Pearson Edexcel

Additional Assessment Materials
Summer 2021

Pearson Edexcel GCSE in Physics (1PH0) Foundation

Resource Set Topic F: Electricity and circuits, Magnetism and the motor effect

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021
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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

3 (a) Figure 4 shows the magnetic field produced by a current in a long, straight wire.

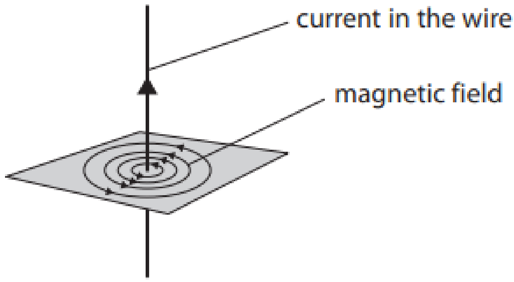


Figure 4

Which row of the table is correct when the strength of the magnetic field is greatest?

(1)

		distance from the wire	current
☐	**A**	small	small
☒	**B**	small	large
☐	**C**	large	small
☐	**D**	large	large

(b) Which of these materials would be the most suitable for making a temporary magnet?

(1)

☐ **A** copper

☒ **B** iron

☐ **C** plastic

☐ **D** steel

(c) Figure 5 shows a magnet holding some paper clips.

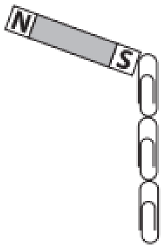


Figure 5

Describe how a student could show that the paper clips are induced magnets.

(2)

When you remove the magnet from the paperclips, the paper clips will no longer be attracted to each other, proving that the paperclips are induced magnets..

(d) Describe how you could show that the Earth has a magnetic field.

(2)

Place a compass on Earth and it will point to the same direction. This proves existence of magnetic poles and the magnetic field induced by them.

(e) A student uses a compass to investigate the magnetic field near a bar magnet.

The student places the compass near the bar magnet as shown in Figure 6.

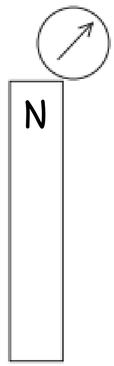


Figure 6

(i) Mark the north pole of the bar magnet with an 'N' in Figure 6.

(1)

(ii) State two ways in which the investigation could be developed to show the shape of the magnetic field around the bar magnet.

You may add to Figure 6 to help with your answer.

(2)

1 Keep the compass at various positions and mark the direction the needle points with dots and join the dots.

2 Sprinkle iron fillings to observe the shape of the magnetic field lines.

6 (a) Figure 12 shows a graph of current against potential difference for an electrical component.

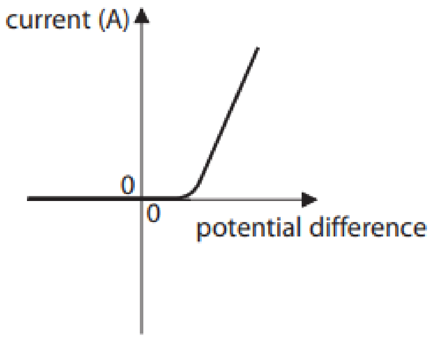


Figure 12

Which electrical component will show this variation of current with potential difference?

(1)

☐ **A** thermistor

☐ **B** low value resistor at constant temperature

☐ **C** high value resistor at constant temperature

☒ **D** diode

(b) A lamp is connected to a potential difference of 0.24V.

The current in the lamp is 0.12A.

(i) Calculate the power of the lamp.

Use the equation

$P = I \times V$

(2)

= 0.12 x 0.24

= 0.0288 ≈ 0.029 W

(ii) The potential difference is changed to 0.30 V.
The current in the lamp is now 0.13 A.

The lamp is switched on for 35 s.

Calculate the energy that is transferred in this time.
Select an equation from the list of equations at the end of this paper.

(2)

$E = V \times I \times t$

$= 0.3 \times 0.13 \times 35$

$= 1.365 \approx 1.4$

energy transferred = 1.4 J

(iii) The current in the lamp stays at 0.13 A.

Calculate the charge that flows through the lamp in 35 s.
Use the equation

$Q = I \times t$

(2)

$= 0.13 \times 35$

$= 4.55 \approx 4.6$

charge = 4.6 C

(c) A student measures the current in the lamp for several values of potential difference across the lamp.

Figure 13 shows the student's results.

potential difference across the lamp in volts (V)	current through the lamp in amps (A)
0.06	0.05
0.12	0.08
0.18	0.10
0.24	0.12
0.30	0.13
0.36	0.13

Figure 13

The student uses the results in Figure 13 to write this conclusion.

'As the potential difference across the lamp increases, the current in the lamp increases and the relationship is directly proportional.'

Comment on the student's conclusion.

(3)

As pd. increases, the current also increases initially. However, the relation is not directly proportional (when the pd doubled the current increases by 0.03 and when the pd tripled, the current increases by 0.05, where an increase of 0.06 is expected to be directly proportional). Furthermore, the current remains constant after a pd of 0.3V which the student has not explained.

1 (a) Figure 1 gives the names of three atomic particles and some descriptions of the charge on the particles and their position in the atom.

Draw one straight line from each atomic particle to its correct description.

(3)

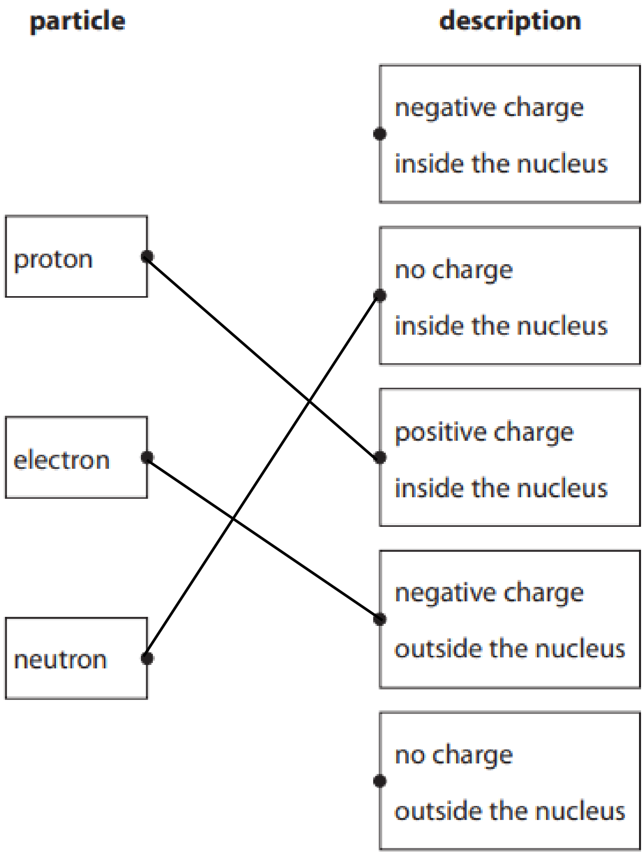


Figure 1

(b) Figure 2 shows the junction of three wires, F, G and H, in a circuit.
The current in wire F is 6.0 A.
The current in wire G is 3.5 A.

Calculate the current in wire H.

(1)

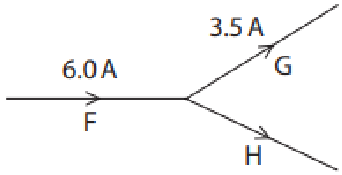


Figure 2

6 = 3.5 + H
H = 2.5

current in wire H = 2.5 A

(c) A wire in a circuit carries a current of 0.9 A.
Calculate the quantity of charge that flows through the wire in 50 s.

State the unit of charge with your answer.

Use the equation

charge = current × time

(3)

= 0.9 × 50

quantity of charge = 45 unit C

3 (a) Which of these is a magnetic material?

(1)

- ☐ **A** aluminium
- ☐ **B** carbon
- ☒ **C** cobalt
- ☐ **D** copper

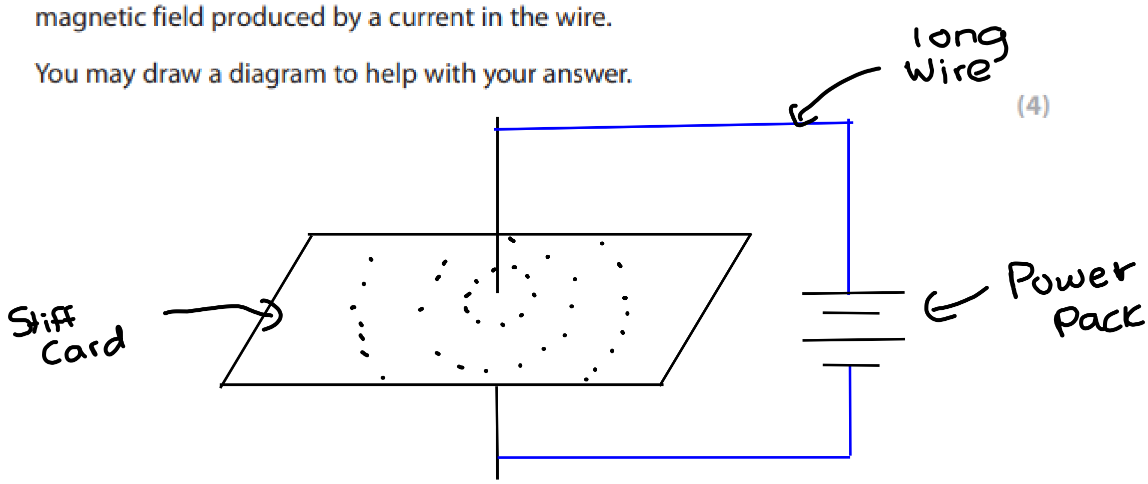
(b) A student has

- a power pack
- a long piece of wire
- a stiff card
- iron filings

Describe how the student could use this equipment to show the shape of the magnetic field produced by a current in the wire.

You may draw a diagram to help with your answer.

(4)



Assemble the apparatus as shown above with the long piece of wire passing through the stiff card and connected to the ends of the power pack. Sprinkle the iron fillings on top of the stiff card and tap the card slightly until the fillings align themselves. These concentric circles show the magnetic field lines produced by the wire.

(c) Figure 5 shows two magnetic poles facing each other.

The magnetic field between the poles is uniform.

On Figure 5, draw the magnetic field lines between the two poles and show the direction of this magnetic field.

(3)

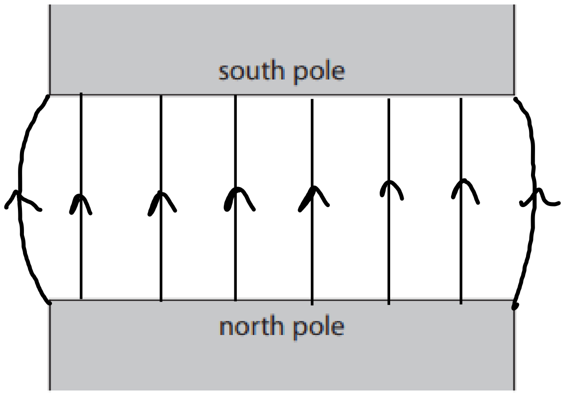


Figure 5

8c

(c) A student plots a graph showing the height at the start and the maximum height reached after each bounce.

Figure 16 shows the student's graph.

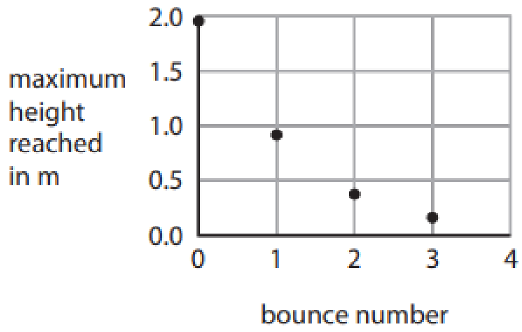


Figure 16

Describe how the maximum height reached changes with the bounce number in Figure 16.

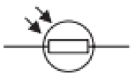
(2)

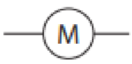
The maximum height reached by the ball decreases after each bounce as energy is lost from the ball as heat and sound at each bounce.

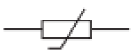
9 (a) Which of these symbols is used to represent a thermistor in an electrical circuit?

(1)

☐ **A** 

☐ **B** 

☐ **C** 

☒ **D** 

(b) A student investigates how the current in a lamp changes with the potential difference across the lamp.

The student uses the results to calculate the resistance of the lamp.

The results are shown in the table in Figure 17.

potential difference in V	current in A	resistance in Ω
1.0	0.09	11
2.0	0.14	14
3.0	0.18	17
4.0	0.22	18
5.0	0.26	
6.0	0.30	20

Figure 17

(i) One value of resistance is missing from the table in Figure 17.

Calculate the value of resistance that is missing from the table.

(3)

$V = IR$

$5 = 0.26 \times R$

$R = 19.23$

≈ 19

missing resistance = 19 Ω

(ii) The student writes this conclusion:

'The resistance of the lamp is directly proportional to the potential difference.'

Comment on the student's conclusion.
Use information from Figure 17 in your answer.

(3)

As the pd doubles from 1 to 2V, the resistance has increased by 3 ohms from 11 to 14 ohms. However, when the pd quadruples from 1 to 4V, the resistance has increased by 7 ohms from 11 to 18 ohms, when an increase of 12 ohms is expected. The resistance is not directly proportional to the potential to difference.

*(c) Figure 18 shows a battery connected to a filament lamp.

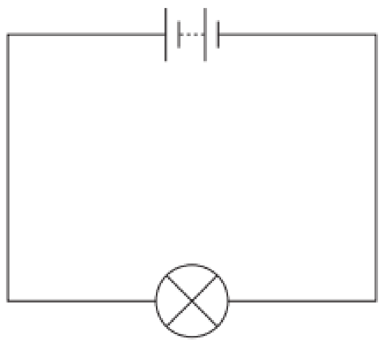


Figure 18

Explain, in terms of the movement of charged particles, how energy is transferred from the battery, through the lamp, to the surroundings.

(6)

Energy is stored as chemical energy on the battery which is converted to electrical energy and transported through electrons to the bulb, where the electrical energy is converted to light and thermal energy.

2 (a) Figure 4 shows the inside of a mains plug.

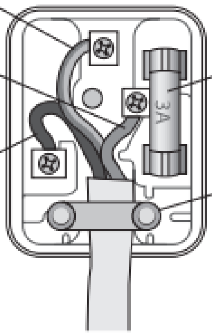


Figure 4

The mains plug has three safety features.

One of these safety features has been ticked in the table.

Put **two** more ticks in the table to show the other two safety features.

(2)

part of plug	safety feature
cable grip	✓
earth wire	✓
fuse	✓
live wire	
neutral wire	

(b) Figure 5 shows a charger for a car battery.

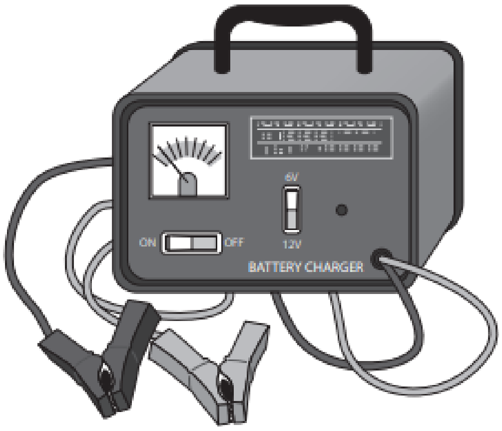


Figure 5

(i) The meter on the battery charger shows the current supplied to a battery.

The meter on the battery charger is

(1)

☒ **A** an ammeter

☐ **B** an ohmmeter

☐ **C** a voltmeter

☐ **D** a wattmeter

(ii) The battery charger supplies a steady current of 2.5 A to the battery.

Calculate the charge flowing to the battery in 8 minutes.

Use the equation

$$\text{charge} = \text{current} \times \text{time}$$

(2)

$= 2.5 \times 8 \times 60$

charge = 1200 C

(c) The transformer in another battery charger has a primary coil and a secondary coil.

The voltage across the primary coil = 230V.

The voltage across the secondary coil = 15V.

The current in the secondary coil is 3.1 A.

Calculate the current in the primary coil.

Use the equation

$$\text{primary current} = \frac{\text{secondary voltage} \times \text{secondary current}}{\text{primary voltage}}$$

(2)

$$= \frac{15 \times 3.1}{230}$$

$$= 0.202$$

$$\approx 0.20$$

current = 0.20 A

5 (a) Figure 13 shows a part of a machine used to separate steel cans from aluminium cans.

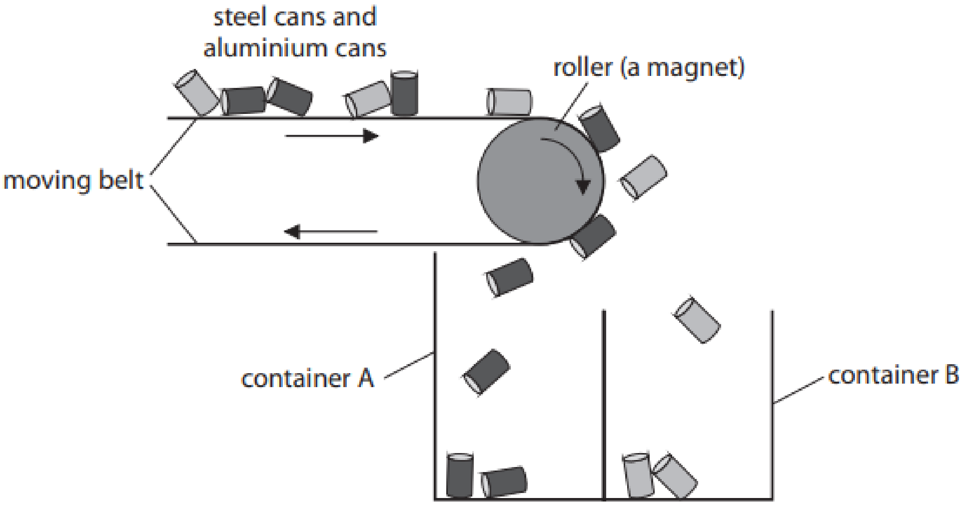


Figure 13

The cans are carried along a moving belt.

The belt goes around a roller.

The roller is a magnet.

Each can falls into one of the containers.

Explain how this machine separates the steel cans from the aluminium cans.

(2)

The aluminium cans are not attracted to the roller and falls directly to container B and steel cans are attracted to the roller and falls after a while to container A.

(b) A student investigates magnetism using two toys as shown in Figure 14.

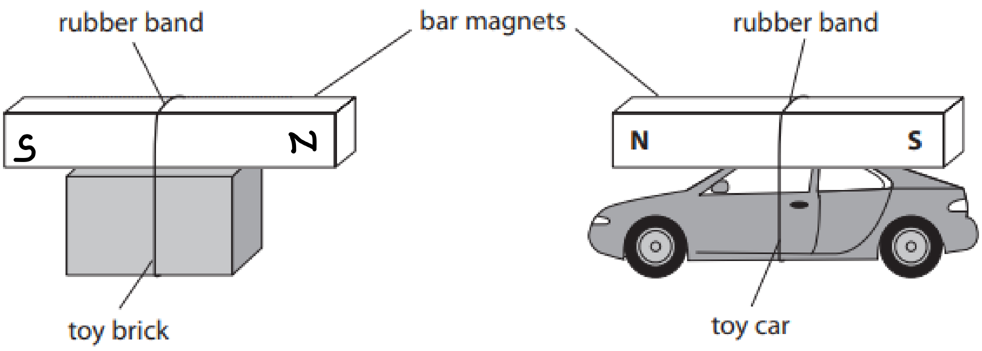


Figure 14

(i) There is a magnet attached to the top of each toy.

The student moves the toy brick towards the toy car.

The magnet on the toy brick repels the magnet on the toy car.

On Figure 14, label the north pole and the south pole on the magnet attached to the toy brick.

(1)

(ii) Explain why the toy car starts to move only when the toy brick gets near to the toy car.

(2)

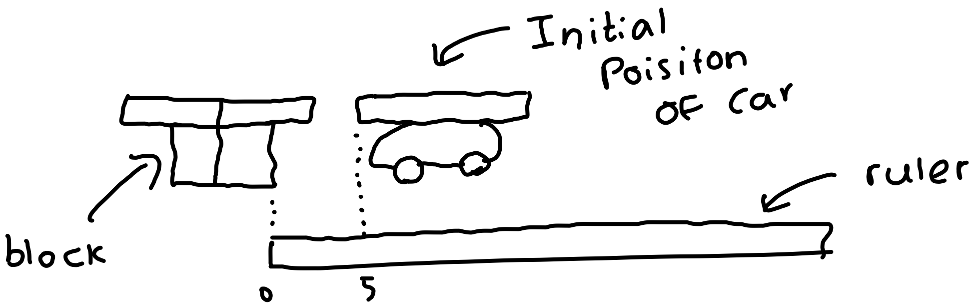
The force experienced by the car is due to the repulsive force due to the two magnets and becomes significant enough to move only when the magnets are close to each other (when the magnetic field strength increases).

(iii) The student thinks that two magnets on top of each other will produce a magnetic field that is stronger than the magnetic field from a single magnet.

The student has a metre rule and more magnets available.

Describe how the student could develop this investigation to test this theory.

(4)



First keep a single magnet on top of the brick. Place the car with the magnet at 5 cm from the brick which can be measure using the ruler. After the car has moved away from the brick, measure the distance moved by subtracting the current distance to the block from the original distance. Repeat the experiment with the block having two magnets on top of each other. If the second method made the car move a larger distance from the block, it can be concluded the student's theory is acceptable.

6 A student investigates resistors connected in series in an electrical circuit.

The student has

- a 3.0 V battery
- a 22 Ω resistor
- a resistor marked X.

The student does not know the value of the resistor marked X.

The student decides to measure the potential difference (voltage) across resistor X.

Figure 15 shows the circuit that the student connected.

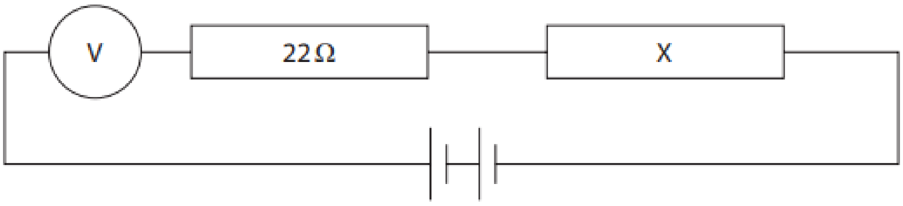


Figure 15

(a) The circuit is connected incorrectly.

Describe how the student should correct the mistake.

(2)

The voltmeter should be kept in parallel across the resistor X only.

(b) The student corrects the mistake.

The voltage across resistor X is 2.1 V.

The circuit is connected to a 3 V battery.

(i) State the value of the voltage across the 22 Ω resistor.

(1)

3 - 2.1

voltage across 22 Ω resistor = 0.9 V

(ii) The current in resistor X is 0.041 A.

The voltage across resistor X is 2.1 V.

Show that the resistance of resistor X must be about 50 ohms.

Use the equation

$$V = I \times R$$

(2)

$2.1 = 0.041 \times R$

$\frac{2.1}{0.041} = R = 51.22 \approx 50\ \Omega$

(iii) Calculate the power in resistor X when the voltage across X is 2.1 V and the current in resistor X is 0.041 A.

(2)

$P = VI$

$= 2.1 \times 0.041$

$= 0.0861$

≈ 0.086

power = 0.086 W

(iv) Calculate the overall resistance of the 22 ohm resistor and resistor X.

(2)

$R = R_1 + R_2$

$= 22 + 50$

overall resistance = 72 Ω

(v) The current in the circuit is 0.041 A.

The voltage across the battery is 3.0 V.

Calculate the energy transferred in 2 minutes.

Use the equation

$$E = I \times V \times t$$

(2)

$= 0.041 \times 3 \times (2 \times 60)$

$= 14.76$

≈ 14.8

energy = 14.8 J

TOTAL FOR PAPER IS 78 MARKS