark

(b) Partridges feed mainly on insects and wild plants (weeds).

Some farmers spray their crops with chemicals to kill insects and weeds.

How would this affect the number of foxes?

.....

Explain your answer.

.....

.....

1 mark

(c) Partridges build their nests on the ground among plants.
They lay up to 18 eggs in the nest.

Suggest why partridges need to lay so many eggs.

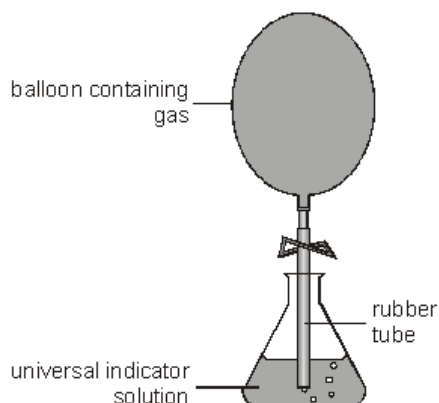
.....

.....

1 mark

maximum 3 marks

- Q4.** A scientist compared the acidity of four gases to see which gas might cause acid rain. She used four balloons to collect the gases. She then bubbled the gases, in turn, through a fresh sample of green, neutral, universal indicator solution.



- (a) Three of the gases caused the indicator to change colour. The scientist added drops of alkali to the indicator until the indicator changed back to green. Her results are shown in the table below.

gases collected	change in colour of indicator	number of drops of alkali needed to change the indicator back to green
exhaust gases from a car	green to red	31
carbon dioxide	green to red	160
air	no change	0
human breath	green to yellow	10

Use information in the table to answer part (i) and part (ii) below.

(i) Which gas dissolved to form the most acidic solution?

.....

Explain your choice.

.....

.....

1 mark

(ii) Which gas formed a neutral solution?

.....

Explain your choice.

.....

.....

1 mark

(iii) What effect does an alkali have on an acid?

.....

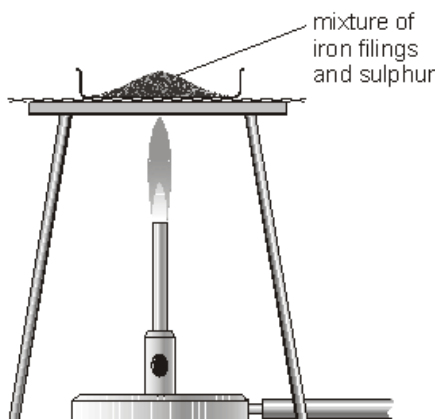
1 mark

(b) Some metals react with acids in the air.
Complete the word equation for the reaction between zinc and hydrochloric acid.

zinc + hydrochloric acid → +

2 marks
maximum 5 marks

Q5. 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.

.....

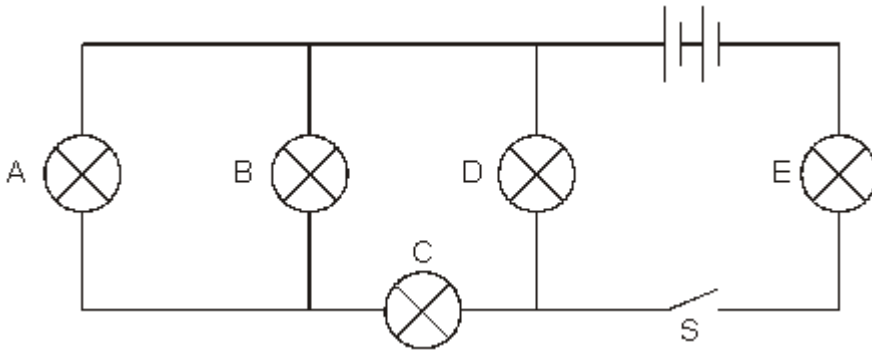
(ii) Some fossil fuels contain sulphur.
When fuels burn, sulphur reacts with oxygen.

Complete the word equation for this reaction.

sulphur + oxygen →

2 marks
maximum 6 marks

Q6. (a) Max built **circuit 1** as shown below.



circuit 1

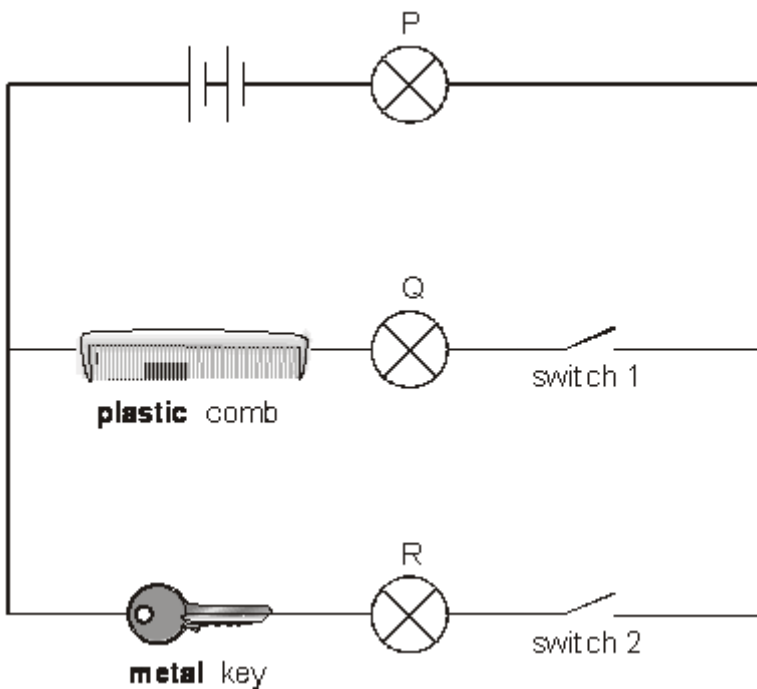
He closed the switch, S, and all the bulbs came on.
One of the bulbs then broke and **all** the bulbs went off.

Which bulb must have broken?
Give the letter.

.....

1 mark

(b) Max built **circuit 2** as shown below.
He connected a plastic comb and a metal key in different parts of the circuit.



circuit 2

Look carefully at **circuit 2**.

Complete the table below to show which bulbs in circuit 2 will be on or off when different switches are open or closed.

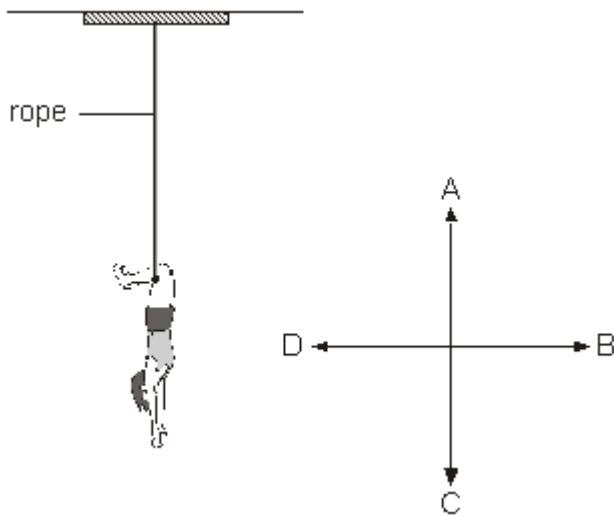
Write **on** or **off** in the boxes below.

switch 1	switch 2	bulb P	bulb Q	bulb R
open	open	off	off	off
open	closed			
closed	open			

2 marks

maximum 3 marks

Q7. The diagram below shows Jo hanging on a trapeze (swing) in a circus.



(a) (i) Which arrow, A, B, C or D, shows the direction of Jo's weight?

.....

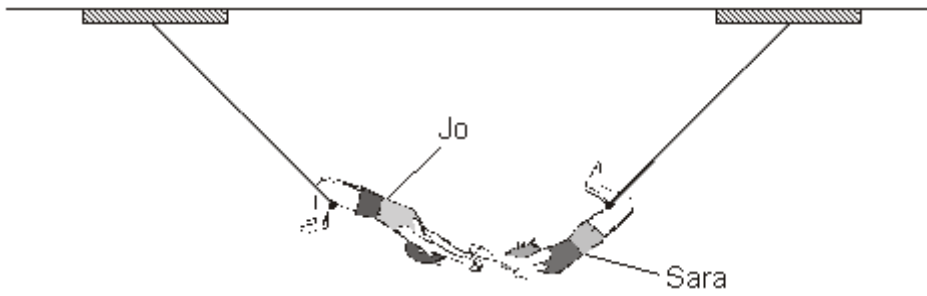
1 mark

(ii) Which arrow, A, B, C or D, shows the direction of the force of the rope on Jo?

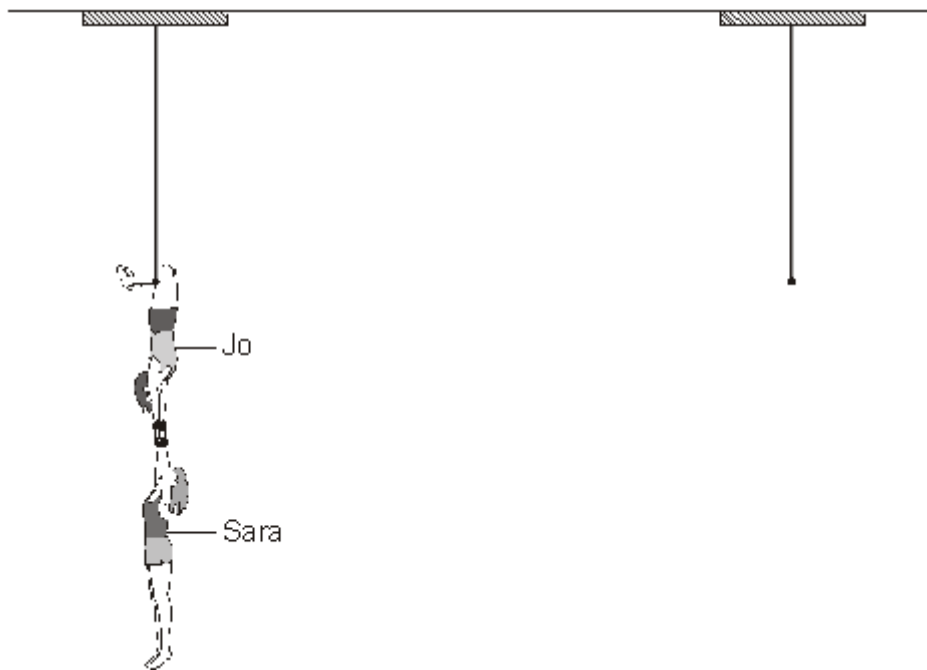
.....

1 mark

(b) Sara swings towards Jo.



Sara lets go of her trapeze and Jo catches her.



(i) What happens to the downward force on the rope of Jo's trapeze?
Tick the correct box.

increases

decreases

stays the same

there is **no** force

1 mark

(ii) Explain your answer.

.....

1 mark

(c) Jo lets go of the trapeze and both Sara and Jo fall into a safety net below them.

What happens to the downward force on the rope when Jo lets go?

.....

1 mark
maximum 5 marks

Q8. 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.

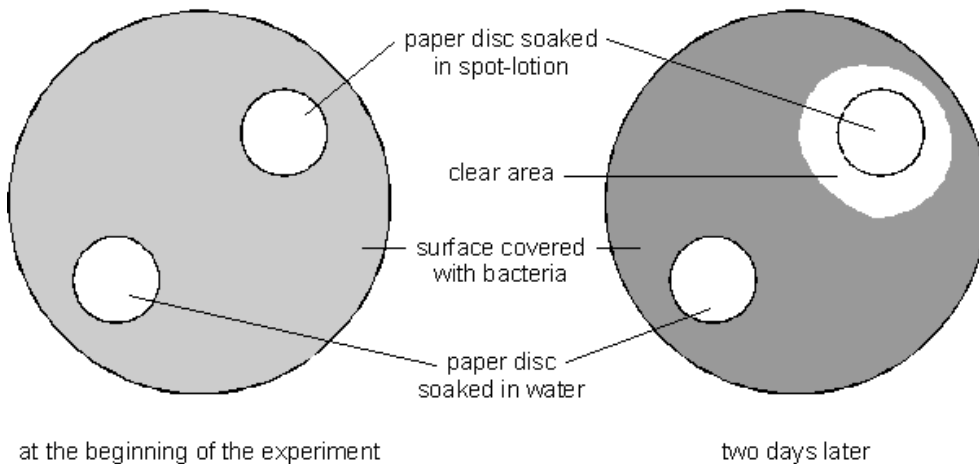
At what temperature would the bacteria reproduce quickly?

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

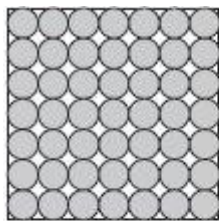
(d) Give **two** safety precautions the researcher should take to avoid contact with the bacteria.

1.
2.

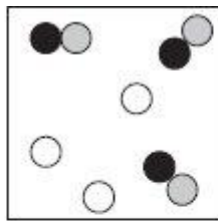
2 marks
Maximum 5 marks

Q9. (a) The diagrams below show the arrangement of atoms or molecules in five different substances A, B, C, D and E.

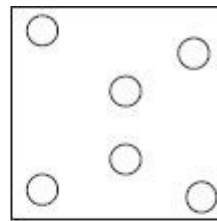
Each of the circles ,  and  represents an atom of a different element.



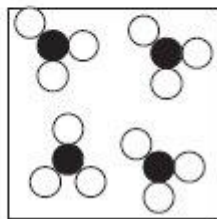
A



B



C



D



E

Give the letter of the diagram which represents:

(i) a mixture of gases;

.....

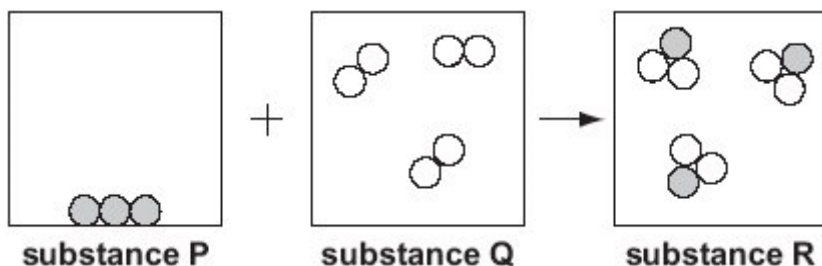
1 mark

(ii) a single compound.

.....

1 mark

(b) The diagram below shows a model of a chemical reaction between two substances.



(i) How can you tell from the diagram that a chemical reaction took place between substance P and substance Q?

.....
.....

1 mark

(ii) Substance P is carbon.

Suggest what substances Q and R could be.

substance Q

substance R

1 mark

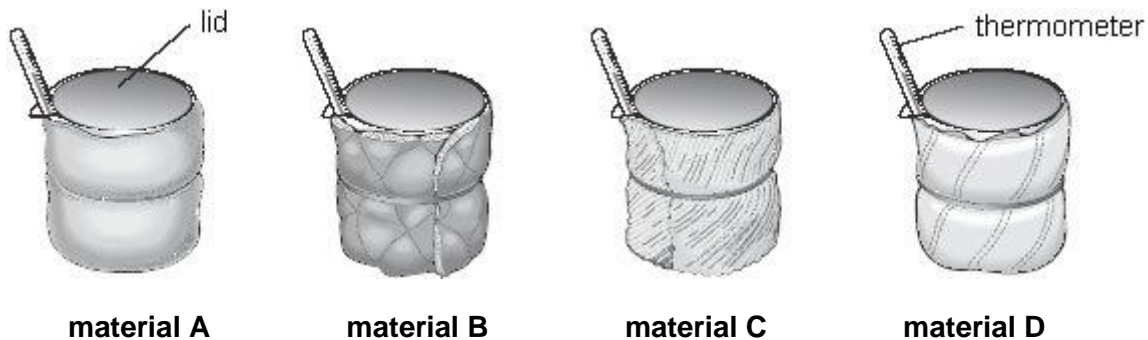
(iii) How does the diagram show that mass has been conserved in this reaction?

.....
.....

1 mark
maximum 5 marks

Q10. 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

Q11. James shone a ray of light at a mirror as shown below.

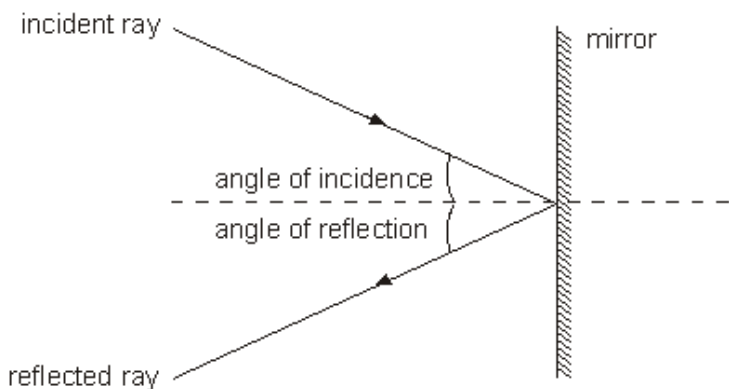


diagram 1

He measured the angle of **reflection** for different angles of incidence. His results are shown below.

angle of incidence ($^{\circ}$)	30	40	50	60	70
angle of reflection ($^{\circ}$)	30	40	50	65	70

(a) Which angle of reflection was **not** measured accurately?

..... $^{\circ}$

How can you tell this from the table?

.....

1 mark

(b) James set up a different experiment as shown below.

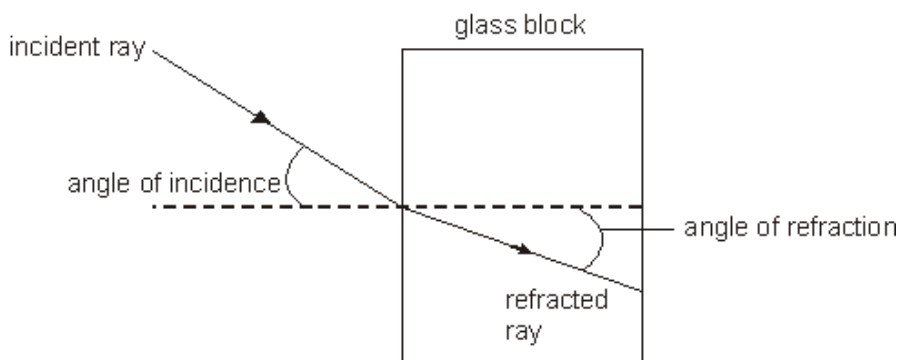
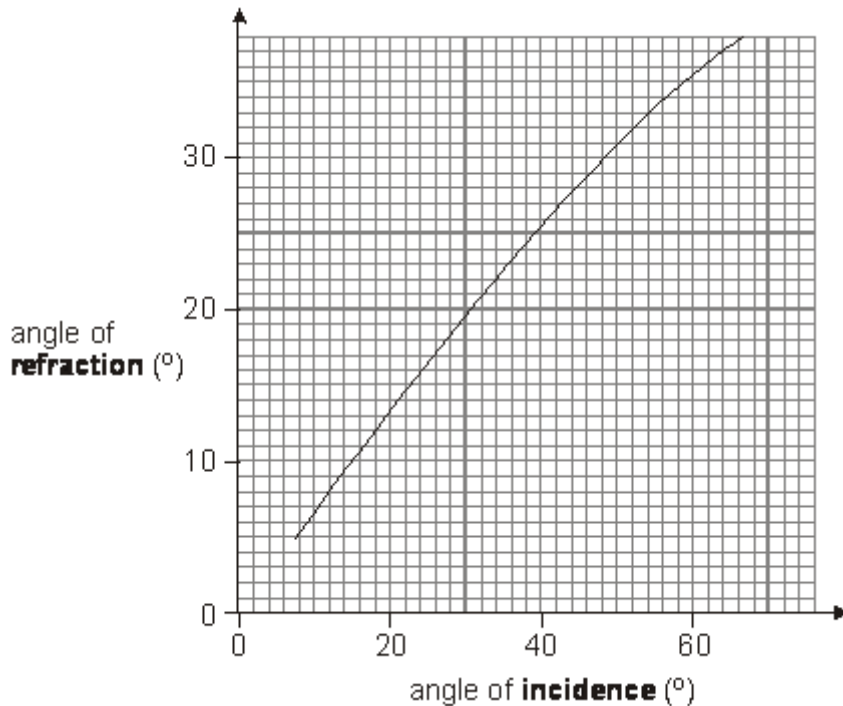


diagram 2

He measured the angle of **refraction** for different angles of incidence.

His results are shown in the graph.



Use the graph to answer the questions below.

- (i) When the angle of **refraction** is 20° , what is the angle of **incidence**?

..... $^\circ$

1 mark

- (ii) What conclusion could James draw from his graph?
Complete the sentence below.

When light passes from air into glass, the angle of **incidence** is

always the angle of **refraction**.

1 mark

- (c) **On diagram 2**, draw a line to continue the refracted ray as it leaves the glass block.

1 mark
maximum 4 marks

Q12. Table 1 gives information about 100 g of five different foods.

food	energy per 100 g of food (kJ)	nutrients per 100 g of each food			
		protein (g)	fat (g)	carbohydrate (g)	calcium (mg)
banana	403	1.2	0.3	23.2	6
wholemeal bread	914	9.2	2.5	41.6	54
butter	3031	0.5	81.7	0	15
cheese	1708	22.5	34.4	0.1	720
milk	275	3.2	3.9	4.8	115

table 1

(a) Look at **table 1**.

(i) Which of the four **nutrients**, protein, fat, carbohydrate or calcium, provides most of the energy in the cheese?

.....

(ii) Which of the four **nutrients** provides most of the energy in the wholemeal bread?

.....

(iii) Which of the four **nutrients** is needed for growth and repair?

.....

3 marks

(b) The recommended daily amount of protein for a woman is 45 g.

Look at **table 1**.

How many grams of cheese would provide 45 g of protein?

Tick the correct box.

50 g 100 g 150 g 200 g

1 mark

(c) **Not** all the types of nutrients needed for a balanced diet are shown in **table 1**.

Give the name of **one** of the missing types of nutrient.

.....

1 mark

- (d) **Table 2** shows the recommended daily amount of calcium for a person in four stages of the human life cycle.
We need calcium for healthy teeth and bones.

person	recommended daily amount of calcium (mg)
a baby aged 6 months	600
a woman before she is pregnant	500
a pregnant woman	1200
a breast-feeding woman	

table 2

- (i) Use information in **table 2** to estimate how much calcium a breast-feeding woman should have each day.

..... mg

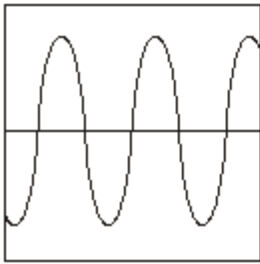
- (ii) Explain why she would need this amount of calcium.

.....
.....

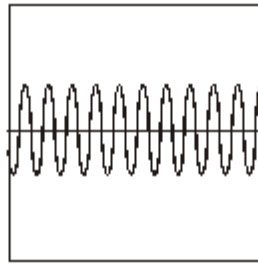
2 marks
maximum 7 marks

Q13.

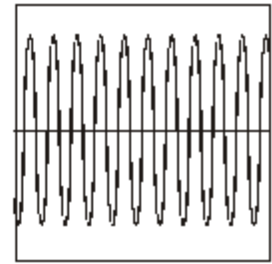
(a) The diagrams below show the patterns produced on an oscilloscope by three different sound waves.



A



B



C

(i) Which **two** waves have the same loudness?
Write the letters.

..... and

How do the diagrams show this?

.....
.....

1 mark

(ii) Which **two** waves have the same pitch?
Write the letters.

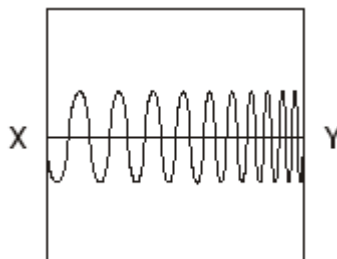
..... and

How do the diagrams show this?

.....
.....

1 mark

(iii) Shuli is listening to a sound that produces the pattern below.



Describe how the sound that Shuli **hears** changes between X and Y.

.....

1 mark

- (b) The table below shows the maximum time a person can listen to music at different sound levels without damage to the ear.

sound level (decibels)	maximum time (hours)
86	8
88	4
90	2
92	1
94	0.5

Estimate the maximum time a person could listen to a sound of 87 decibels.

..... hours

1 mark

- (c) The diagram below shows part of the human ear.



What happens to the ear drum as a sound gets louder?

.....
.....

1 mark
maximum 5 marks

END OF QUESTIONS