HARROW
SCHOOL

SIXTH FORM ENTRY PAPER

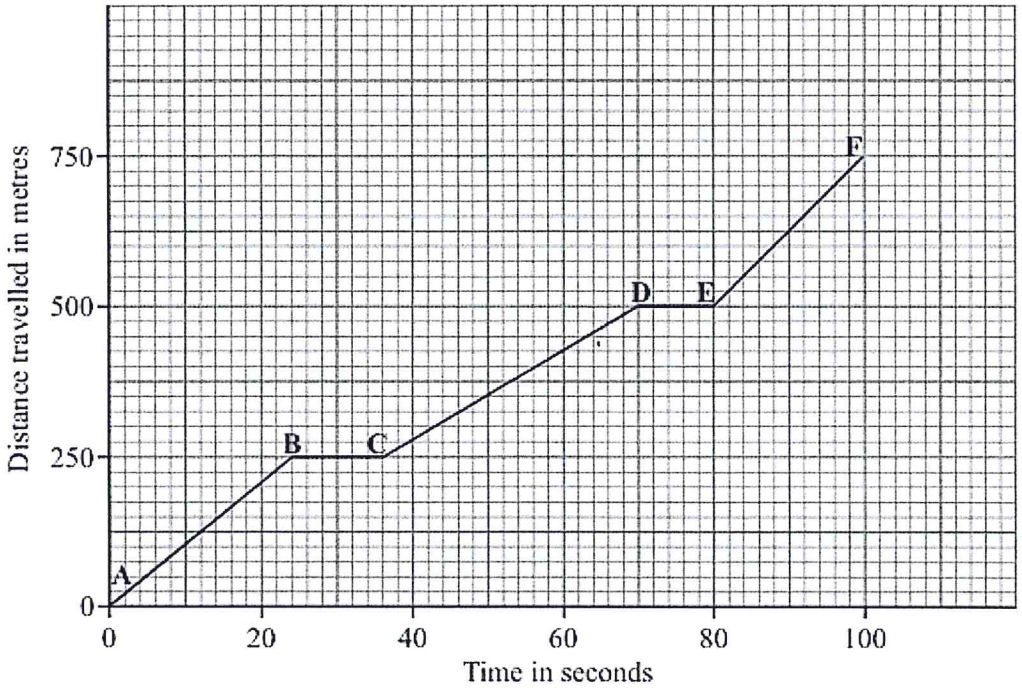
PHYSICS

(90 minutes)

NAME……

Q1. This question is about a car travelling through a town.

(a) The graph shows how far the car travelled and how long it took.



(i) Between which points was the car travelling fastest? Tick (✓) your answer.

Points	Tick (✓)
A – B	
B – C	
C – D	
D – E	
E – F	

(1)

(ii) Between which points was the car stationary?

.....

.....

(1)

(b) Complete the sentences by writing the correct words in the spaces.

When a car has to stop, the **overall** stopping distance is greater if:

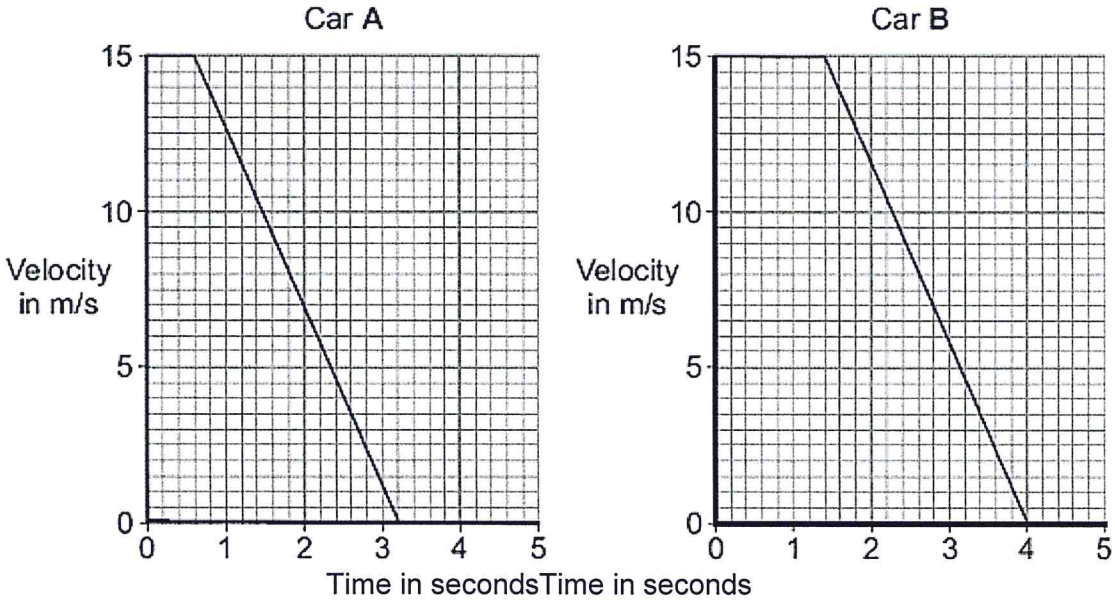
- the car is poorly maintained;
- there are adverse weather conditions;
- the car is travelling ..... ;
- the driver's reactions are ..... .

Also, the greater the speed of the car, then the greater the braking .....

needed to stop in a certain time.

(3)
(Total 5 marks)

Q2.(a) The graphs show how the velocity of two cars, **A** and **B**, change from the moment the car drivers see an obstacle blocking the road.



One of the car drivers has been drinking alcohol. The other driver is wide awake and alert.

(i) How does a comparison of the two graphs suggest that the driver of car **B** is the one who has been drinking alcohol?

.....

.....

(1)

(ii) How do the graphs show that the two cars have the same deceleration?

.....

.....

(1)

(iii) Use the graphs to calculate how much further car **B** travels before stopping compared to car **A**.

Show clearly how you work out your answer.

.....

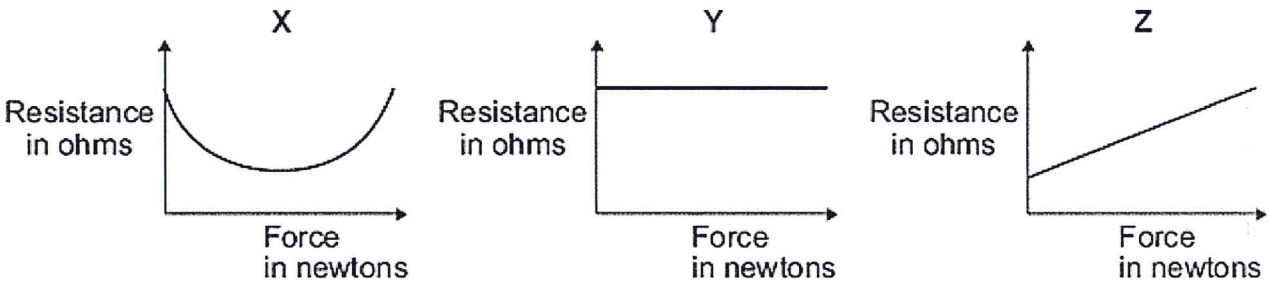
.....

.....

Additional stopping distance = ... m

(3)

(b) In a crash-test laboratory, scientists use sensors to measure the forces exerted in collisions. The graphs show how the electrical resistance of 3 experimental types of sensor, **X**, **Y**, and **Z**, change with the force applied to the sensor.



Which of the sensors, **X**, **Y** or **Z**, would be the best one to use as a force sensor?

.....

Give a reason for your answer.

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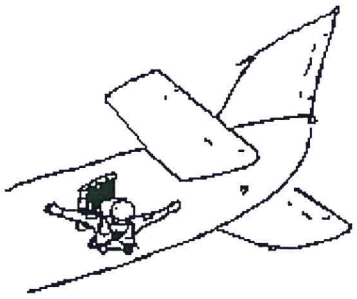
(2)
(Total 7 marks)

Q3. A sky-diver steps out of an aeroplane. After 10 seconds she is falling at a steady speed of 50m/s. She then opens her parachute.



After another 5 seconds she is once again falling at a steady speed.

This speed is now only 10m/s.

(a) Calculate the sky-diver's average acceleration during the time from when she opens her parachute until she reaches her slower steady speed. (Show your working.)

.....

.....

.....

(3)

(b) Explain, as fully as you can:

(i) why the sky-diver eventually reaches a steady speed (with or without her parachute).

.....

.....

.....

.....

(3)

(ii) why the sky-diver's steady speed is lower when her parachute is open.

.....

(1)

(c) The sky- diver and her equipment have a total mass of 75kg. Calculate the gravitational force acting on this mass. (Show your working.)

.....

.....

Answer ..... N

(1)

(Total 8 marks)

Q4. The hammer throw is an athletic event.

The athlete throws a heavy metal ball attached by a wire to a handle.

(a) The hammer thrower swings the hammer round in a circle before letting go.

He swings the hammer slowly at first and then faster.

Complete the following sentence by drawing a ring around the correct word or line in the box.

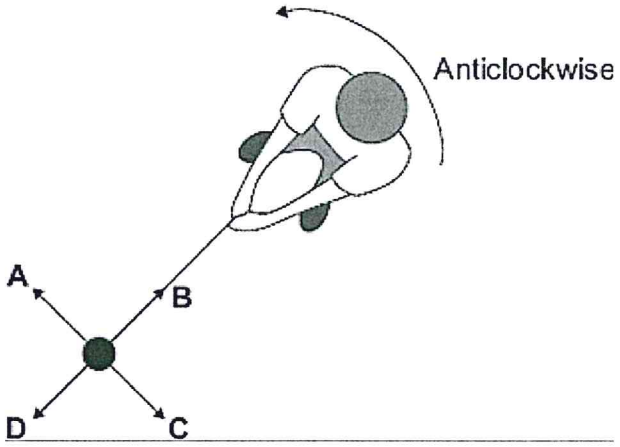
As the speed of the swing increases, the centripetal force on the

hammer

decreases.
does not change.
increases.

(1)

(b) The diagram shows an overhead view of a hammer thrower swinging the hammer anticlockwise in a circle.



(i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the hammer? ☐

(1)

(ii) Complete the following sentence by drawing a ring around the correct line in the box.

The centripetal force is provided by the

air resistance.
gravitational force.
tension in the wire.

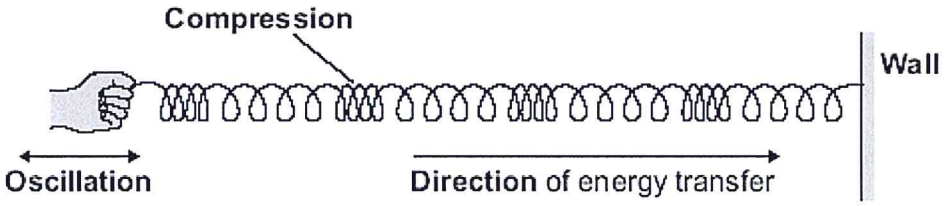
(1)

(iii) At the instant shown in the diagram above, the athlete lets go of the handle.

In which direction, **A**, **B**, **C** or **D**, does the hammer move?

(1)
(Total 4 marks)

Q5. (a) The diagram shows a longitudinal wave being produced in a stretched spring.



(i) Use the bold words from the diagram to complete the following sentence. Put only
one word in each space.

A longitudinal wave is one in which the ..... causing

the wave is parallel to the ..... of energy transfer.

(2)

(ii) Name the type of energy that is transferred by longitudinal waves.

.....

(1)

(b) The diagram shows water waves made by a wave machine in a swimming pool.

Every second, two waves go past a person standing in the swimming pool.

The waves have a wavelength of 0.8 metres.

Calculate the speed of the water waves.

Write down the equation you use, and then show clearly how you work out your answer.

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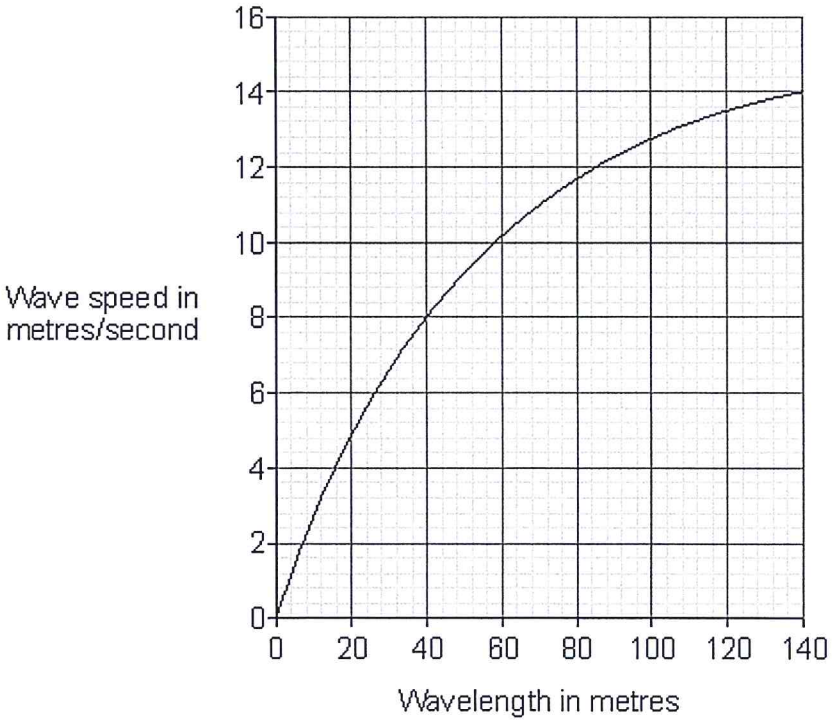
Wave speed = ... m/s

(2)

(c) The graph shows how the speed of deep ocean waves depends on the wavelength of the waves.



What can you conclude from the graph?

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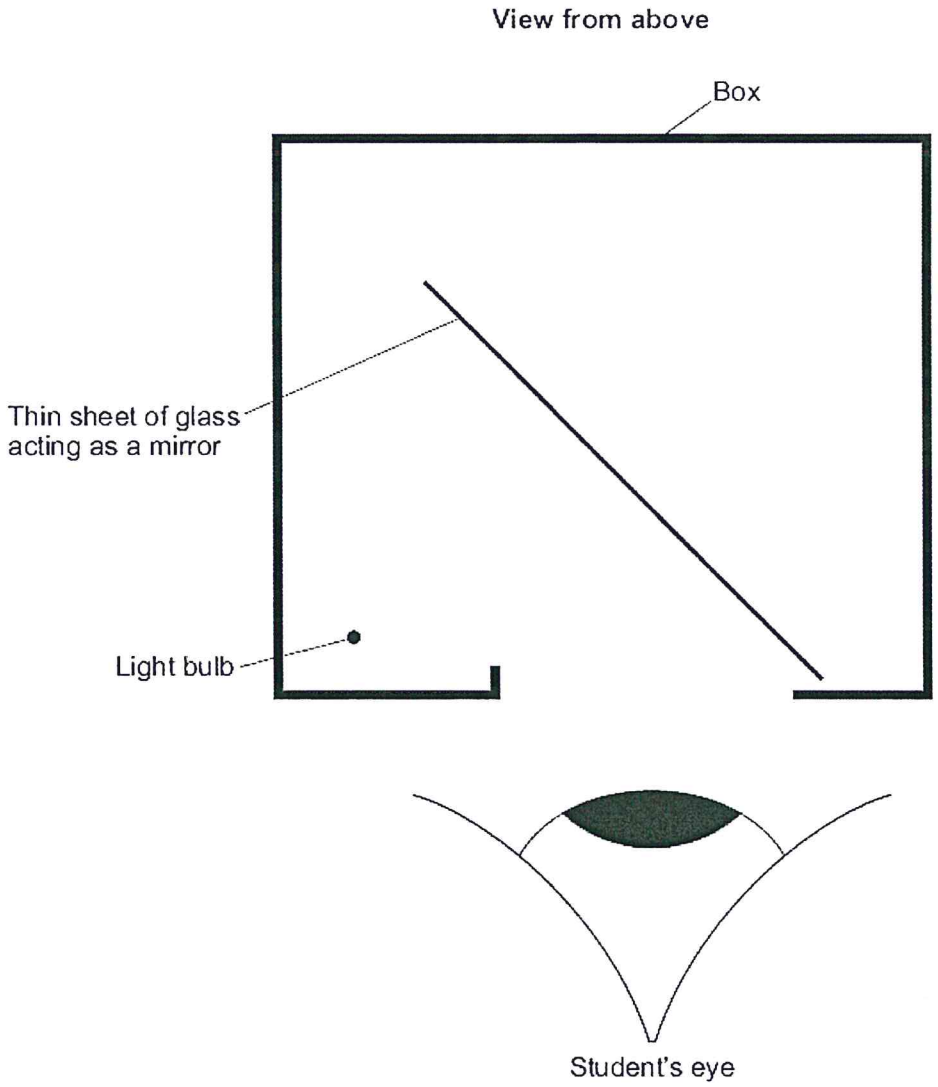
.....

.....

(2)
(Total 7 marks)

Q6. The diagram shows a model used to demonstrate an illusion known as 'Pepper's Ghost'.

A small light bulb and thin sheet of glass are put inside a box. The thin sheet of glass acts as a mirror. Although the light bulb is switched on, a student looking into the box cannot see the bulb. What the student does see is a virtual image of the bulb.



(a) Use a ruler to complete a ray diagram to show how the image of the light bulb is formed. Mark and label the position of the image.

(4)

(b) The image seen by the student is virtual.

Why?

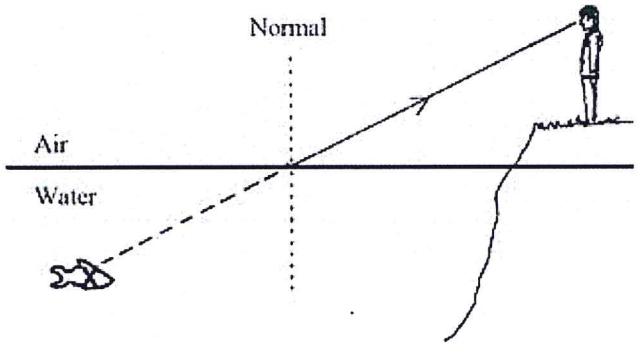
.....

.....

(1)
(Total 5 marks)

Q7. A man is walking along the bank of a river.

He sees a fish which seems to be at X.



(a) Show, on the diagram, where the fish **really** is.

Complete the ray of light which goes from the fish into the man's eye.

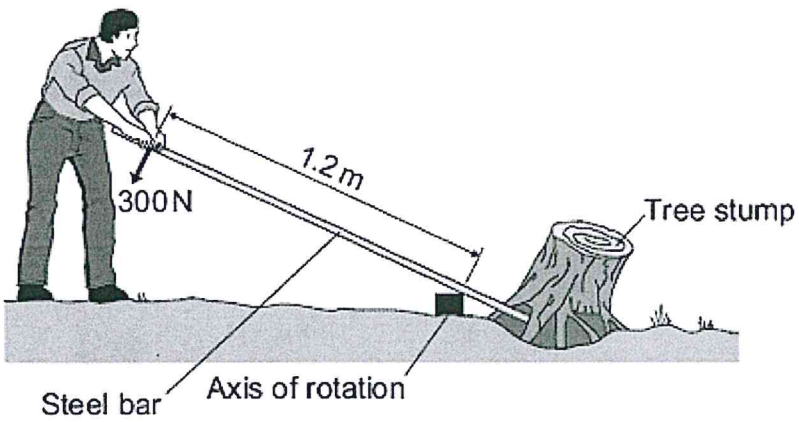
(2)

(b) Complete the sentence.

The ray of light is ..... as it passes from the water into the air.

(1)
(Total 3 marks)

Q8. The diagram shows a gardener using a steel bar to lift a tree stump out of the ground.



When the gardener pushes with a force of 300 **N**, the tree stump just begins to move.

(a) Use the equation in the box to calculate the moment produced by the 300 N force.

moment = force x	perpendicular distance from the line of action of the force to the axis of rotation

Show clearly how you work out your answer.

.....

.....

Moment = ... newton metres

(2)

(b) Using a longer steel bar would have made it easier for the gardener to lift the tree stump out of the ground.

Explain why.

.....

.....

.....

.....

(2)
(Total 4 marks)

Q9. (a) A student investigates the moment of a force.

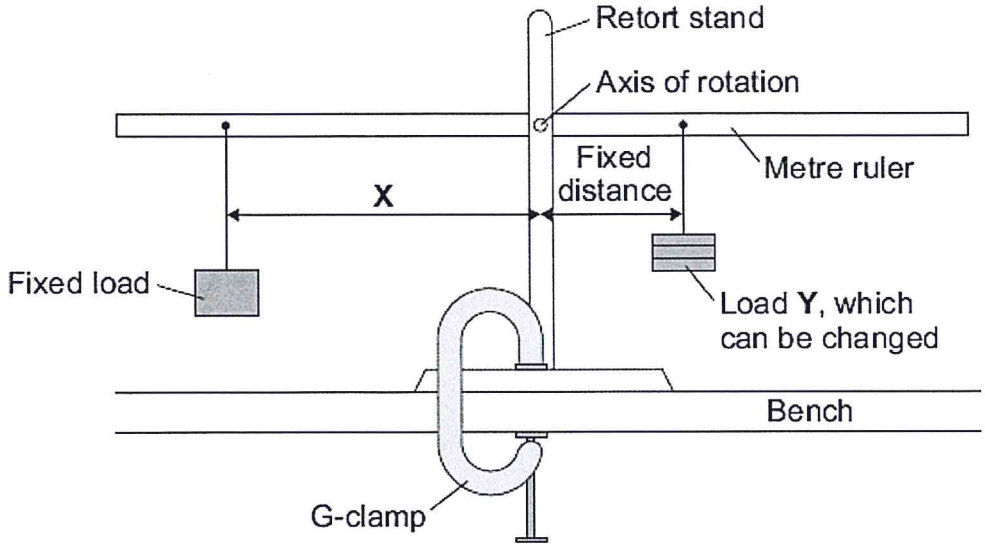
(i) What does the word *moment* mean in this sentence?

.....

.....

(1)

(ii) The diagram overleaf shows how she sets up her apparatus.



Suggest the purpose of the G-clamp.

.....

.....

(1)

(iii) A horizontal rod fits into a hole at the centre of the metre ruler. This is the axis of rotation. The student changes the load **Y** and adjusts the distance **X** until the metre ruler is horizontal. She takes six pairs of measurements which are shown in the table.

Load Y in newtons	**Distance X in centimetres**
1	7
2	14
3	21
4	28
5	35
6	42

Explain fully how distance **X** varies with load **Y**.

.....

.....

.....

.....

(2)

(iv) The weight of the ruler can be ignored in this experiment.

Which statement gives the reason why?

Put a tick (✓) in the box next to your answer.

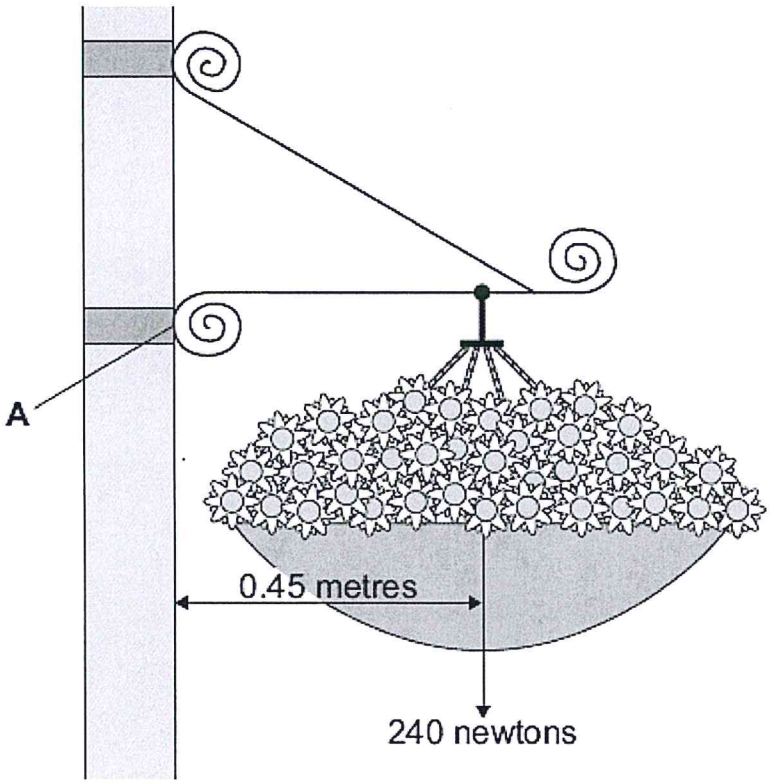
The weight of the ruler is so small it is negligible. ☐

The centre of mass of the ruler is at the axis of rotation. ☐

The ruler is a symmetrical object. ☐

(1)

(b) In the summer, a town council fits hanging baskets to some of its lamp posts.



Use the information in the diagram and the equation in the box to calculate the moment produced by the weight of the hanging basket about an axis through point **A**.

moment = force × perpendicular distance from the line of

action of the force to the axis of rotation

Show clearly how you work out your answer **and** give the unit.

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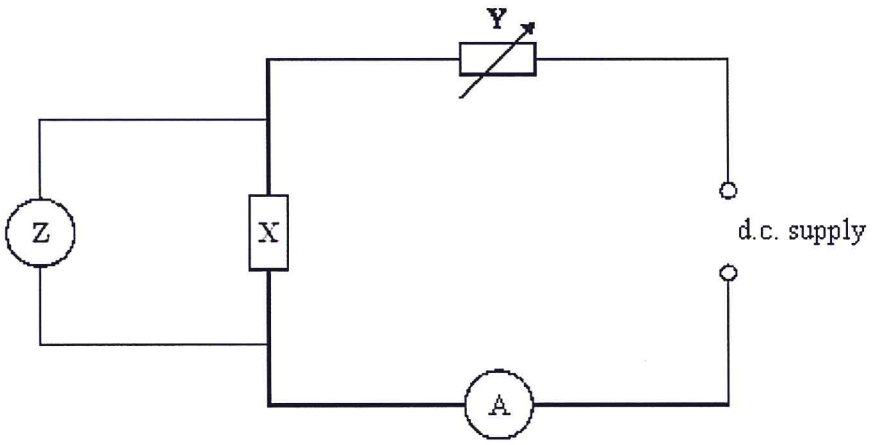
.....

Moment =.....

(3)
(Total 8 marks)

Q10. The current through component **X** is measured when different voltages are applied across it.



(a) Name the component labelled **Y** in the circuit.

.....

(1)

(b) What type of meter is **Z**?

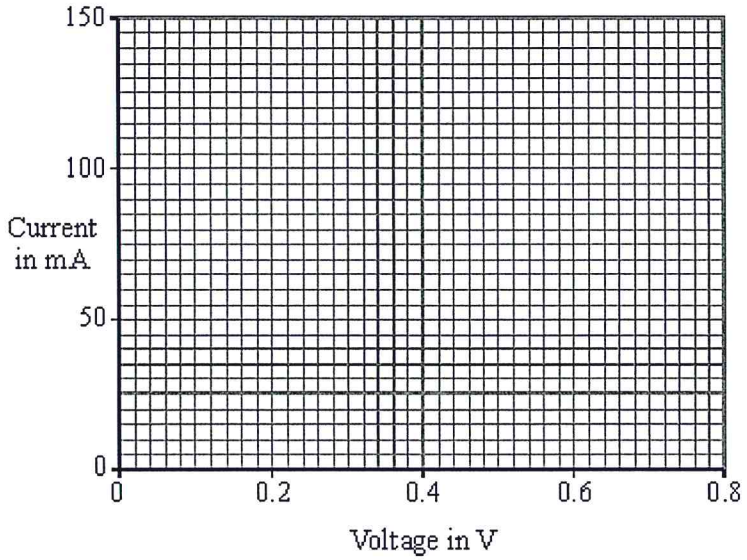
.....

(1)

(c) The table overleaf shows the measurements obtained in this experiment.

Voltage in V	0	0.2	0.4	0.6	0.8
Current in mA	0	0	50	100	150

Draw a graph of the measurements.



(2)

(d) Use the shape of the graph to name component **X**.

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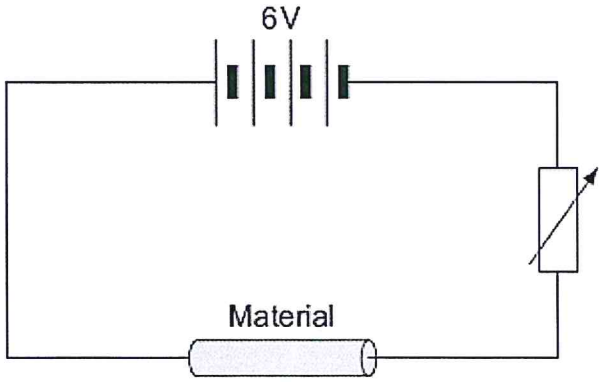
(1)
(Total 5 marks)

Q11.(a) The diagram shows the circuit used to investigate the resistance of a sample of a material. The diagram is not complete; the ammeter and voltmeter are missing.



(i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places.

(2)

(ii) How can the current through the material be changed?

.....

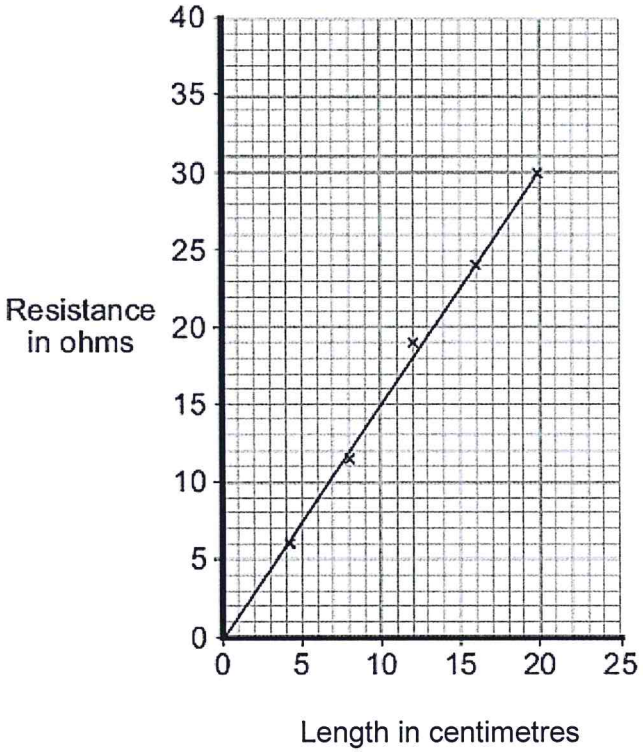
.....

(1)

(b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thickness.

Graph 1 shows how the resistance changes with length.

Graph 1



(i) The current through a 25 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 25 cm length of conducting putty.

Resistance = ... ohms

(1)

(ii) Use your answer to **(b) (i)** and the equation in the box to calculate the potential difference across a 25 cm length of conducting putty.

potential difference = current x resistance

Show clearly how you work out your answer.

.....

.....

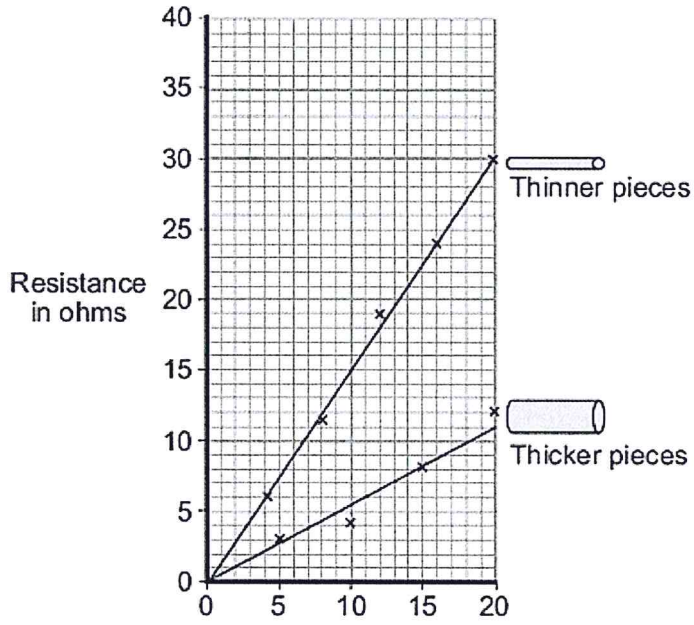
.....

Potential difference = ... volts

(2)

(c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.

Graph 2



(i) What is the relationship between the resistance and the thickness of the conducting putty?

.....

.....

(1)

(ii) Name **one** error that may have reduced the accuracy of the results.

.....

(1)

(iii) How could the reliability of the data have been improved?

.....

.....

(1)

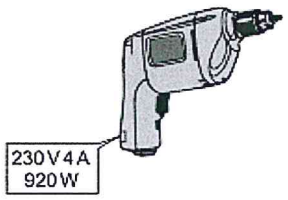
(Total 9 marks)

Q12. (a) Look at this electrical safety information poster.

Get it right!
Choose the right fuse.

Most fuses are 3 A or 13 A.

To choose the right fuse you must know the power of the appliance.



Power is marked on the information plate.

Power over 700 W use a 13 A fuse.	Power under 700 W use a 3 A fuse.
• Fan heaters • Kettles • Dishwashers • Washing machines	• Radios • Table lamps • Portable TVs • Electric blankets

(i) Complete the table to show which size fuse, 3 A or 13 A, should be fitted to each of the appliances.

Appliance	Power rating	Fuse
Hairdryer	1600 W	
Electric saw	350 W	
Food mixer	1200 W	

(2)

(ii) The plug of an electric kettle has been wrongly fitted with a 3 A fuse.

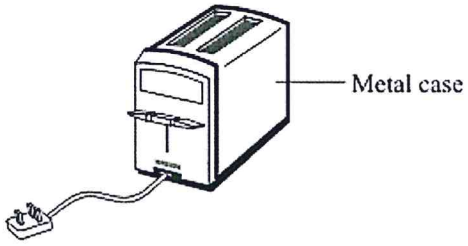
What will happen to the fuse when the kettle is switched on?

.....

.....

(1)

(b) The drawing shows a toaster, which takes a current of 4 A from the 230 V mains electricity supply.



(i) Use the equation in the box to calculate the power of the toaster.

Power (watt, W)	=	current (ampere, A)	×	potential difference (volt, V)

Show clearly how you work out your answer.

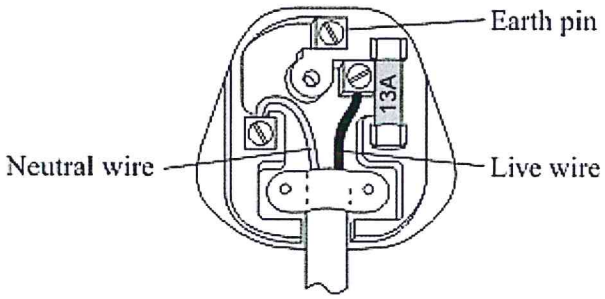
.....

.....

Power = ... W

(2)

(ii) A householder rewires the toaster with a new cable and plug. The diagram shows how the new cable has been connected to the plug.



Explain why the toaster may **not** be safe to use.

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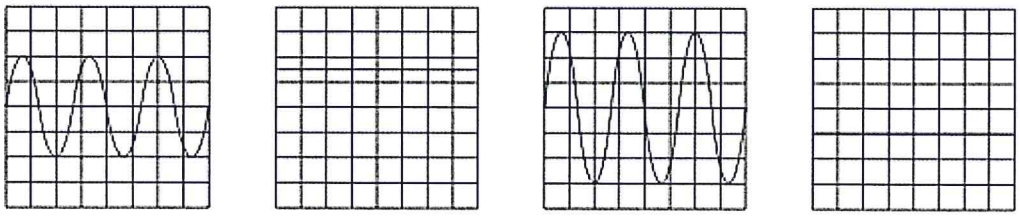
.....

.....

(2)

(c) The diagram shows the oscilloscope traces produced by four different electricity supplies. The settings on the oscilloscope are the same for each electricity supply.



(i) Which **two** supplies give a direct current (d.c.)?

..... and .....

(1)

(ii) Supply **K** provides a peak potential difference of 6 V.

What is the peak potential difference provided by supply **M**?

.....

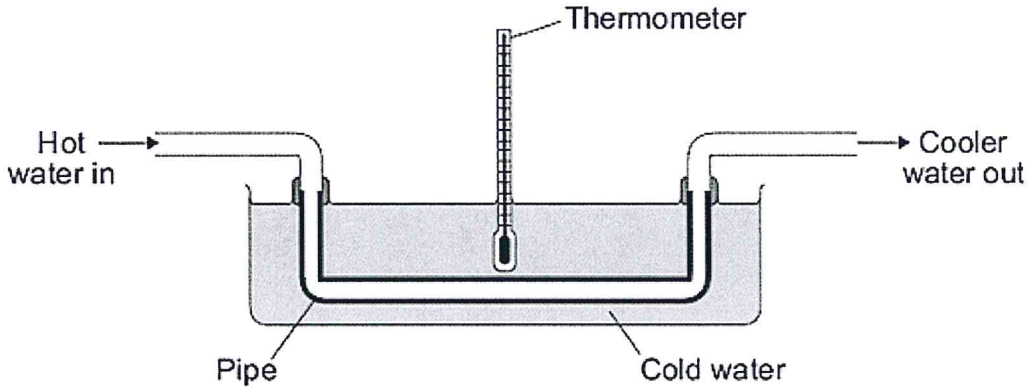
(1)

(Total 9 marks)

Q13. Heat exchangers are devices used to transfer heat from one place to another.

The diagram shows a pipe being used as a simple heat exchanger by a student in an investigation.

Heat is transferred from the hot water inside the pipe to the cold water outside the pipe.



(a) Complete the following sentence by drawing a ring around the correct word in the box.

Heat is transferred from the hot water inside the pipe

to the cold water outside the pipe by

conduction
convection.
radiation.

(1)

(b) The student wanted to find out if the efficiency of a heat exchanger depends on the material used to make the pipe. The student tested three different materials. For each material, the rate of flow of hot water through the pipe was kept the same.

The student's results are recorded in the table.

Material	Temperature of the cold water at the start in °C	Temperature of the cold water after 10 minutes in °C
Copper	20	36
Glass	20	23
Plastic	20	21

(i) The rate of flow of hot water through the pipe was one of the control variables in the investigation.

Give **one** other control variable in the investigation.

.....

(1)

(ii) Which **one** of the three materials made the best heat exchanger?

.....

Give a reason for your answer.

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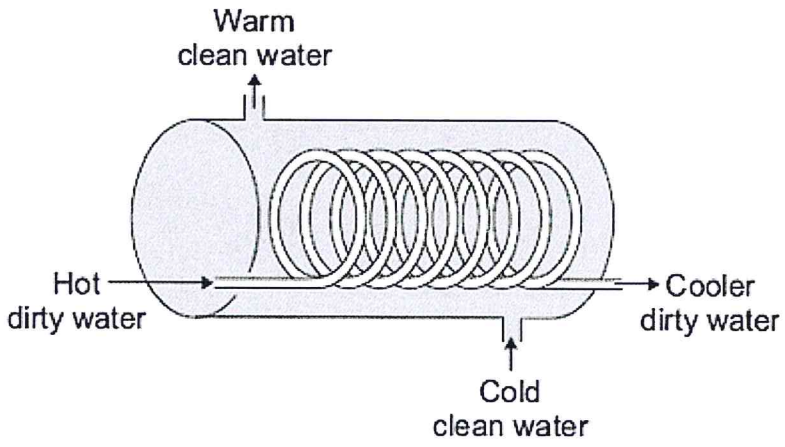
(2)

(c) The student finds a picture of a heat exchanger used in an industrial laundry. The heat exchanger uses hot, dirty water to heat cold, clean water.



This heat exchanger transfers heat faster than the heat exchanger the student used

in the investigation.

Explain why.

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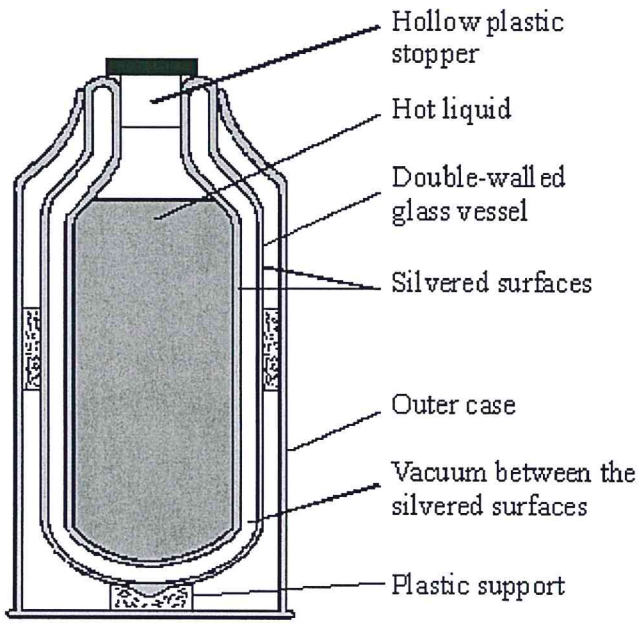
(2)
(Total 6 marks)

Q14. The drawing shows a section of a vacuum flask.



(a) Heat is slowly "lost" from the hot liquid in the closed flask. It may be transferred by:

conduction	convention	evaporation	radiation

Choose from the words above to complete the following sentences. You may use a word once, more than once or not at all.

(i) The vacuum between the glass walls reduces

..... and .....

(2)

(ii) The silvered surfaces of the glass walls reduce

.....

(1)

(iii) The stopper in the opening of the flask reduces

..... and .....

(2)

(iv) Heat is transferred by the air molecules, away from the vacuum flask, by

.....

(1)

(v) The plastic of the plastic stopper is preferred to metal because it cuts down

.....

(1)

(b) Mark **X** on the diagram of the vacuum flask where the liquid in the flask is hottest.

(1)

(c) Explain, in terms of particles, how heat is conducted through a glass wall of the vacuum flask.

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.....

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(2)

(Total 10 marks)