Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Physics/Additional Science

Unit P2: Physics for Your Future

Higher Tier

Thursday 8 November 2012 – Morning
Time: 1 hour

Paper Reference
5PH2H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 1 7 4 8 A 0 1 2 0

PEARSON

FORMULAE

You may find the following formulae useful.

charge = current × time $Q = I \times t$

potential difference = current × resistance $V = I \times R$

electrical power = current × potential difference $P = I \times V$

energy transferred = current × potential difference × time $E = I \times V \times t$

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \qquad a = \frac{(v - u)}{t}$$

force = mass × acceleration $F = m \times a$

weight = mass × gravitational field strength $W = m \times g$

momentum = mass × velocity

$$\text{force} = \frac{\text{change in momentum}}{\text{time}} \qquad F = \frac{(mv - mu)}{t}$$

work done = force × distance moved in the direction of the force $E = F \times d$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{E}{t}$$

gravitational potential energy = mass × gravitational field strength × vertical height

$\text{GPE} = m \times g \times h$

kinetic energy = ½ × mass × velocity^2 $\text{KE} = ½ \times m \times v^2$

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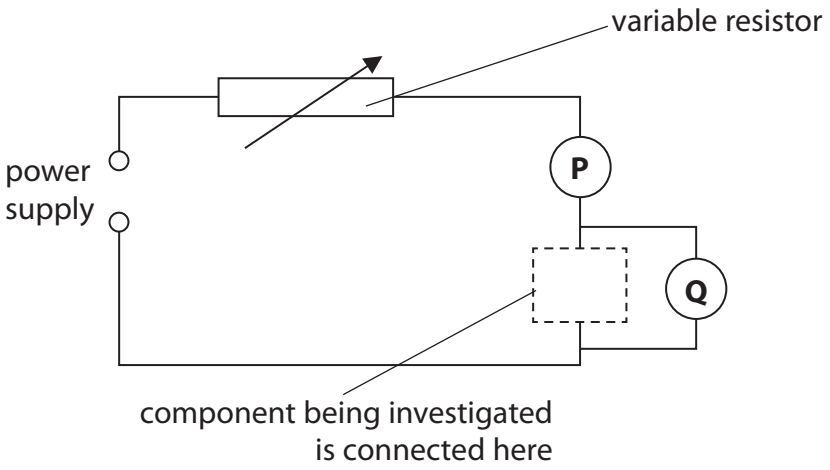
Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Electrical resistance

1 (a) Some students investigate the electrical resistance of different components using this circuit.



(i) Which row of the table is correct for both meters **P** and **Q**?

Put a cross (☒) in the box next to your answer.

(1)

	meter P is	meter Q is
☒ **A**	an ammeter	an ammeter
☒ **B**	an ammeter	a voltmeter
☒ **C**	a voltmeter	a voltmeter
☒ **D**	a voltmeter	an ammeter

(ii) One of the components being investigated is a 12 ohm resistor. When it is in the circuit, the ammeter reading is 0.50 A.

Calculate the voltmeter reading.

(2)

voltmeter reading = ... V

(iii) The students reduce the resistance of the variable resistor.
State what happens to the readings on each of the meters **P** and **Q**.

(2)

.....

.....

.....

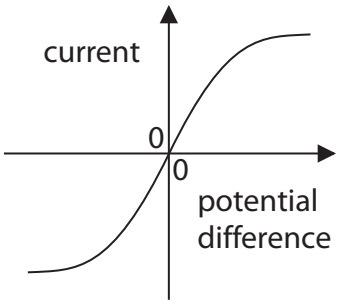
.....

(iv) The students then reduce the voltage of the power supply.
State what happens to the current in the circuit.

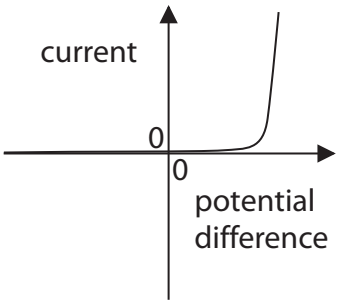
(1)

.....

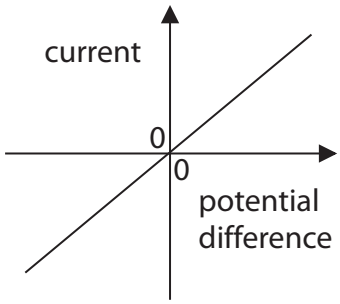
(b) The graphs **L**, **M** and **N** each show how the current in a component varies with the potential difference (voltage) across that component.



L



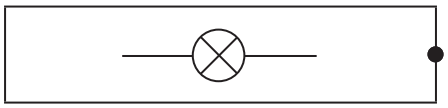
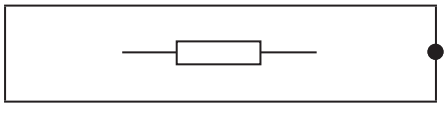
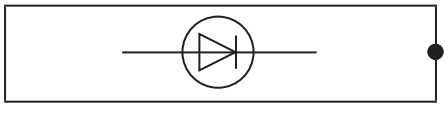
M



N

Match each graph with the symbol of the component to which it applies.
Draw lines to connect each symbol with its correct graph.

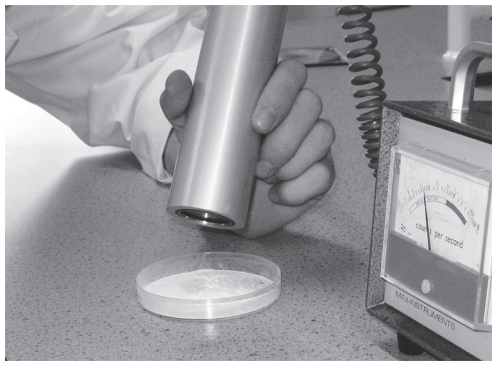
(2)

component symbol	**graph**
	graph **L**
	graph **M**
	graph **N**

(Total for Question 1 = 8 marks)

Measuring radioactivity

2 (a) A scientist uses a Geiger counter to measure the radioactivity of a sample.



She writes down the results in her notebook.
The Geiger counter gives a count rate of 120 counts per minute.
The average background radiation in her laboratory is 10 counts per minute.

(i) What should she write down for the count rate of this sample?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** 12 counts per minute

☒ **B** 110 counts per minute

☒ **C** 130 counts per minute

☒ **D** 1200 counts per minute

(ii) Name **one** source of background radiation.

(1)

.....

(iii) Explain why some people are exposed to more background radiation than others.

(2)

.....

.....

.....

.....

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

The recommended safe limit for exposure to radiation has been reduced over the last 80 years.
This is because now

(1)

☒ **A** better instruments allow scientists to make measurements more quickly

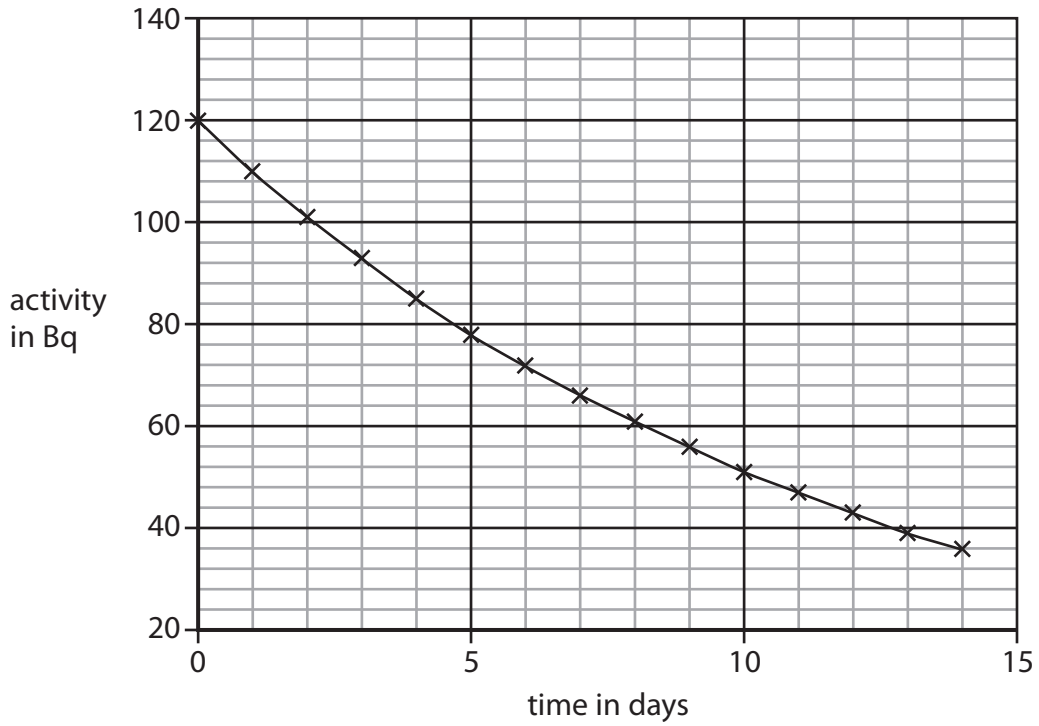
☒ **B** global warming has increased the rate of decay of radioactive materials

☒ **C** humans release more radioactive materials into the environment

☒ **D** scientists have a better understanding of the dangers of radiation

(b) After the accident at the Fukushima nuclear plant in Japan, some drinking water became contaminated with radioactive iodine-131.

The graph shows how the activity of a sample of iodine-131 changes over two weeks.



(i) Use the graph to estimate the half-life of the iodine-131.
Show your working clearly.

(2)

half-life = ... days

(ii) The recommended safe limit for a sample of this size is 100 Bq.

How long did it take for the activity of the sample to decay until it was below the safe limit?

(1)

time taken = ... days

(iii) When iodine-131 decays, it emits beta radiation.

State one possible danger to health from exposure to beta radiation.

(1)

.....

.....

(Total for Question 2 = 9 marks)

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Nuclear power

3 (a) Two isotopes of uranium are U-235 and U-238.

Here are the symbols of the nuclei of these isotopes.

$$^{235}_{92}U \quad \text{and} \quad ^{238}_{92}U$$

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.
The U-235 isotope has

(1)

☒ **A** the same number of neutrons as U-238

☒ **B** the same number of protons as U-238

☒ **C** more neutrons than U-238

☒ **D** more protons than U-238

(ii) U-235 is radioactive.
When it decays, it releases an alpha particle.

Describe an alpha particle.

(2)

(b) U-235 can also be made to undergo fission.

Describe what happens during nuclear fission.

(4)

(c) Fission is used in nuclear reactors.
Graphite is used as a moderator in nuclear reactors.

Explain why a moderator is needed in a nuclear reactor.

(2)

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.....

(Total for Question 3 = 9 marks)

Static electricity

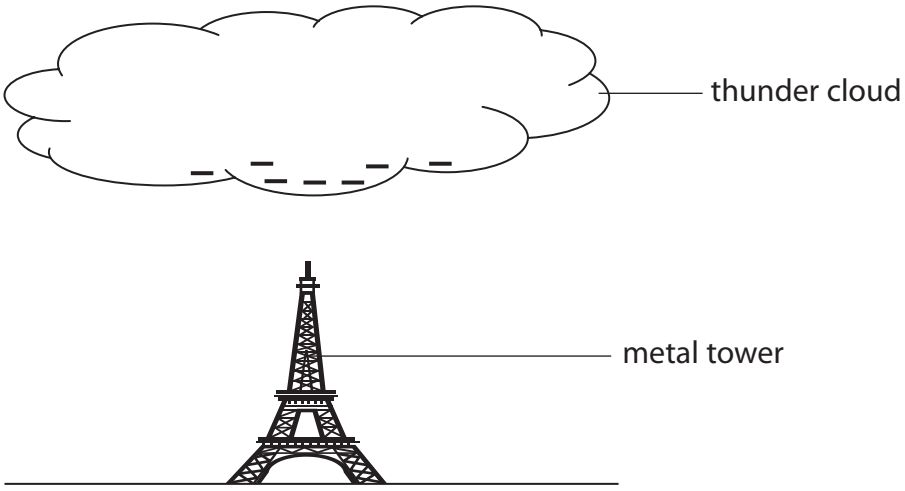
4 (a) A lightning strike on a metal tower can be described as follows.

In the cloud.

A thunder cloud contains moving ice particles.

Some of these ice particles are negatively charged and some are positively charged.

The negatively charged particles move to the bottom of the cloud.



Not to scale

When the charged cloud is over the metal tower.

A charge builds up on the top of the metal tower as the cloud passes over.

During the lightning flash.

Eventually a flash of lightning travels between the cloud and the tower.

(i) Which row of this table is correct when the cloud is over the top of the tower before the lightning flash?

Put a cross (☒) in the box next to your answer.

(1)

		charge on top of the cloud is	charge on top of the tower is
☒	**A**	negative	negative
☒	**B**	negative	positive
☒	**C**	positive	positive
☒	**D**	positive	negative

(ii) Here are **four** statements.
Three of these are a reason for what happens at each stage.

1: opposite charges attract each other
2: like charges repel each other
3: ice particles gain electrons
4: ice particles lose protons

Choose the best reason for each of the stages listed below by writing its number in the box next to the description of what happens.
One has been done for you.
A reason can only be used **once**.

(2)

in the cloud	reason
the bottom of the cloud becomes negatively charged	

when the charged cloud is over the metal tower	reason
the top of the tower becomes charged	

during the lightning flash	reason
electrons move through the air	1

(iii) Explain what happens to the charge on the metal tower as a result of the lightning flash.

(2)

.....

.....

.....

.....

(b) During the lightning flash a total charge of 52 C flows.
The average current is 2600 A.

Calculate the duration of the flash in seconds.

(3)

duration of flash = ... s

(c) When fuel tanks on an aircraft are being filled, the aircraft, fuel pipes and tanker are connected by a metal wire to the ground.

Explain why this greatly reduces the chance of a spark.

(2)

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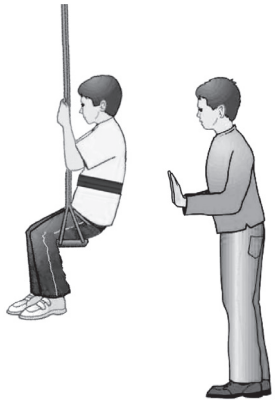
(Total for Question 4 = 10 marks)

The swing

5 A child is stationary on a swing.



(a) The child is given a push by his brother to start him swinging.
His brother applies a steady force of 84 N over a distance of 0.25 m.

(i) Calculate the work done by this force.

(2)

work done = ... J

(ii) State how much energy is transferred by this force.

(1)

energy transferred = ... J

(iii) After several more pushes, the child has a kinetic energy of 71 J.

The mass of the child is 27 kg.

Show that the velocity of the child at this point is about 2.3 m/s.

(2)

(iv) Which one of these quantities changes in both size and direction while he is swinging?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** his gravitational potential energy

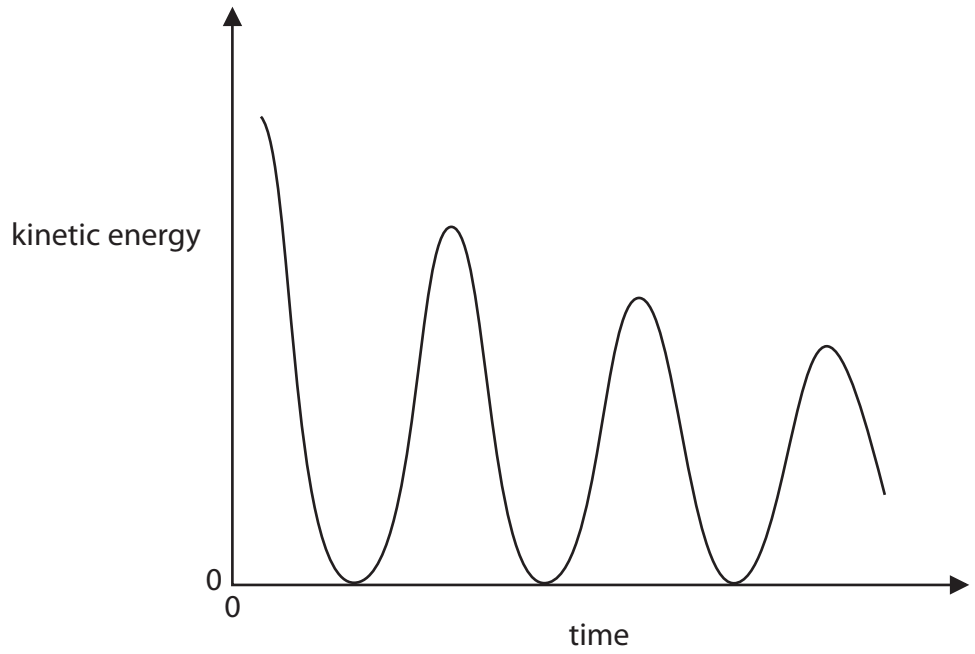
☒ **B** his momentum

☒ **C** the force of gravity acting on him

☒ **D** his kinetic energy

*(b) The brother then stops pushing the child.

The graph shows how the kinetic energy of the child varies over the next few swings.

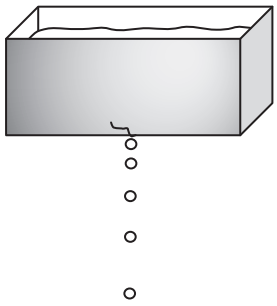


Explain the energy changes during this time.

(6)

(Total for Question 5 = 12 marks)

6 A water tank drips water.



(a) Scientists could use four quantities to describe the movement of the water drops.
Three of these quantities are vectors.
The other quantity is a scalar.

acceleration	force	mass	velocity

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

The scalar quantity is

(1)

☒ **A** acceleration

☒ **B** force

☒ **C** mass

☒ **D** velocity

(ii) Complete the following sentence using one of the quantities from the word box above.

(1)

In a vacuum, all bodies falling towards the Earth's surface

have the same ..... .

(b) The mass of one water drop is 0.000 08 kg.

Calculate its weight.

(gravitational field strength is 10 N/kg)

(2)

weight = ... N

(c) The water drop falls to the ground, 13 m below, in 1.7 s.

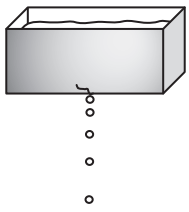
Calculate the average speed of the drop while it is falling.

(2)

average speed = ... m/s

*(d) The tank is a long way above the ground.
It drips at a steady rate.

The first drawing shows water drops which have just left the tank.
The second drawing shows water drops which are near to the ground.



drops leaving the tank

drops near to the ground

Explain why the drops which are near to the ground are an equal distance apart but the drops which have just started to fall are not.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS