Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Modular)

Paper 3
Higher Tier

[G8206]

G8206

WEDNESDAY 25 MAY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

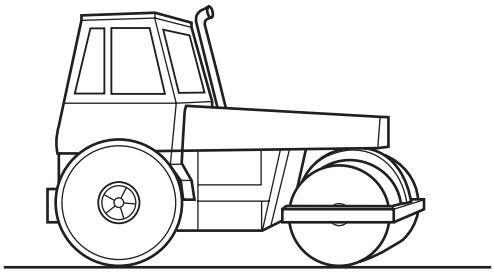
INFORMATION FOR CANDIDATES

The total mark for this paper is 110.
Quality of written communication will be assessed in question **4(c)(i)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

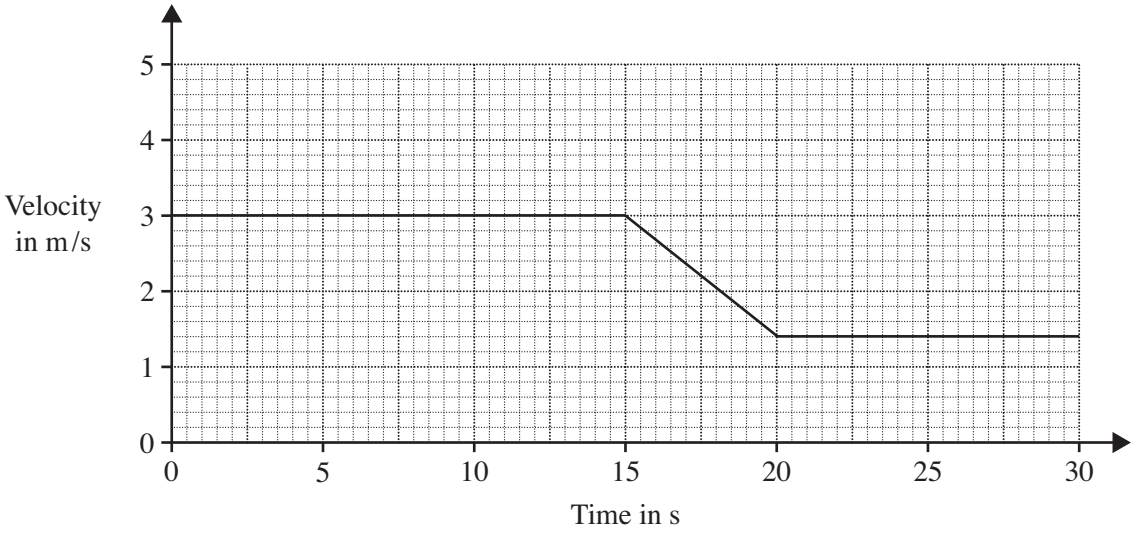
For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
Total Marks	

Examiner Only	
Marks	Remark

1 A steam roller is used to smooth a newly laid road surface.



A graph of velocity against time for the steam roller is shown.



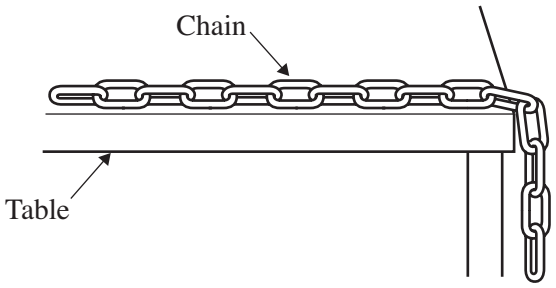
(a) (i) How far does the roller travel during the first 15 seconds?
You are advised to show your working out.

Distance = _____ m [3]

(ii) The steam roller has a mass of 3000 kg. Use the graph to calculate its **minimum** momentum.
Remember to include the unit.
You are advised to show your working out.

Minimum momentum = _____ [4]

A stationary chain hangs over the end of a table as shown.



(b) (i) Explain, in terms of forces, why the chain does not move.

_____ [1]

The weight of the links hanging over the edge is increased to 0.8 N and the frictional force exerted by the table is 0.2 N.

(ii) If the mass of the whole chain is 0.3 kg calculate the initial acceleration of the chain.
You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

When a cricket ball is struck by a bat it is compressed, regains its full size and speeds off in the opposite direction.

(c) (i) What type of energy is possessed by the compressed ball?

_____ [1]

(ii) The speed of the cricket ball is 30 m/s.
If the mass of the ball is 0.5 kg, what is its kinetic energy?
You are advised to show your working out.

Kinetic energy = _____ J [3]

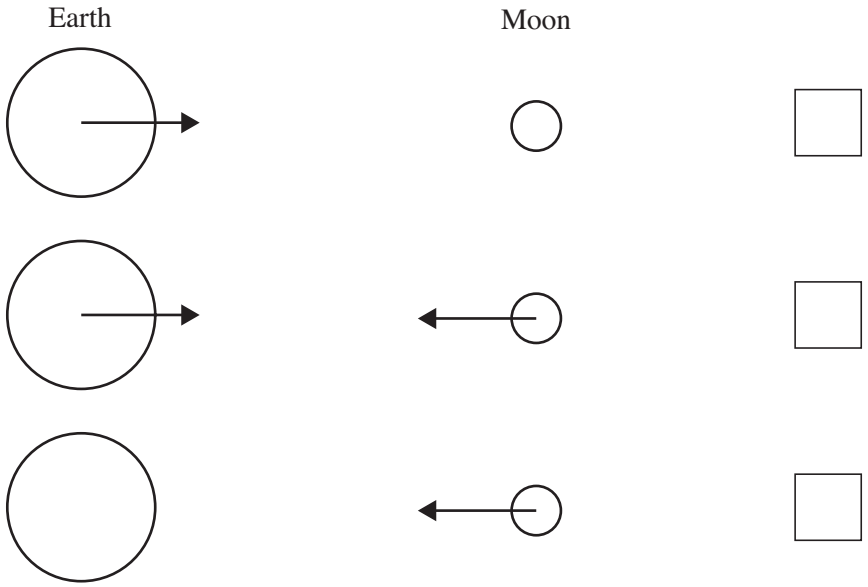
Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 Gravitational forces act between astronomical bodies.

(a) (i) Which of the diagrams below best illustrates the gravitational forces between the Earth and the Moon? Tick (✓) the correct box.



[1]

Historically, two theories have been put forward for the structure of our Solar System.

(ii) Name these two theories.

_____ and _____ [2]

(iii) Which two of the following statements correctly describes our ideas about the universe?

Tick (✓) the correct boxes.

The universe consists of the Sun and 8 planets. ☐

The universe is expanding. ☐

Stars are colder than planets. ☐

Some comets orbit the Sun. ☐

[2]

The incomplete statements below describe the formation of a star.

Examiner Only	
Marks	Remark

(b) Complete each sentence.

Clouds of dust and gas, which we call nebulae, come together because of a force called _____ . [1]

As a result of this coming together there is an increase in _____ . [1]

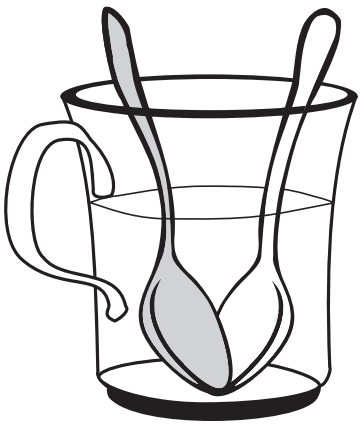
Eventually the star forms and gives out energy, powered by a nuclear process called _____ . [1]

(c) Suggest two reasons why it is possible to see a star but not a planet outside our Solar System.

1. _____

2. _____ [2]

(d) Coffee can be stirred with a metal spoon or a plastic spoon.



(i) Name the method of heat transfer through these spoons.

_____ [1]

(ii) Which particles are mainly responsible for the transfer of heat along the metal spoon?

_____ [1]

(iii) Describe how heat passes through the plastic spoon.

_____

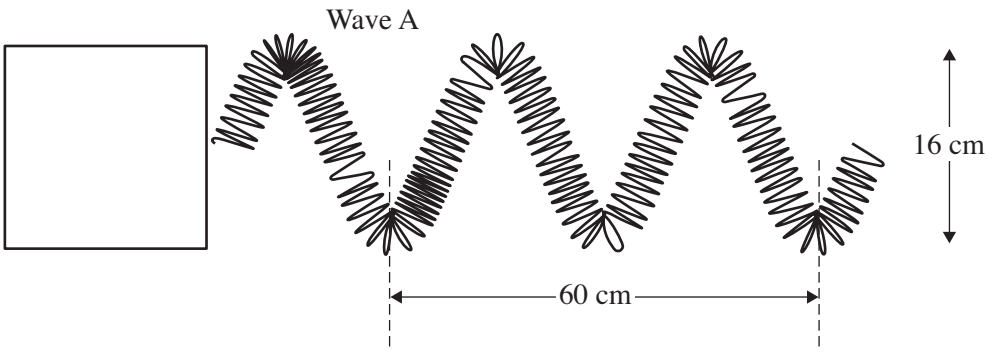
_____ [2]

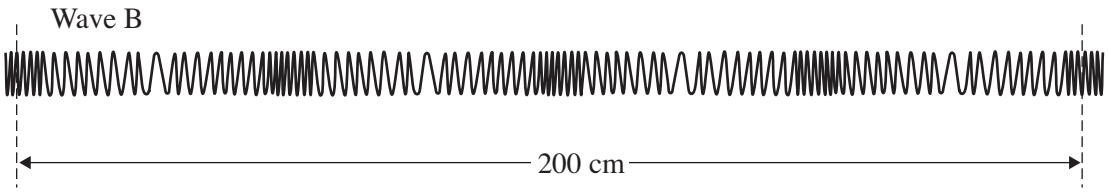
(iv) How can heat loss from the top surface of a cup of coffee be reduced?

_____ [1]

Examiner Only	
Marks	Remark

3 **(a)** A stretched slinky spring can be used to demonstrate waves.





(i) What do both waves transfer as they move from left to right?

_____ [1]

(ii) In the box to the left of wave A indicate the direction of vibration of a particle in the spring. [1]

(iii) What types of wave are A and B?

Wave A _____ Wave B _____ [2]

(iv) What is the wavelength of wave A?

_____ cm [1]

(v) What is the wavelength of wave B?

_____ cm [1]

(vi) What is the amplitude of wave A?

_____ cm [1]

Examiner Only

Marks	Remark

The end of wave B vibrates 40 times in 10 seconds.

(vii) How many times does the end of wave B vibrate in one second?

_____ [1]

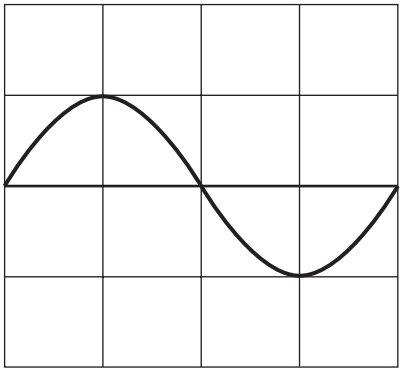
(viii) What is the frequency of vibration of wave B?

_____ Hz [1]

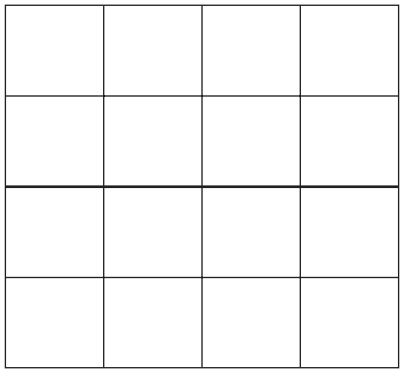
(b) A wave has a frequency of 6 Hz and a wavelength of 0.4 m.
Calculate the speed of the wave.
You are advised to show your working out.

Speed = _____ m/s [3]

(c) The sound wave produced by a tuning fork is displayed on a CRO.



In the space below draw the sound wave produced by a tuning fork of greater loudness and the same frequency.



[2]

Examiner Only

Marks	Remark

(d) For each statement tick (✓) the box to show whether it is true or false.

Statement	True	False
Sound and light travel at the same speed in air.		
Light can travel through a vacuum.		
Sound is a longitudinal wave motion.		

[3]

(e) **(i)** What damage can a long exposure to loud sound cause to the ears?

_____ [1]

(ii) What precaution can people who operate very noisy machines take to reduce damage to their ears?

_____ [1]

(iii) What happens to the upper frequency limit of hearing with increasing age?

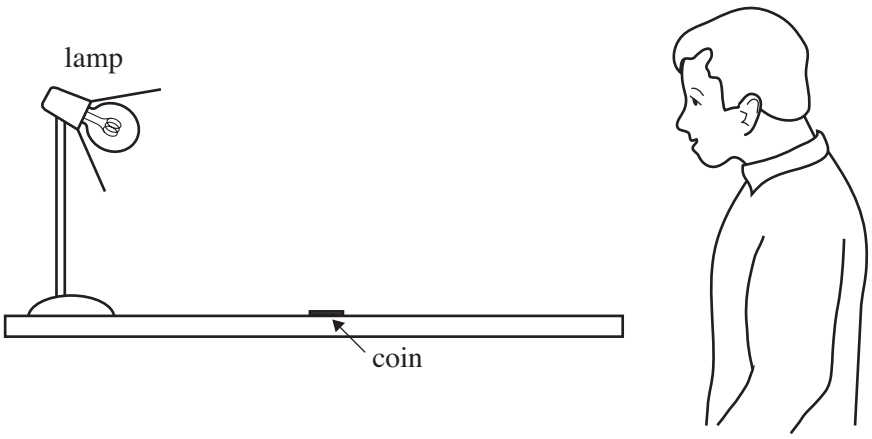
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

4 John observes a coin sitting on a table.

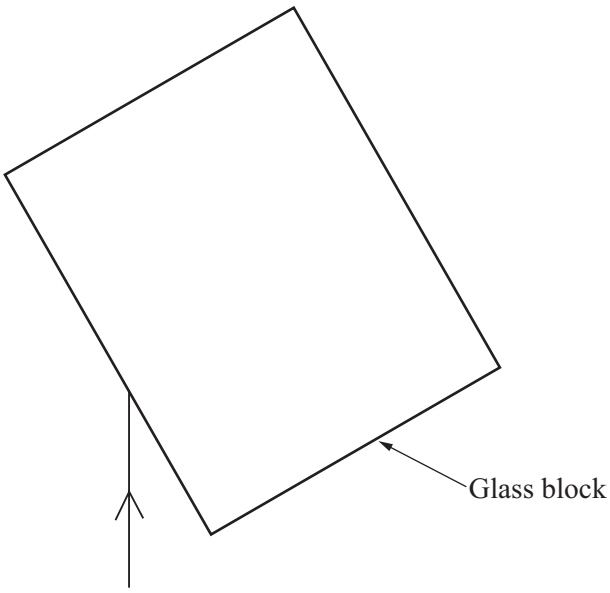


(a) (i) Draw an incident ray and a reflected ray to show how John sees the coin. Include an arrow to show the direction of the light. [3]

(ii) John sees the coin because of reflected light. Other objects are seen by the light they emit. Give an example of an object seen because of the light it emits.

Name of object _____ [1]

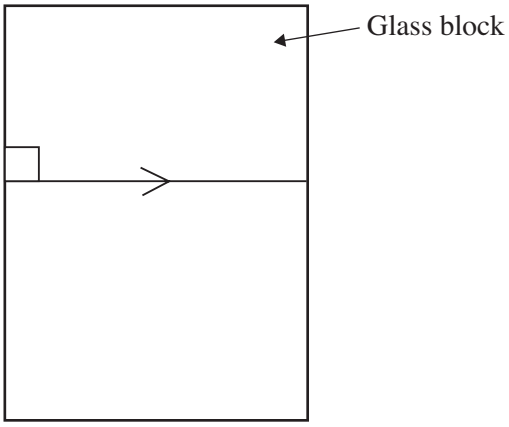
A ray of light travels from air into glass. The incident ray is shown.



(b) (i) Draw in the normal and show the refracted ray inside the glass. [3]

Examiner Only	
Marks	Remark

(ii) Draw in the incident ray which produces the ray inside the glass block as illustrated below.



[1]

(iii) Choose the correct statement below to show what happens to light when it travels from air into glass. Tick (✓) the correct box.

The light travels faster in glass than in the air. ☐

The light travels at the same speed in air and glass. ☐

The light travels faster in air than in glass. ☐ [1]

(c) (i) Explain fully the meaning of the term **dispersion**.

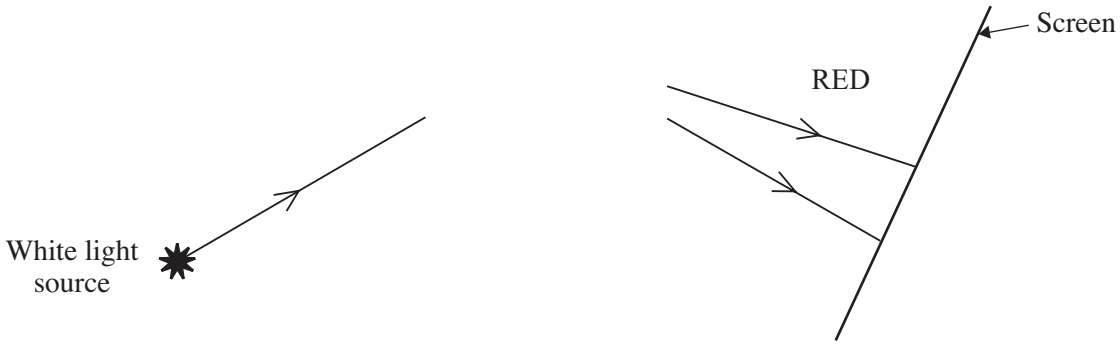
_____

_____

_____ [2]

Quality of written communication [1]

The diagram shows part of an arrangement which is used to demonstrate dispersion.



(ii) What piece of apparatus is missing?

_____ [1]

(iii) What is the name of the band of colours produced on the screen?

_____ [1]

(iv) State the colours, in order, starting with red in the diagram above.

Red, _____ [1]

Examiner Only

Marks	Remark

Freda attempts to list the parts of the electromagnetic spectrum in order of increasing wavelength. However, one part is missing and another two parts have been interchanged.

X-Rays	Gamma Rays		Visible	Infra-red	Micro-waves	Radio

Increasing wavelength →

(d) (i) Which part is missing?

_____ [1]

(ii) Which two parts have been interchanged?

_____ and _____ [1]

Different parts of the spectrum have different uses. Identify the following parts from the information given.

(e) (i) This part is used to check for broken bones.

_____ [1]

(ii) This part is used in communication when two people wave to each other.

_____ [1]

(iii) This part is emitted from hot bodies.

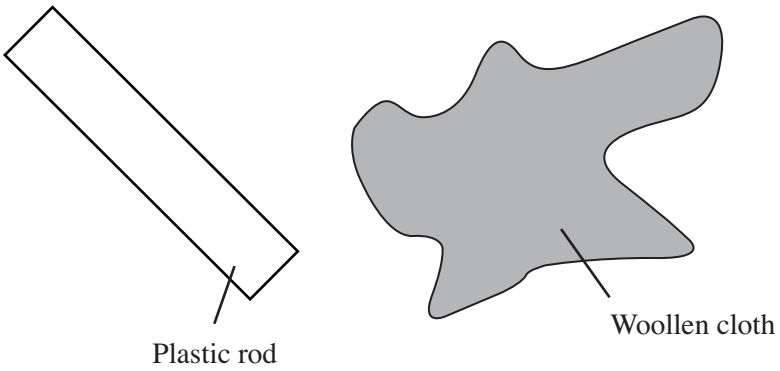
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** When insulators are rubbed together static electricity is produced.
A plastic rod becomes negatively charged when it is rubbed with a woollen cloth.



(i) What charged particles move from the woollen cloth to the plastic rod?

_____ [1]

(ii) What charge is left on the woollen cloth?

_____ [1]

(b) Before a racing car is refuelled, a conducting metal strip is connected between the car and the ground.
This is called "earthing".

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Explain why it is essential to earth the racing car when refuelling.

_____

_____ [2]

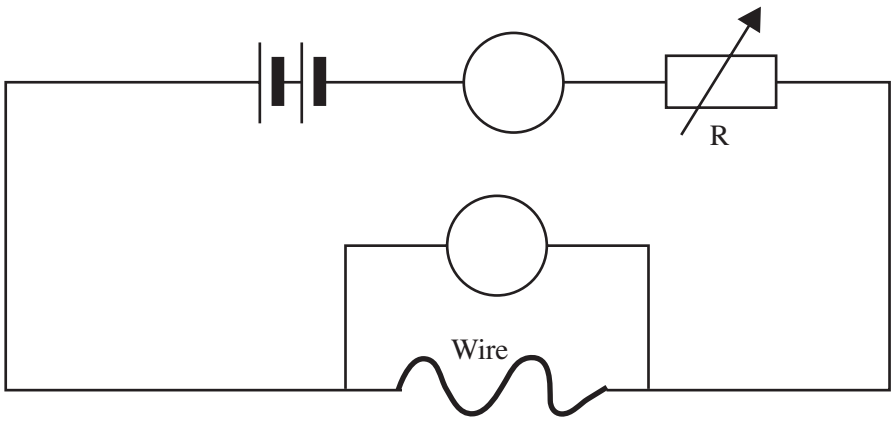
(c) What charge passes through a 50 Ω resistor if a current of 0.24 A flows for 5 **minutes**?
Remember to include the unit for charge.
You are advised to show your working out.

Examiner Only

Marks	Remark

Charge = _____ [4]

(d) A pupil sets up a circuit to investigate the relationship between voltage and current for a length of resistance wire.



(i) Use the letters A and V to label the ammeter and voltmeter in the above diagram. [1]

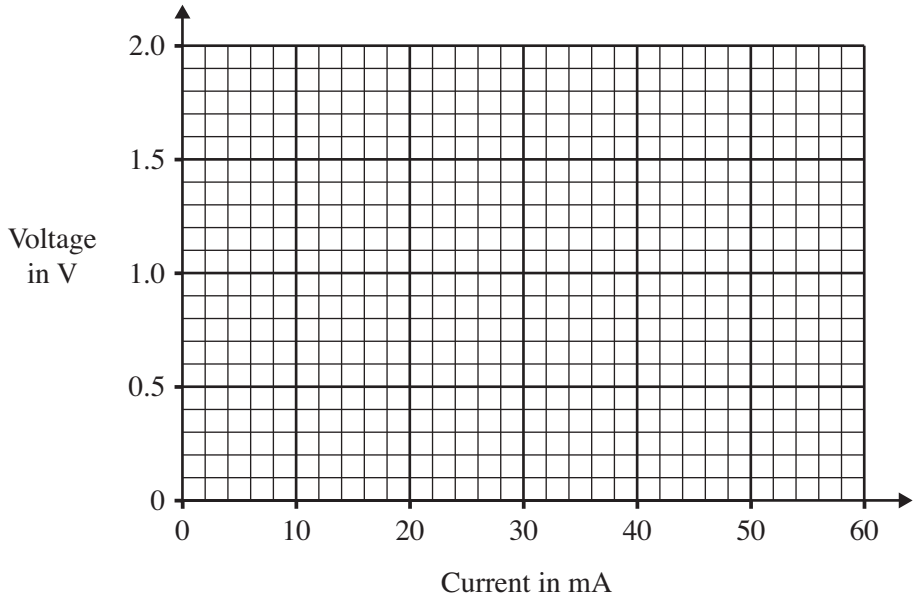
(ii) What is the purpose of the rheostat (variable resistor) R?

_____

_____ [1]

The results of the investigation are given below.

Voltage in V	0	0.5	1.0	1.5	2.0
Current in mA	0	12	26	40	54



(iii) Plot the points on the grid. [1]

(iv) Draw the line of best fit. [1]

(v) Use the graph to find the current in mA when the voltage is 0.8 V.

Current = _____ mA [1]

(vi) Convert your answer to **(d)(v)** to amperes.
Remember 1 mA = 0.001 A.

Current = _____ A [1]

Examiner Only

Marks	Remark

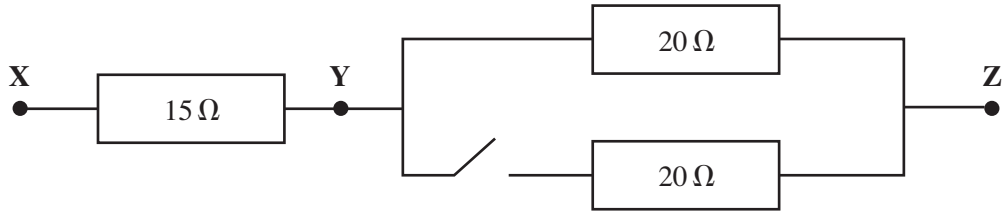
(vii) Use your answer to **(d)(vi)** to calculate the resistance of the wire when the voltage is 0.8V.
You are advised to show your working out.

Examiner Only

Marks	Remark

Resistance = _____ Ω [3]

(e) Three resistors are connected between **X** and **Z** as shown below.



(i) What is the resistance between **X** and **Z** with the switch open?

Resistance = _____ Ω [1]

(ii) What is the resistance between **Y** and **Z** with the switch closed?

Resistance = _____ Ω [1]

(iii) What is the resistance between **X** and **Z** with the switch closed?

Resistance = _____ Ω [1]

Examiner Only	
Marks	Remark

6 A hairdryer is double insulated.

(a) (i) Explain what this means.

_____

_____ [2]

(ii) Which wire is missing from the hairdryer?

_____ [1]

(b) A circuit breaker may be included in a circuit as a safety device. Give two advantages, not related to cost, of the circuit breaker compared to a fuse.

1. _____

2. _____ [2]

(c) (i) Explain what is meant by alternating current (a.c.).

_____

_____ [2]

(ii) Some electrical appliances use alternating current (a.c.) and some use direct current (d.c.).
Indicate which type is used in the following:

transformer, _____ [1]

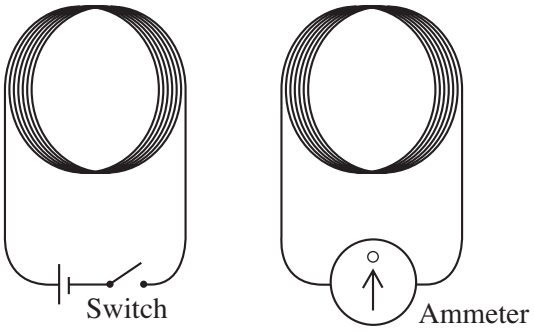
car battery, _____ [1]

electric cooker. _____ [1]

(d) For each of the following arrangements decide which statement, A, B or C, best describes the deflection of the ammeter.

A	No deflection.
B	Continuous (steady) deflection.
C	Deflection followed by a return to zero.

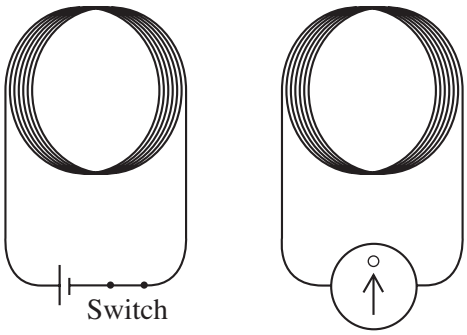
(i)



A student **closes** the switch.

Letter _____ [1]

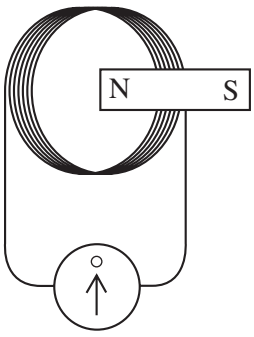
(ii)



A student **opens** the switch.

Letter _____ [1]

(iii)



A student holds a magnet **at rest** inside a coil.

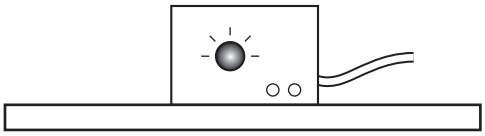
Letter _____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

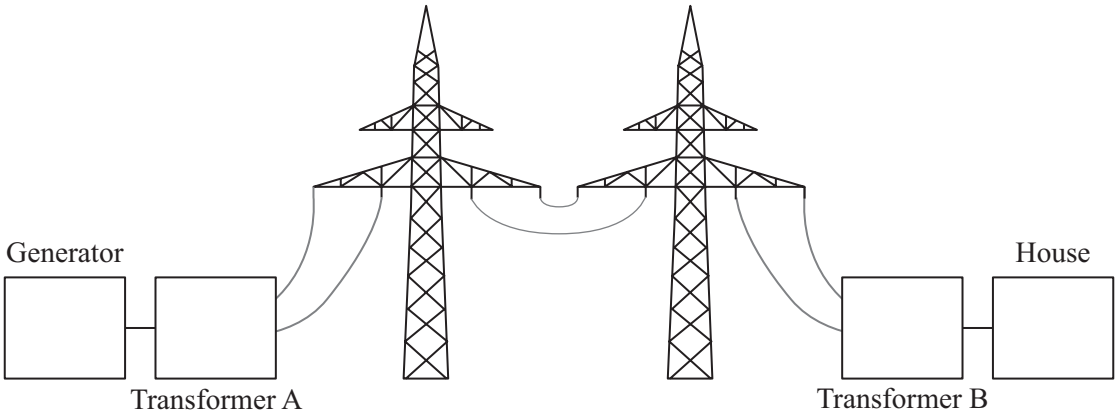
(e) A power pack used in a school laboratory contains a step-down transformer. The transformer changes the mains voltage from 240 V to a much safer level.



The primary coil of the transformer has 3600 turns and it is connected to the mains voltage. Calculate the number of turns in the secondary coil if the student has selected a voltage of 12 V.
You are advised to show your working out.

Number of turns = _____ [4]

The diagram below represents the electricity transmission system.



(f) **(i)** Explain fully the function of transformer A.

_____

_____ [2]

(ii) What is the role of transformer B?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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