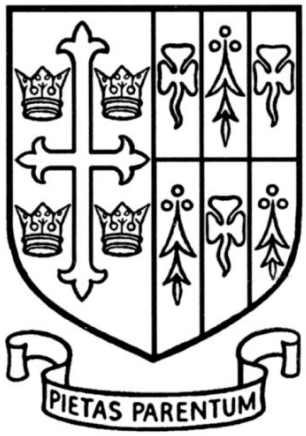
ST EDWARD'S
OXFORD



13+ Entrance Examination

For Entry in

September 2018

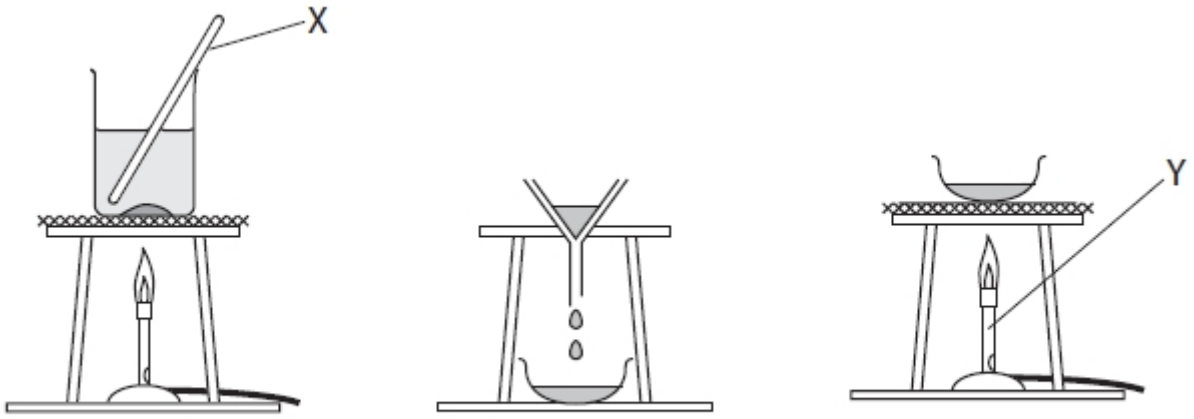
Science

1 hour

Candidate Name: …….

Q1.

The diagram shows the apparatus a student uses to separate a mixture of salt and sand.
She adds the mixture to water in a beaker and then carries out the three stages shown.



(a) Give the names of the pieces of apparatus labelled X and Y.

(2)

X .....

Y .....

(b) (i) A liquid that dissolves substances is a

(1)

- ☒ **A** solute
- ☒ **B** solution
- ☒ **C** solvent
- ☒ **D** suspension

(ii) The clear liquid that forms in stage 1 is a

(1)

- ☒ **A** solute
- ☒ **B** solution
- ☒ **C** solvent
- ☒ **D** suspension

(c) (i) At which stage, 1, 2 or 3, is the sand collected?

(1)

.....

(ii) At which stage, 1, 2 or 3, is the salt collected?

(1)

.....

(d) What happens to the water in stage 3?

(1)

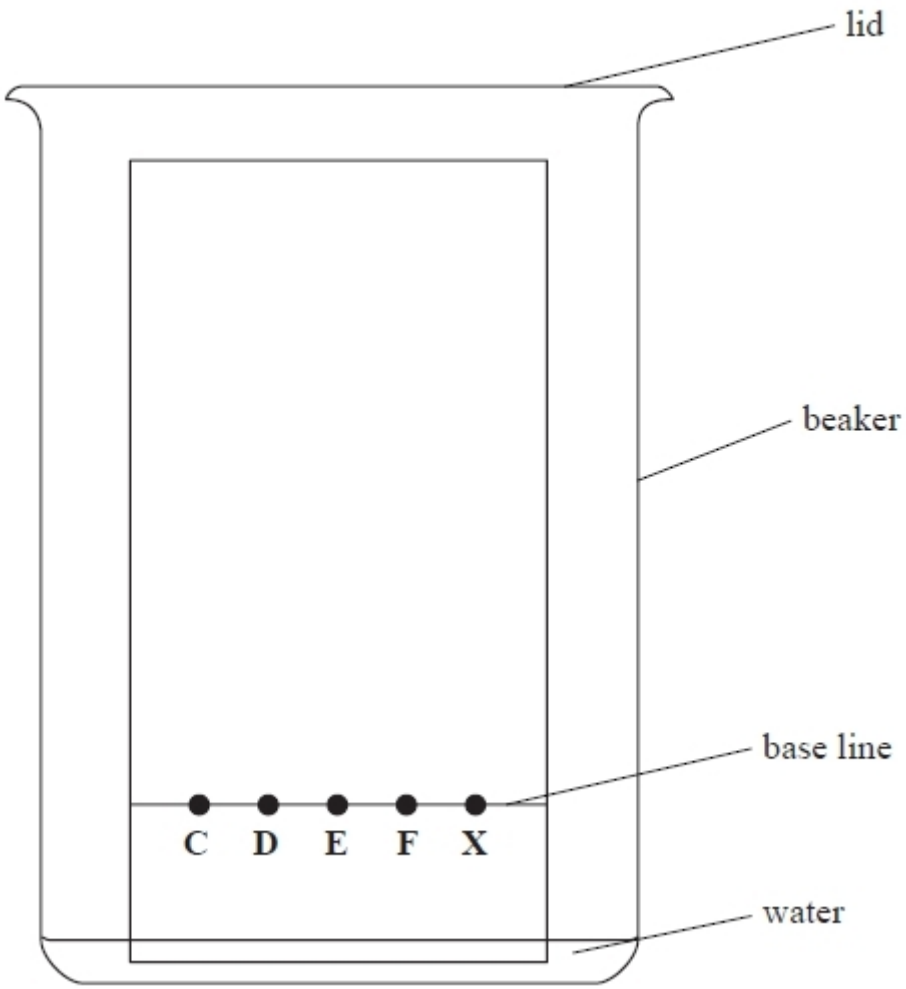
.....

.....

(Total for question = 7 marks)

Q2.

Four separate food dyes (**C**, **D**, **E** and **F**) and a mixture of food dyes (**X**) were investigated using paper chromatography. The diagram shows the apparatus used.



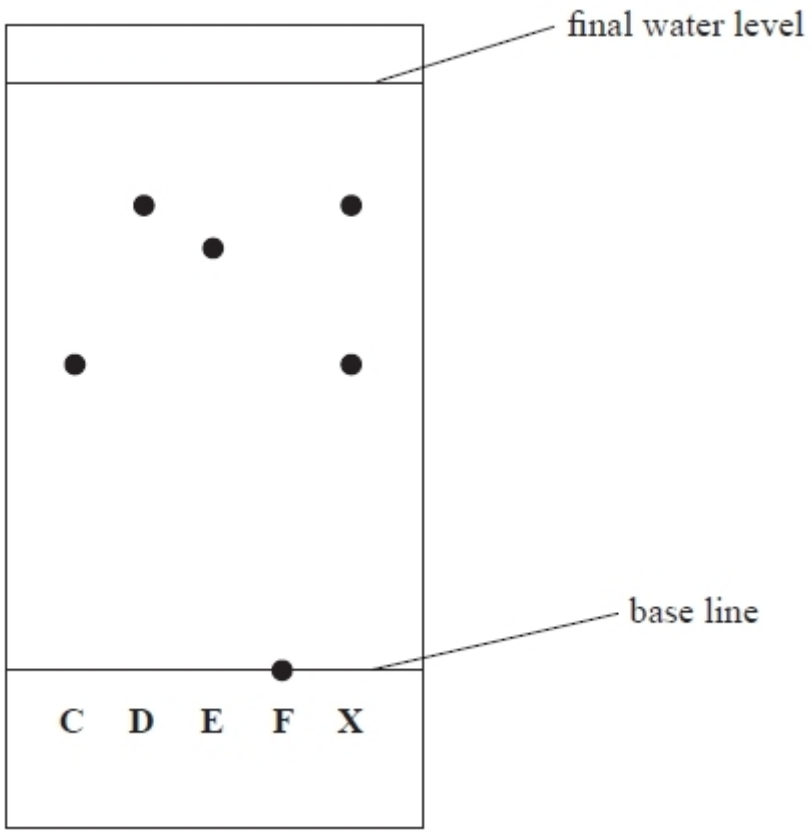
(a) Why should the water level be below the food dyes?

(1)

.....

(b) During the experiment the water rises up the paper. The experiment is stopped just before the water reaches the top of the paper.

The diagram shows the paper after it has been removed from the beaker and dried.



(i) Which of the food dyes **C**, **D**, **E** and **F** does **X** contain?

(1)

.....

(ii) Suggest why food dye **F** did not move up the paper during the experiment.

(1)

.....

(c) Each food dye has an R_f value that can be calculated using this expression:

$$R_f = \frac{\text{distance moved by food dye from base line}}{\text{distance moved by solvent from base line}}$$

Record the distances for food dye **D** in the table below and calculate its R_f value.

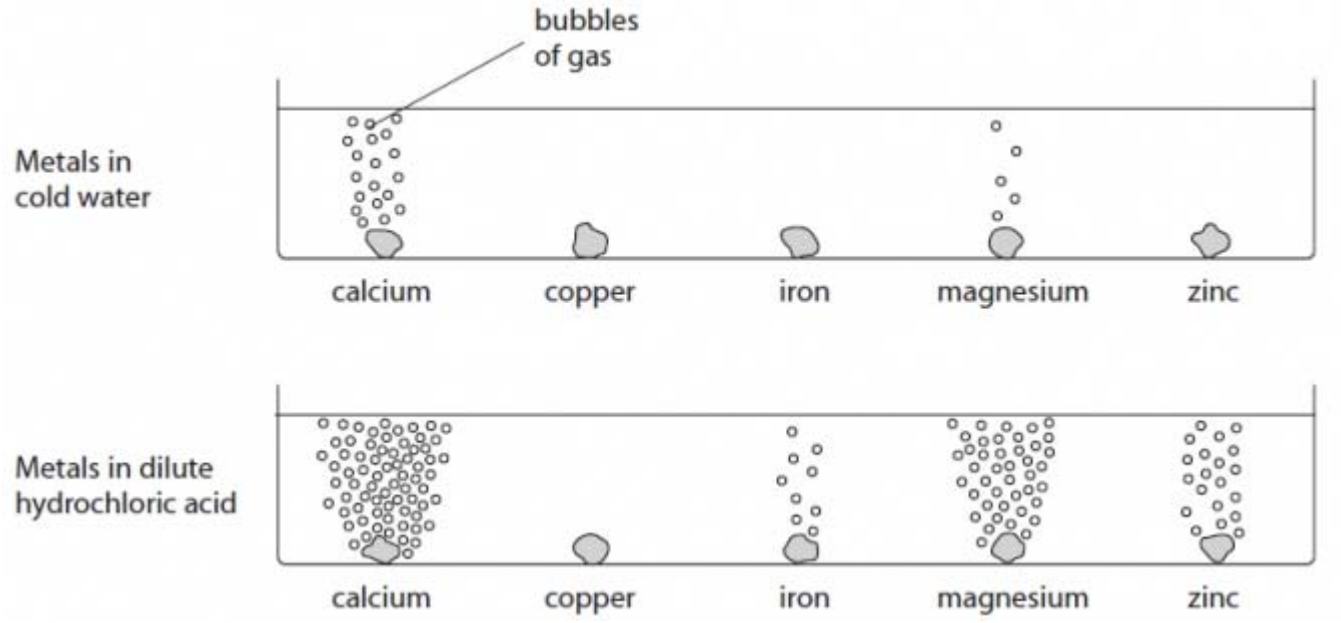
(3)

Distance moved by food dye **D** from base line in mm	
Distance moved by solvent from base line in mm	
R_f value	

(Total for question = 6 marks)

Q3.

The diagrams show the reactions of some metals with cold water and with dilute hydrochloric acid.



(a) Answer the following questions, using only the metals that appear in the diagrams.

(i) Name **two** metals that react with cold water.

(2)

..... and .....

(ii) Name **one** metal that reacts with dilute hydrochloric acid but not with cold water.

(1)

.....

(iii) Arrange the five metals in order of reactivity.

(3)

Most reactive metal .....

.....

.....

.....

Least reactive metal .....

(b) Some magnesium powder is added to dilute sulfuric acid in a test tube.

A colourless solution is formed and a gas is given off.

When more magnesium is added, the reaction continues for a while and then stops, leaving some magnesium powder in the test tube.

When a flame is placed at the mouth of the test tube, the gas burns with a squeaky pop.

Identify the gas produced.

(1)

.....

(**Total for question = 7 marks)**

Q4.

The photograph shows a bee collecting nectar from a flower.

(a) Nectar is made from glucose produced by plants. Name the process that plants use to make glucose.

(1)

.....

(b) (i) When the bee collects nectar from the flower, the plant benefits because the pollen sticks to the bee and is carried to another flower.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The relationship between the bee and the plant is an example of:

(1)

☒ **A** decomposing
☒ **B** eutrophication
☒ **C** mutualism
☒ **D** parasitism

(ii) Some bees have evolved a new method of collecting nectar from flowers. They drill a small hole in the base of the flower and collect the nectar through the hole. This means the pollen does not stick to the bee. Suggest why this is an advantage to the bees.

(2)

.....

.....

.....

.....

(c) Bees can sting people. State the physical barrier of the human body that would have to be broken by the bee sting.

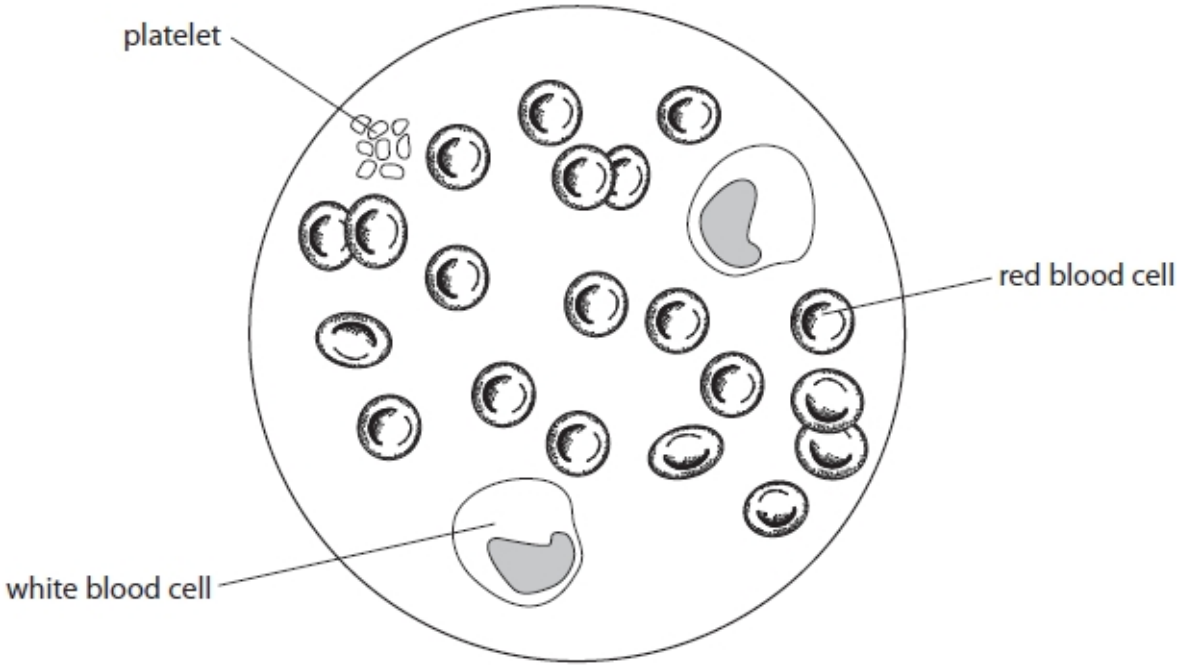
(1)

.....

(Total for Question is 5 marks)

Q5.

The diagram shows a blood sample from a patient.



(i) State the ratio of red blood cells to white blood cells in this blood sample.

(1)

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Platelets in the blood:

☒ **A** transport glucose

☒ **B** transport carbon dioxide

☒ **C** have a nucleus

☒ **D** are involved in blood clotting

(iii) Red blood cells are adapted to carry oxygen.

Explain how one feature of a red blood cell increases the amount of oxygen carried.

(2)

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q6.

Type 2 diabetes is associated with being obese. A high Body Mass Index (BMI) is an indication of obesity.

BMI is calculated using this equation.

$$\text{Body Mass Index} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

Calculate the BMI for a 90 kg man who is 1.50 metres tall.

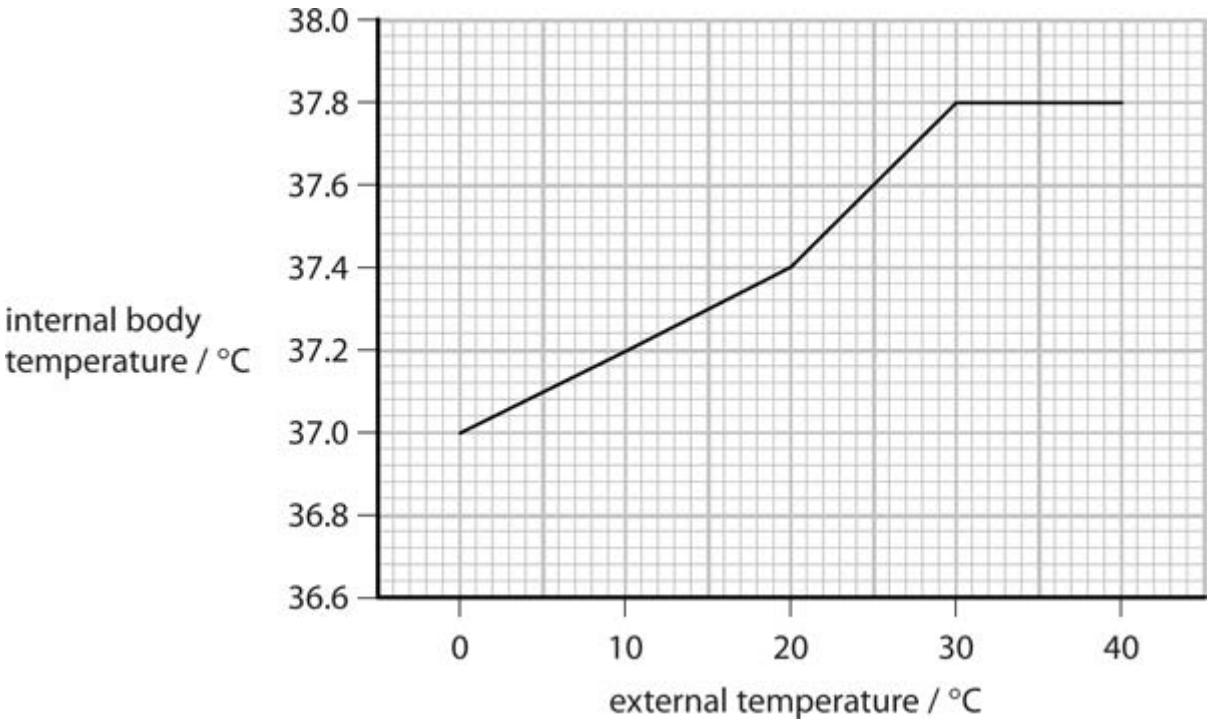
(2)

.....

(Total for question = 2 marks)

Q7.

A scientist investigated the effect of changes in external temperature on a person's internal body temperature. The graph shows the results of this investigation.



(a) (i) Calculate the difference in internal body temperature between an external temperature of 20°C and 40°C.

(1)

answer = ...°C

(ii) Explain why it is important that body temperature does not rise above 40°C.

(2)

.....

.....

.....

.....

(b) Explain how hair on the skin helps to maintain body temperature in a cold environment.

(2)

.....

.....

.....

.....

(Total for question = 5 marks)

Q8.

The photographs show a 350 year-old light microscope and a modern light microscope.

(a) (i) Suggest how the modern light microscope helps us to see cells in greater detail than the 350 year-old microscope. Use the photographs to help you.

(2)

.....

.....

.....

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Structures in bacterial cells are so small they can only be seen using

(1)

☒ **A** a hand lens

☒ **B** an electron microscope

☒ **C** a light microscope

☒ **D** a camera

(b) State the function of the nucleus in the animal cell.

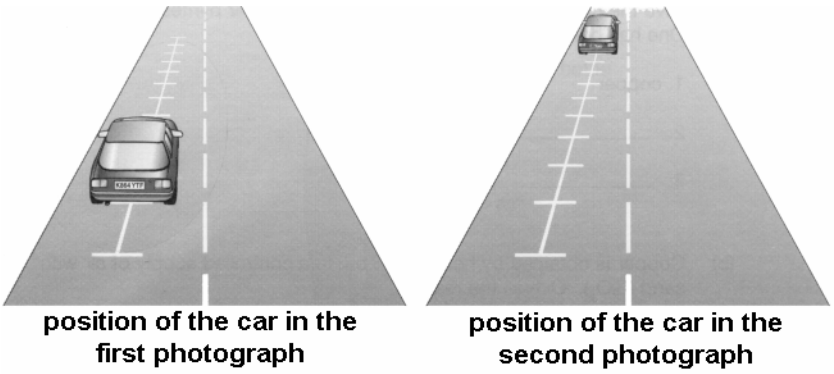
(1)

.....

.....

(Total for question = 4 marks)

Q9. Speed cameras are used to detect motorists who break the speed limit. A number of lines 2 m apart are painted on the road. As a speeding car crosses the painted lines, the camera takes two photographs, 0.5 s apart.



(a) (i) How far did the car move between the two photographs?
Give the correct unit.

.....

.....

1 mark

(ii) How fast is the car in the photographs moving?

.....

..... **m/s**

1 mark

(b) It takes 0.0002 s to take each photograph.
How far does the car move while the speed camera is taking **one** photograph?

.....

..... **m**

1 mark

(c) The speed camera gives out bright flashes to provide enough light for the photographs.
How does the light from the flash get back to the camera to produce the photographs?

.....

.....

1 mark

Maximum 4 marks

Q10. Sue pumps up a bicycle tyre. As she does so, she notices that the pump becomes hot.

(a) Where, and how, was the energy stored before it was transferred in pumping up the tyre?

.....

1 mark

(b) Explain how the gas molecules inside the tyre exert pressure on the walls of the tyre.

.....

.....

1 mark

(c) The air going into the tyre was warmed up by the pumping. What effect will this have on the motion of gas molecules in the air in the tyre?

.....

.....

1 mark

(d) When the air in the tyre becomes hotter, the pressure rises. Give **one** reason, in terms of the motion of gas molecules in air, why the pressure rises.

.....

.....

1 mark

(e) The pressure in the tyre increases as Sue forces more air into the tyre. Explain why a larger number of gas molecules increases the pressure in the tyre.

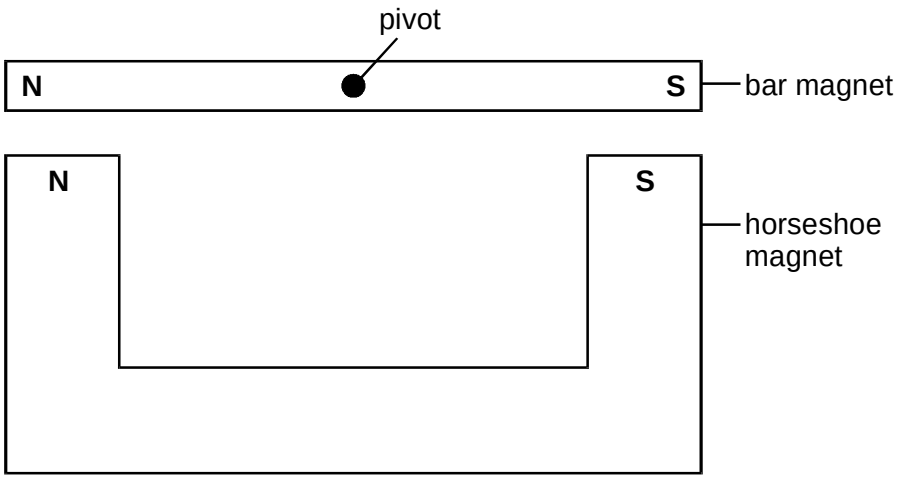
.....

.....

1 mark

Maximum 5 marks

Q11. Anita has arranged a horseshoe magnet with a long bar magnet pivoted above it.



(a) Whenever Anita tips the bar magnet, it always moves back to the position shown in the diagram. Explain why this happens.

……

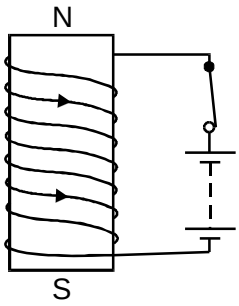
……

……

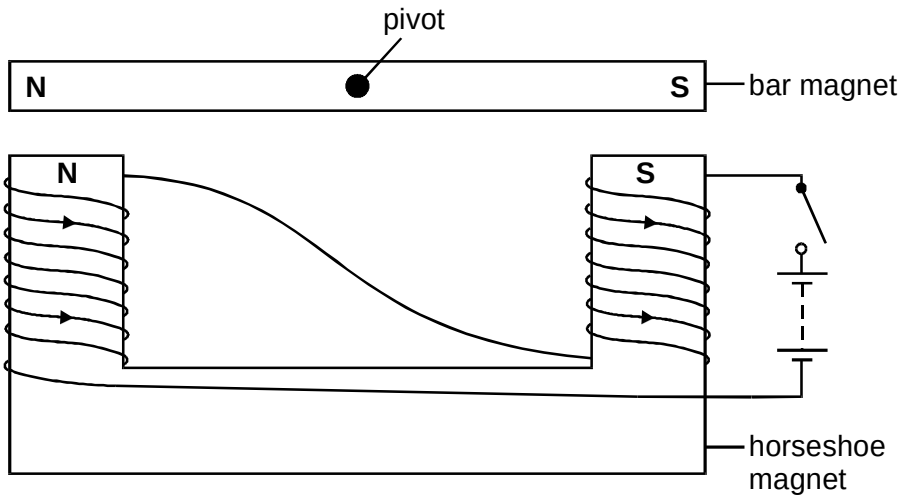
……

2 marks

(b) When a current is passed through a coil, it produces magnetic poles as shown in the diagram below.



Anita winds a coil around each end of the horseshoe magnet as shown below.



(i) Describe what will happen to the bar magnet when she closes the switch. Explain your answer.

……

……

……

……

……

……

3 marks

(ii) Anita reverses the battery. Suggest what happens to the bar magnet.

……

……

1 mark

(iii) Anita replaces the battery with a power supply which changes the direction of the current every second. Suggest what happens to the bar magnet.

……

……

1 mark

Maximum 7 marks

Q12. James shone a ray of light at a mirror as shown below.

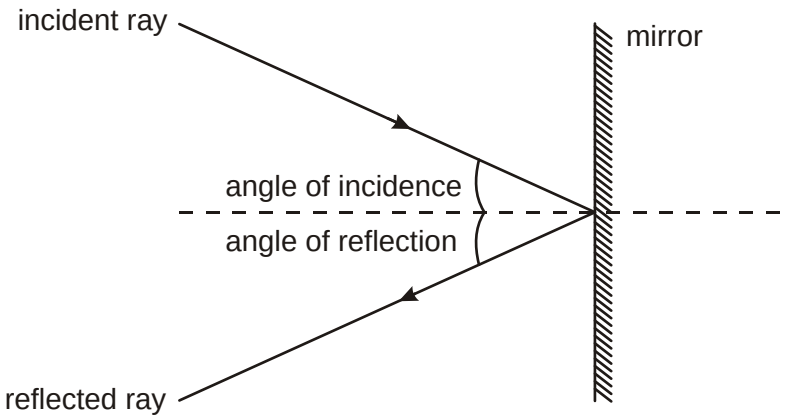


diagram 1

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

angle of **incidence** (º)	30	40	50	60	70
angle of **reflection** (º)	30	40	50	65	70

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

.....°

How can you tell this from the table?

.....

.....

1 mark

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

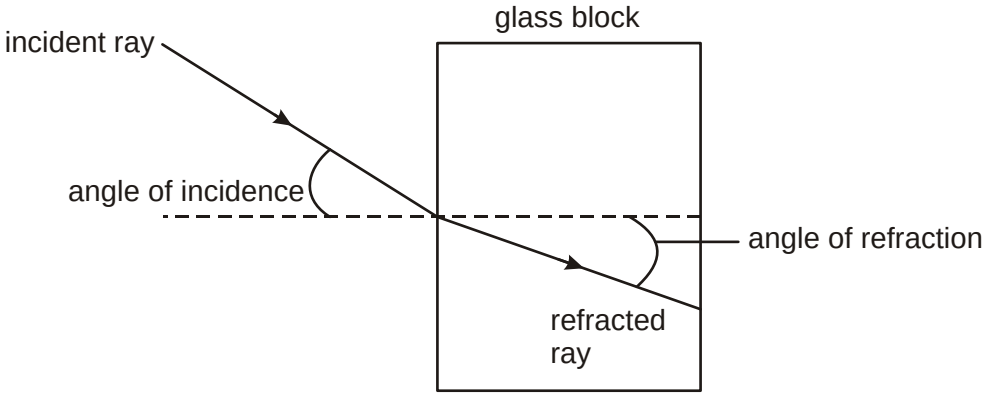
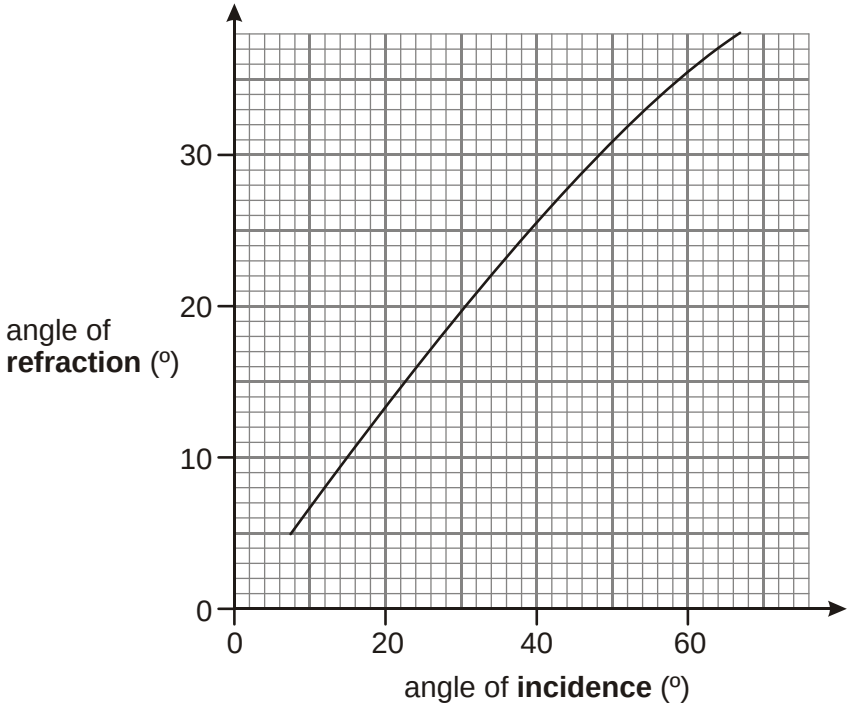


diagram 2

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**?

.....°

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