OCR
Oxford Cambridge and RSA

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Wednesday 8 November 2017 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A/ADDITIONAL SCIENCE A

A182/01 Modules P4 P5 P6 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

* A 1 8 2 0 1 *

* 2 7 4 6 5 8 4 9 9 2 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of useful relationships is printed on page two.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric circuits

power = voltage × current

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

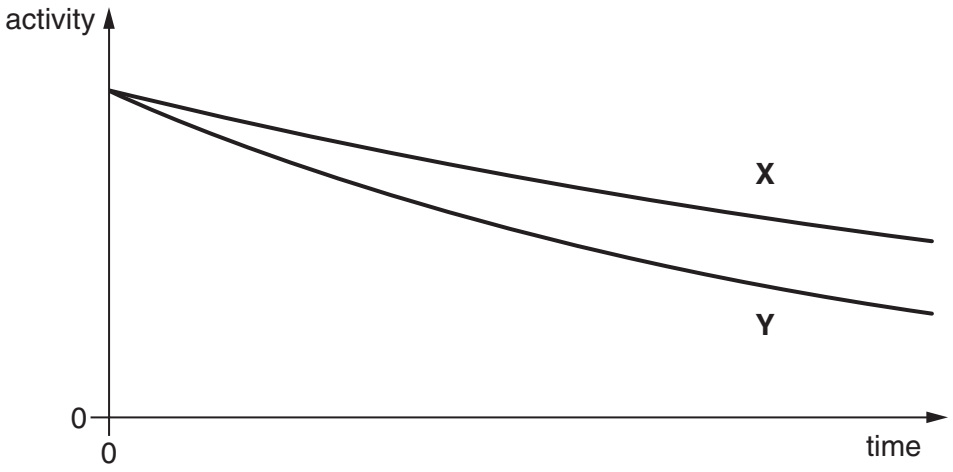
Radioactive materials

energy = mass × [speed of light in a vacuum]^2

Answer **all** the questions.

1 Some materials give out ionising radiation.

(a) The graph shows information about the activity of two materials, **X** and **Y**, which give out ionising radiation.



Use the graph to help you answer this question.

Put a tick (✓) in the box next to each statement to show whether it is **true** or **false**.

	True	**False**
The activity of both **X** and **Y** decreases with time.		
The half-life of **X** is longer than that of **Y**.		
Y reaches a safe level later than **X**.		
If **X** and **Y** were heated the curves would be different.		

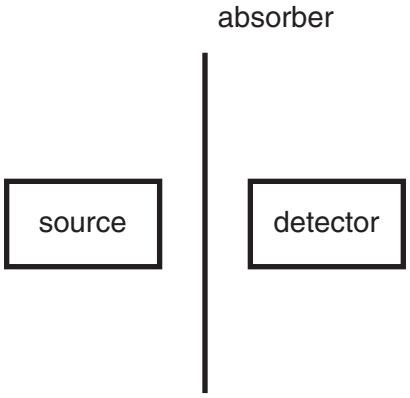
[2]

(b) Which word best describes materials that give out ionising radiation?

Put a (ring) around the correct answer.

ionic **molecular** **nuclear** **radioactive** **[1]**

(c) The ionising radiation given out by three different sources was tested using the apparatus shown.



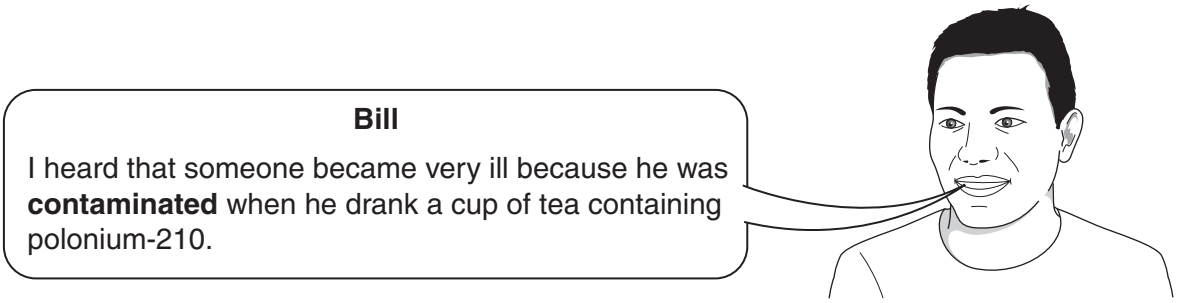
Each source was tested using different absorbers.

Complete the table by writing **yes** or **no** for each row.

Radiation from the source	**Absorber**	**Is radiation detected?** **(yes or no)**
alpha only	5 mm thickness of lead	
beta only	5 mm thickness of cardboard	
beta and gamma	5 mm thickness of aluminium	

[2]

(d) Bill and Maria are discussing a case of radiation poisoning using polonium-210.



Bill

I heard that someone became very ill because he was **contaminated** when he drank a cup of tea containing polonium-210.

Maria

What about the person who put the polonium-210 in the tea? Surely he was **irradiated** while carrying the polonium-210 in his pocket.

(i) Use the incident in the conversation to explain the difference between irradiation and contamination.

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..... **[2]**

(ii) Explain how the ionising radiation produced by the polonium-210 makes the person very ill.

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..... **[2]**

[Total: 9]

2 Hospitals use ionising radiation to investigate how well a patient's kidneys are working.

(a) Alex and Meena are discussing the material used as the tracer in these investigations.

Alex says 'It needs to have a short half life, about 3 minutes.'

Meena replies 'Also it needs to give out gamma radiation.'

Do you agree with their comments?

Give reasons for your answer.

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..... **[3]**

(b) Radiographers carry out the tests on patients' kidneys.

They handle the tracers every working day.

They wear protective clothing.

Give two **other** ways in which radiographers are protected from receiving a high dose of ionising radiation.

1 .....

2 .....

[2]

(c) The radioactive materials used as tracers are produced in nuclear reactors in power stations.

There are waste products created during the production and use of these materials.

These include:

- waste nuclear fuel
- waste medical tracers
- used protective clothing from the hospital.

Each of these types of radioactive waste needs a different method of disposal.

Describe the method of disposal for **each** of these categories of waste.

The quality of written communication will be assessed in your answer.

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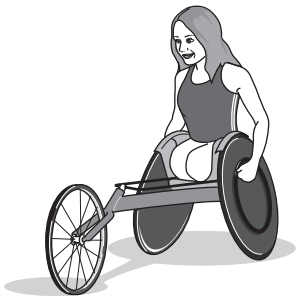
..... **[6]**

[Total: 11]

3 The Paralympics include events for athletes using wheelchairs.



(a) The track for the wheelchair race is on horizontal ground. What happens to the gravitational potential energy of the wheelchair during the race?

Put a (ring) around the correct answer.

it decreases **it increases** **it stays the same** **[1]**

(b) During a 100 metre race, the wheelchair reaches a maximum velocity of 8 m/s.

The mass of the wheelchair is 10 kg.

(i) What is the correct way to calculate the maximum kinetic energy of the wheelchair?

Put a (ring) around the correct answer.

10×8 **$\frac{1}{2} \times 8 \times 10$** **$\frac{1}{2} \times 10 \times 8^2$** **$\frac{1}{2} \times 8 \times 10^2$** **[1]**

(ii) The athlete does work to give the wheelchair kinetic energy.

Put a tick (✓) in the box next to the correct statement.

The work done by the athlete is **less than** the kinetic energy gained by the wheelchair. ☐

The work done by the athlete is **the same as** the kinetic energy gained by the wheelchair. ☐

The work done by the athlete is **more than** the kinetic energy gained by the wheelchair. ☐

[1]

(c) The average velocity of a wheelchair for a 100 metre race is 7 m/s.

Explain why the average velocity is less than the maximum velocity.

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..... **[2]**

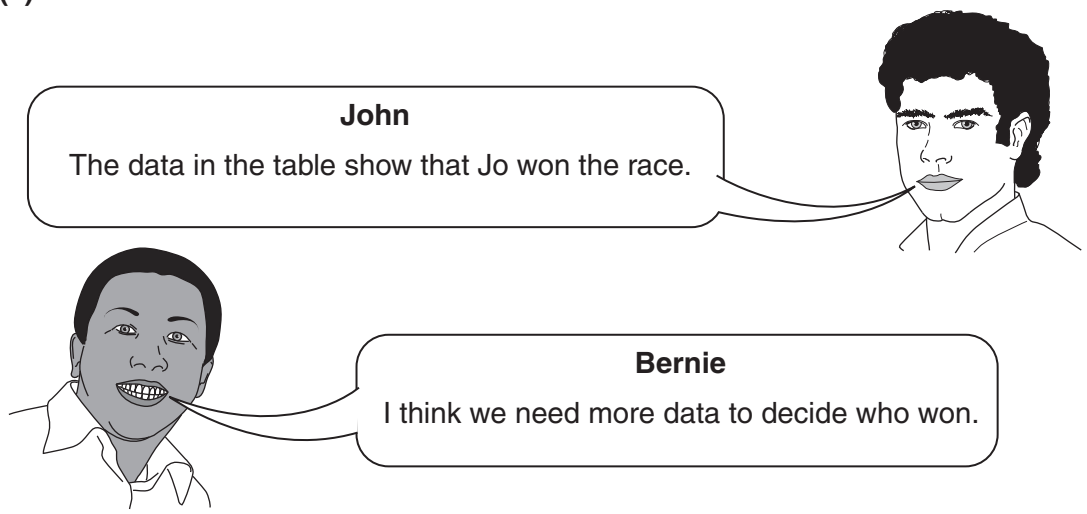
(d) This table shows data for three contestants in another race.

Name of athlete	Mass of athlete and wheelchair in kg	Velocity at finishing line in m/s
Alex	90	6.5
Chris	95	6.5
Jo	90	7.0

(i) Calculate the momentum of Jo and the wheelchair at the finishing line.

momentum = ... kg m/s **[2]**

(ii)



Suggest why Bernie is right.

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..... **[1]**

(e) Suggest why knowing about counter forces on a racing wheelchair is important in its design.

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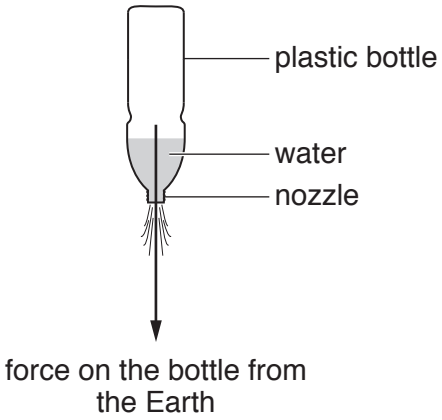
..... **[2]**

[Total: 10]

4 Kassy makes a water rocket from a plastic bottle.

The diagram shows the rocket in flight.



the Earth

The rocket moves when pressurised air in the bottle pushes water out of the nozzle.

(a) The force on the bottle from the Earth is one force in an interaction pair.

What is the partner force in the interaction pair?

Complete the following sentence:

The partner force is the force on the ..... from the ..... . **[1]**

(b) There are forces on the rocket which slow it down as it moves upwards.

One of these forces is the weight of the bottle.

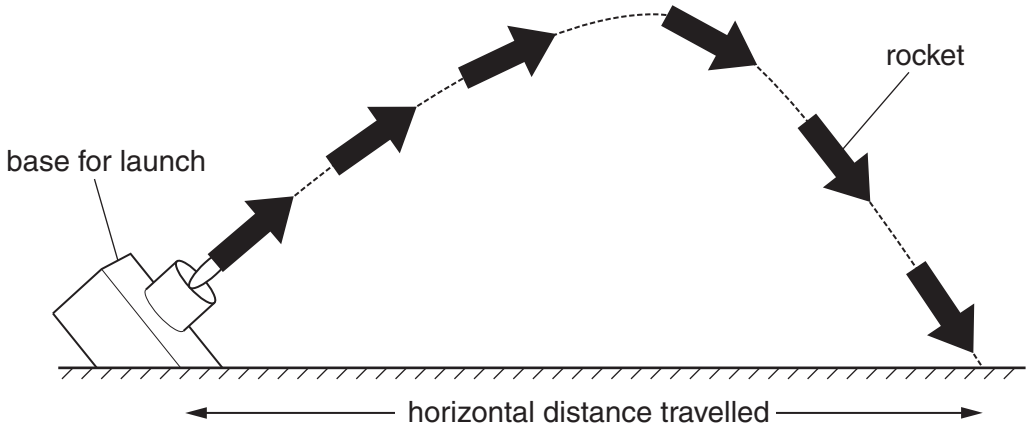
What is the name of another force which slows the rocket down?

..... **[1]**

(c) Kassy carried out some tests on her rocket to find out how far it would go.

She launched her rocket at an angle as shown in the diagram below.

She measured the horizontal distance travelled by the rocket.



In her tests she changed the volume of water in the rocket

(i) She used the same angle of launch and the same pressure to launch the rocket for all the tests.

Explain why she did this.

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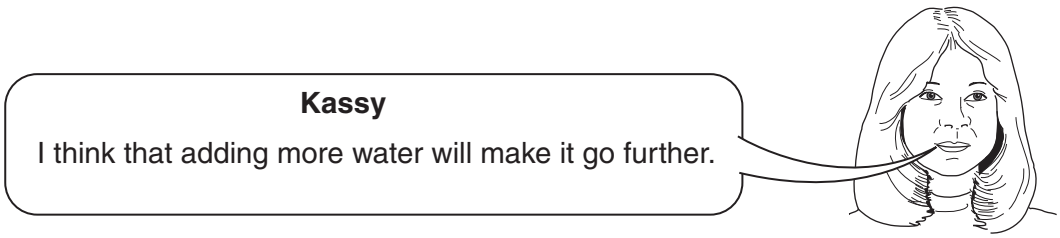
..... **[1]**



Her results are shown in the table below.

Volume of water in cm^3	Horizontal distance travelled in metres
500	13
750	12
1250	14

(ii) Kassy's prediction was that a greater volume of water would make the rocket go further.

Do the data support her prediction?

Give a reason for your answer.

.....

..... **[1]**

(iii) How could she get more evidence to test her prediction?

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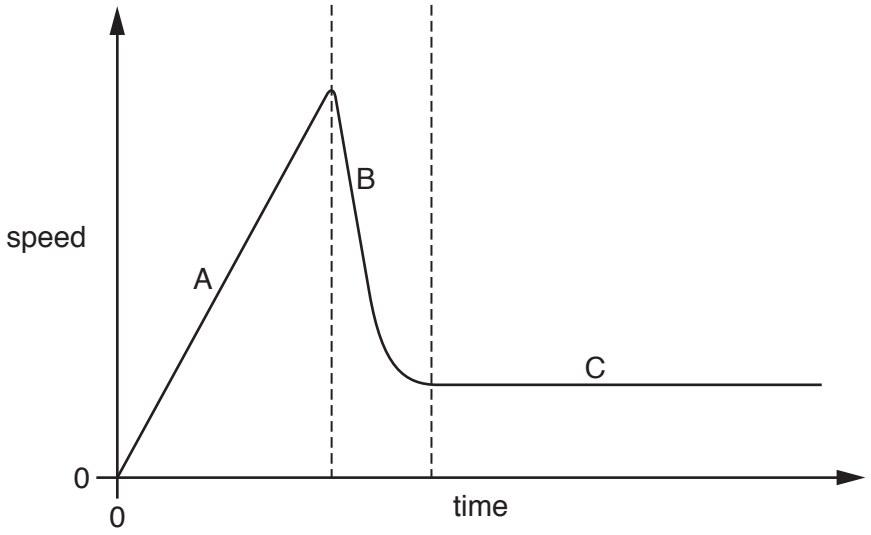
..... **[1]**

[Total: 5]

5 Paul jumps from a helicopter.

After a period of time he opens his parachute.

The graph shows how his **speed** changes with time.



Describe how Paul's speed changes as he falls. Explain these changes using ideas about forces.

The quality of written communication will be assessed in your answer.

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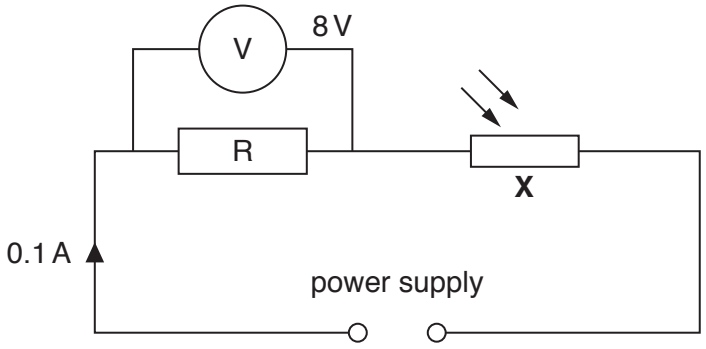
[Total: 6]

6 Dan makes a light meter using this circuit.



(a) Dan shines a torch on component **X**.

(i) What is the name of component **X**?

Put a (ring) around the correct answer.

fixed resistor **lamp** **light dependent resistor** **thermistor** **[1]**

(ii) The voltmeter reading across R is 8 V.

The current is 0.1 A.

Calculate the resistance of R.

Show your working.

resistance = ... Ω **[2]**

(b) He now brings the torch closer to **X**, so that more light falls on it.

(i) This question is about the resistances of **X** and R.

Put a (ring) around the correct choice to complete each sentence.

When more light falls on component **X**, its resistance

decreases

stays the same

increases

and the resistance of R

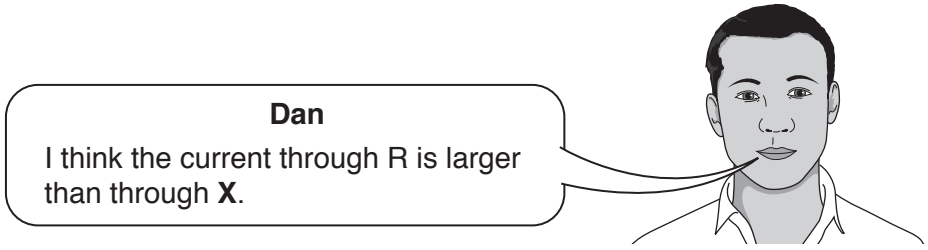
decreases.

stays the same.

increases.

[2]

(ii) The circuit has components R and **X** in series.



Is Dan correct?

Give a reason for your answer.

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..... **[1]**

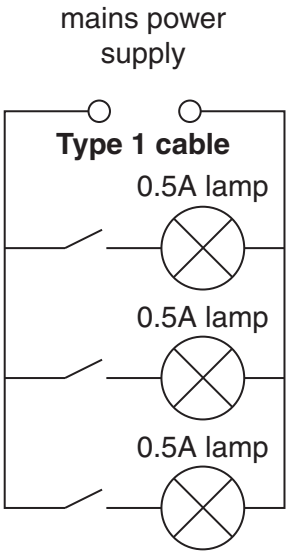
[Total: 6]

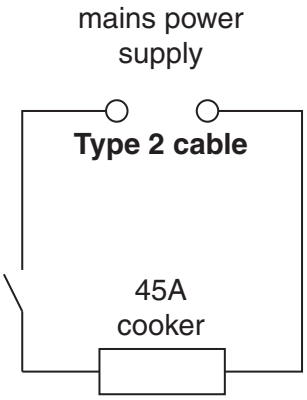
7 Rohan wants to put new lights and an electric cooker into his kitchen.

This will need new electric cables.

He asks a qualified electrician to tell him how much these cables will cost.

The electrician gives Rohan this information.





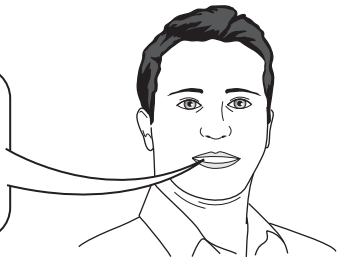
Type 1 cable
Maximum Safe Current: 14A
Cost: 30p per metre

Type 2 cable
Maximum Safe Current: 53A
Cost: £2.70 per metre

Rohan makes suggestions that are unsafe and will not work.

Rohan

We can use just Type 1 cable and connect the cooker and lamps in one series circuit. This will be cheaper.



How would the electrician explain to Rohan that his suggestions are incorrect?

Include risks and likely consequences in your answer.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 6]

8 **(a)** Electricity is produced at a power station.

What is the name of the **device at the power station** that produces electricity?

Put a (ring) around the correct answer.

battery **generator** **motor** **thermistor** **[1]**

(b) Electricity in the home comes from the mains electricity supply.

(i) Which of the statements are true about mains electricity in UK homes?

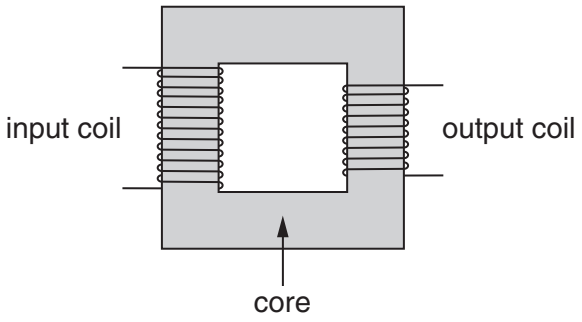
Put ticks (✓) in the boxes next to the **two** correct statements.

Mains electricity is 50 V.	☐
Mains electricity is 110 V.	☐
Mains electricity is 230 V.	☐
Mains electricity is a.c.	☐
Mains electricity is d.c.	☐
Mains electricity is a.c. and d.c.	☐

[2]

(ii) When a laptop computer is connected to the mains, a transformer is used.

The diagram shows the input and output coils of the transformer wound around a core.



Here is a description of how the transformer works.

Complete the sentences by choosing the correct words from this list.

Each word may be used once, more than once or not at all.

copper **current** **electric** **iron**

magnetic **plastic** **resistance** **voltage**

The changing current in the input coil produces a changing ..... field in the core.

The core is made of ..... .

This changing field in the core induces a ..... across the output coil. **[3]**

(c) Why does a transformer not work when there is a battery connected across the input coil?

.....

..... **[1]**

[Total: 7]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).