Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Higher Tier

Thursday 12 June 2014 – 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 3 4 2 2 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 $P = m \times v$

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

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 ☒.

Static electricity

1 (a) A student rubs a plastic rod with a dry cloth. The cloth becomes positively charged.

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

The cloth becomes positively charged because

(1)

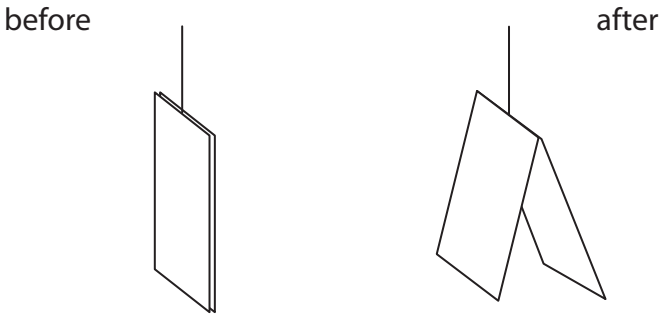
☒ **A** negative charge has moved from the cloth to the rod

☒ **B** negative charge has moved from the rod to the cloth

☒ **C** positive charge has moved from the cloth to the rod

☒ **D** positive charge has moved from the rod to the cloth.

(ii) Two plastic strips are joined at the top and are hanging by a thread.
The student rubs both strips with another dry cloth.
The diagram shows the two plastic strips before and after the student rubs them.



Explain why the strips behave in this way after they are rubbed with the cloth.

(2)

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(b) The student reads an article about the possible build-up of static electricity during the refuelling of an aircraft.

(i) Explain why this build-up could be dangerous.

(2)

(ii) The article also states that the aircraft is connected by a metal cable to the ground. The aircraft is also connected by a metal cable to the refuelling tanker.

Explain how these cables reduce the dangers when refuelling the aircraft.

(3)

(Total for Question 1 = 8 marks)

Using electric current

2 A student uses an electric kettle.

It works from the 230 V mains supply.

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

A potential difference of 1 volt is the same as

(1)

☒ **A** 1 joule per coulomb

☒ **B** 1 joule per ohm

☒ **C** 1 watt per ohm

☒ **D** 1 watt per coulomb

(b) The power of the kettle when it is heating water is 1.8 kW.
The mains voltage is 230 V.

(i) Calculate the current in the kettle.

(3)

current = ... A

(ii) The kettle is switched on for 2 minutes.

Calculate the total amount of energy transferred by the kettle in this time.

(2)

energy transferred = ... J

(iii) The heating element of the kettle contains a resistor made from a long length of wire. Explain why an electric current in a resistor makes the resistor heat up.

(2)

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(Total for Question 2 = 8 marks)

Momentum, energy, work and power

3 (a) A father pushes his child in a cart. The cart starts to move.

Scientists can use many physical quantities to describe what is happening.

Four of these are shown in the box.

energy	momentum	power	work

(i) Which one of these can be measured in joules per second?

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

(1)

☒ **A** energy

☒ **B** momentum

☒ **C** power

☒ **D** work

(ii) Complete the sentence using words from the box.

(1)

The ..... transferred to the cart is equal to the ..... done on the cart.

(iii) The child and cart have a total mass of 50 kg. They travel at a velocity of 4 m/s.

Calculate the momentum of the child and cart.

(2)

momentum = ... kg m/s

(iv) The father applies a steady force for a time of 1.5 s. The momentum of the child and cart increases by 450 kg m/s.

Calculate the force which the father applies.

(2)

force = ... N

(v) Momentum is a vector quantity.

State what is meant by a vector quantity.

(1)

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(b) The photograph shows a mother and her daughter stationary on an ice rink.

The mother and daughter push each other away.
They move in opposite directions with different speeds.

Explain why they have different speeds.

(3)

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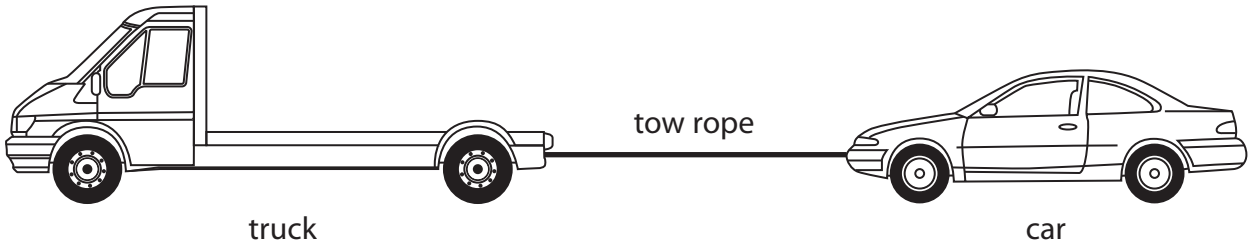
(Total for Question 3 = 10 marks)

4 A truck is towing a car along a level road at a constant velocity.

A tow rope is attached to the truck and the car.



(a) Which of these shows the directions of the forces between the car and the tow rope?

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

(1)

	force exerted by car on tow rope	force exerted by tow rope on car
☒ **A**	←	→
☒ **B**	→	←
☒ **C**	→	→
☒ **D**	←	←

(b) The truck has to provide a force of 4000 N to the left on the car to keep the car at a constant velocity.

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

The resultant force on the car is

(1)

☒ **A** 0 N

☒ **B** 4000 N to the left

☒ **C** 4000 N to the right

☒ **D** 8000 N to the left

(c) Both vehicles are travelling at 13 m/s.

The driver of the truck then accelerates at 1.2 m/s^2 until both vehicles are travelling at 20 m/s.

(i) Calculate the time taken for this acceleration.

(3)

time = ... s

(ii) The mass of the car is 1400 kg.

Calculate the resultant force on the car needed to produce an acceleration of 1.2 m/s^2.

(2)

force = ... N

(iii) A rope can withstand a tension of 12 000 N before it breaks.
The weight of the car is 14 000 N.

Discuss whether this rope could be strong enough to tow the car with the truck.

(3)

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(Total for Question 4 = 10 marks)

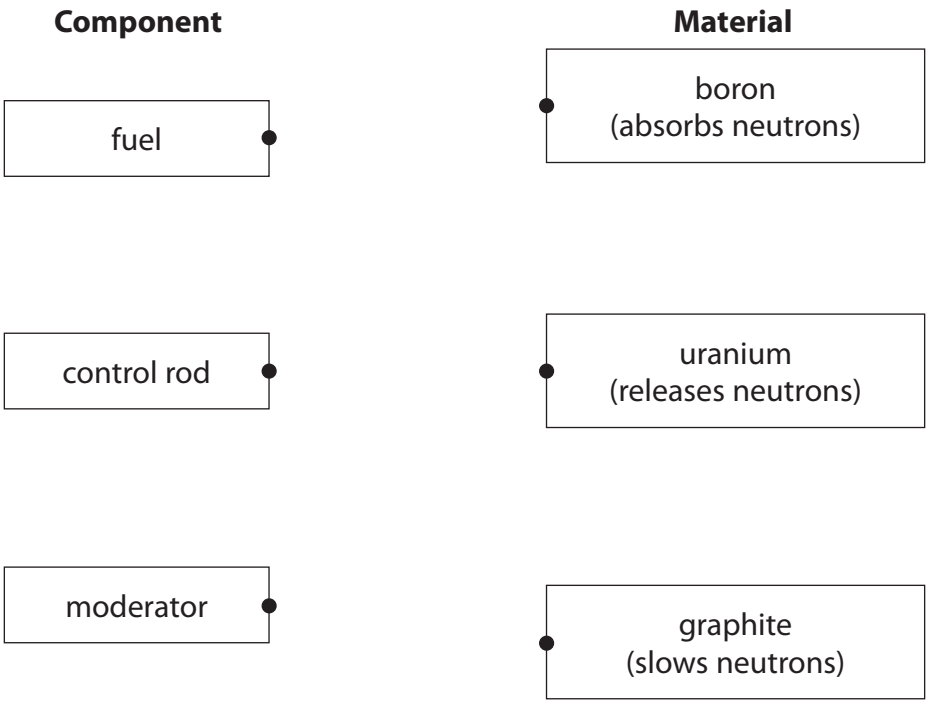
Nuclear reactors

5 (a) Fast neutrons are released during nuclear fission.

(i) Three different components of a nuclear fission reactor are shown.
Three different materials used in a nuclear fission reactor are also shown.

Draw one line from each component to the material it contains.

(2)



(ii) Another type of nuclear reactor is a fusion reactor.
Nuclear fusion also releases fast neutrons.

Suggest why a nuclear fusion reactor does not need anything to slow these neutrons down.

(1)

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(b) Both nuclear fission and nuclear fusion release thermal energy.

Describe how the thermal energy released could be converted into electrical energy in a power station.

(3)

*(c) Scientists and engineers are still trying to build a practical and economic nuclear fusion reactor.

They have not been able to sustain the extreme conditions needed for controlled nuclear fusion.

Explain what these conditions are and why they are needed.

(6)

(Total for Question 5 = 12 marks)

Using radioactive materials

6 (a) In some countries food is sold with this label.

This food has been deliberately exposed to gamma radiation.

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

The gamma radiation is used to

(1)

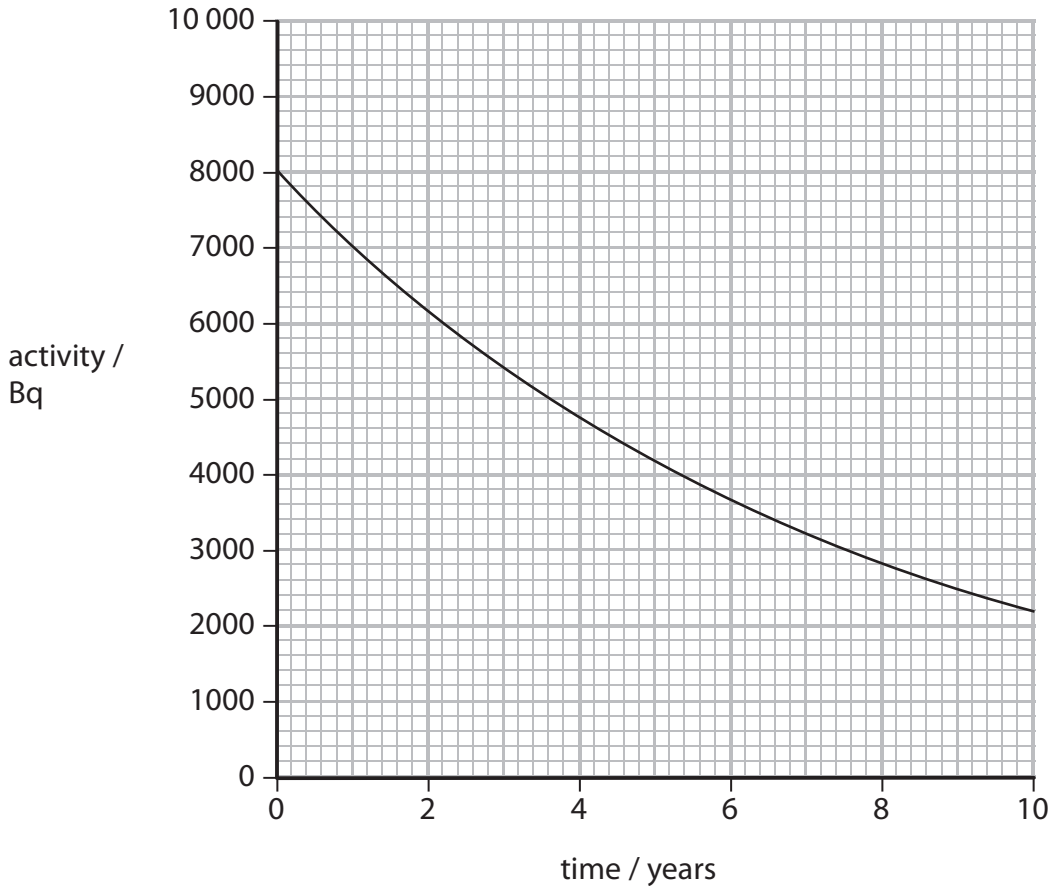
☒ **A** produce cancer cells in the food

☒ **B** kill cancer cells in the food

☒ **C** kill microbes in the food

☒ **D** make the food radioactive.

(b) Cobalt-60 is one source of gamma radiation used for food irradiation.
This graph shows how the activity of a sample of cobalt-60 changes over 10 years.



(i) Use the graph to find the half-life of cobalt-60.

(2)

half-life = ... years

(ii) The cobalt-60 has to be replaced when its activity has fallen below 1000 Bq.

Estimate how long it takes for the activity to fall from 8000 Bq to 1000 Bq.

(1)

time taken = ... years

(c) The cobalt-60 sources used to irradiate the food are small metal rods about the size of a pencil. They are made from stable cobalt-59 which is put inside a nuclear reactor. Some of the cobalt-59 is turned into cobalt-60 by the radiation in the reactor.

(i) The nuclei of the two isotopes can be represented as

$$^{60}_{27}Co \qquad\qquad ^{59}_{27}Co$$

Compare these two isotopes of cobalt.

(2)

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*(ii) When it is time to replace the cobalt-60 rods there are two options.

- The rods can be disposed of.
- The rods can be transported to a nuclear reactor to turn more of the cobalt-59 into cobalt-60 so that they can be used again.

Discuss the hazards in these two options.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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