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Candidate Number

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Physics/Additional Science

Unit P2: Physics for Your Future

Higher Tier

Friday 26 January 2018 – Morning Time: 1 hour	Paper Reference 5PH2H/01
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<p>You must have: Calculator, ruler</p>	<p>Total Marks</p>
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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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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FORMULAE

You may find the following formulae useful.

charge = current \times time

$$Q = I \times t$$

potential difference = current \times resistance

$$V = I \times R$$

electrical power = current \times potential difference

$$P = I \times V$$

energy transferred = current \times potential difference \times time

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

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

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

$$a = \frac{(v - u)}{t}$$

force = mass \times acceleration

$$F = m \times a$$

weight = mass \times gravitational field strength

$$W = m \times g$$

momentum = mass \times velocity

$$P = m \times v$$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$F = \frac{(mv - mu)}{t}$$

work done = force \times distance moved in the direction of the force

$$E = F \times d$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{E}{t}$$

gravitational potential energy = mass \times gravitational field strength \times vertical height

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

kinetic energy = $\frac{1}{2} \times$ mass \times velocity²

$$\text{KE} = \frac{1}{2} \times m \times v^2$$

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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.

(1)

The cloth becomes positively charged because

- 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 hang 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.

the two strips before rubbing



the two strips after rubbing



Explain why the strips behave in this way after the student rubs them with the cloth.

(2)

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

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

(2)

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(ii) The article 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 during the refuelling of the aircraft.

(3)

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(Total for Question 1 = 8 marks)

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Using radioactive materials

2 (a) A scientist investigates a radioactive sample.

She measures a count rate of 130 counts per minute.

The average background radiation count rate in her laboratory is 10 counts per minute.

(i) What is the count rate due to this sample?

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

(1)

- A 13 counts per minute
- B 120 counts per minute
- C 140 counts per minute
- D 1300 counts per minute

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

(1)

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

(2)

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(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

(1)

- A** scientists now have better instruments to make measurements more quickly
- B** global warming has increased the rate of decay of radioactive materials
- C** humans have released more radioactive materials into the environment
- D** scientists now have a better understanding of the dangers of radiation

(b) After an accident at a nuclear power plant in Japan, some drinking water was contaminated with radioactive iodine-131.

When iodine-131 decays, it emits beta radiation.

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

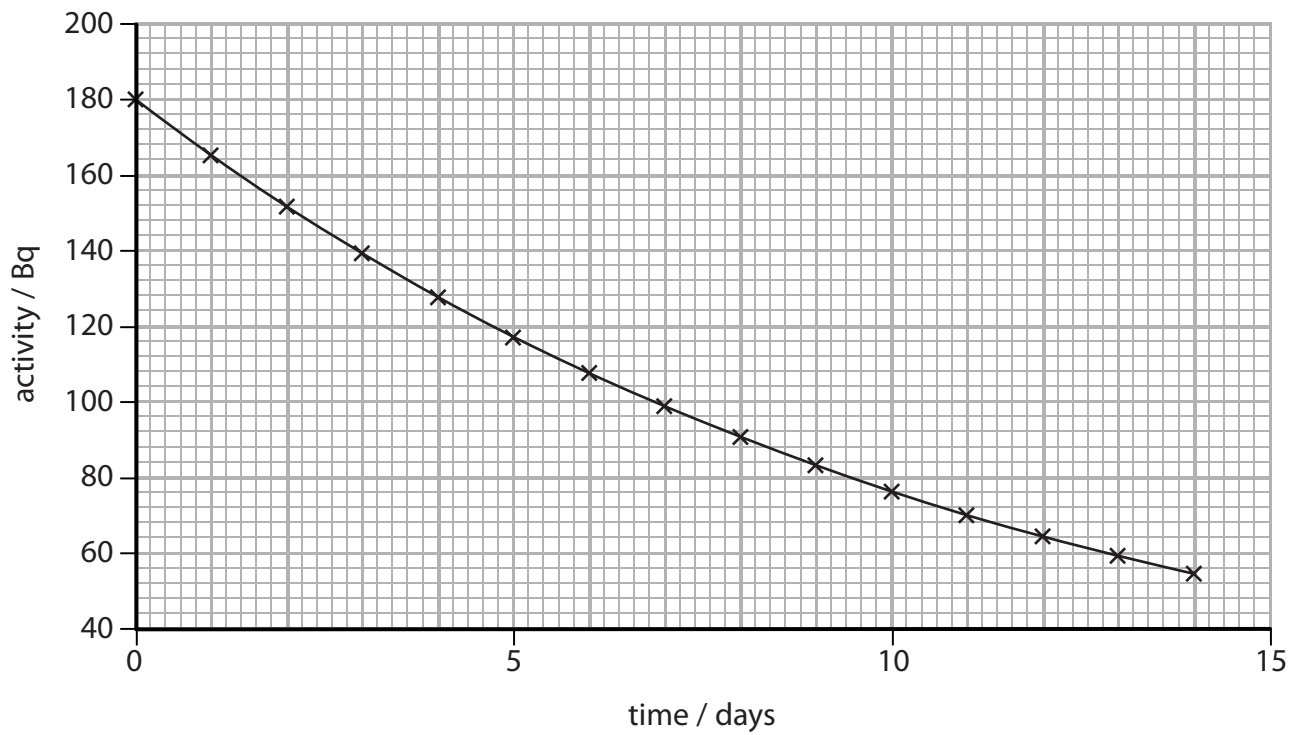
(1)

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(c) The graph shows how the activity of a sample of iodine-131 changes over a period of 14 days.



(i) Use the graph to estimate the half-life of iodine-131.

Show your working.

(2)

half-life = days

(ii) Estimate the time it would take for the activity to fall from 180 Bq to 40 Bq.

(1)

time taken = days

(Total for Question 2 = 9 marks)



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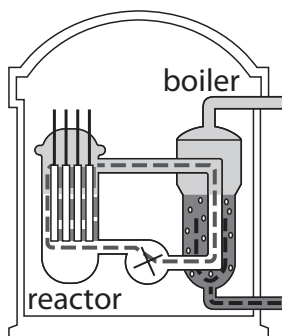
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Nuclear fission

- 3 Electricity is generated in a nuclear power station. The diagram shows the first stages in this process.



- (a) The thermal energy released in the reactor is used to produce steam. Describe how the steam is used to generate electricity.

(2)

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- (b) Controlled nuclear chain reactions take place in the reactor.

Describe how the fission of a uranium-235 nucleus can start off a chain reaction. You may draw a diagram to help with your answer.

(3)

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(c) There are both fuel rods and control rods inside the reactor.

Explain how pushing control rods between the fuel rods changes the rate of nuclear fission in the reactor.

(2)

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(d) One of the products of the fission of uranium-235 is krypton-91.

Which of these could be a product of the same reaction?

(1)

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

- A barium-143
- B barium-145
- C barium-147
- D barium-235

(e) Nuclear fusion is another type of nuclear reaction.
It needs large amounts of energy to make it happen.

Explain why large amounts of energy are needed to make a fusion reaction happen.

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(Total for Question 3 = 10 marks)

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Forces and movement

4 (a) Which one of these is a vector quantity?

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

(1)

- A energy
- B momentum
- C power
- D work

(b) A father pushes his child in a cart.



The child and cart have a total mass of 60 kg.

The total momentum of the child and the cart is 90 kg m/s.

(i) Calculate the velocity of the child and the cart.

(3)

velocity = m/s



- (ii) The father stops pushing when the momentum of the child and cart is 420 kg m/s .
The cart takes a further 18 s to come to rest.

Calculate the force that brings the cart to rest.

(2)

force = N

- (c) The image shows a mother and her daughter standing still 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 4 = 9 marks)

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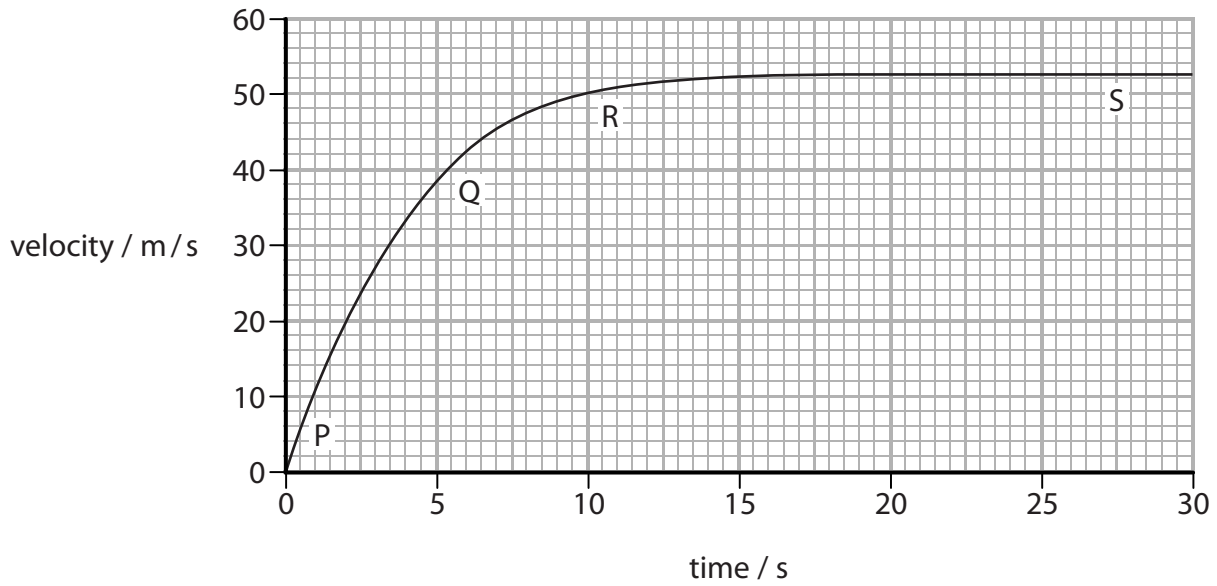
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Investigating motion

5 A free-fall parachutist is falling straight down.

This is a velocity/time graph of the first part of the jump, before the parachute is opened.



(a) Which of these points on the graph shows the largest acceleration?

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

- A P
- B Q
- C R
- D S

(1)

(b) Estimate the distance that the parachutist falls in the first 2.5 s.

(3)

distance = m



(c) Explain the difference between velocity and speed.

(2)

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*(d) Explain, in terms of forces, why the parachutist's velocity changes as shown in the graph.

(6)

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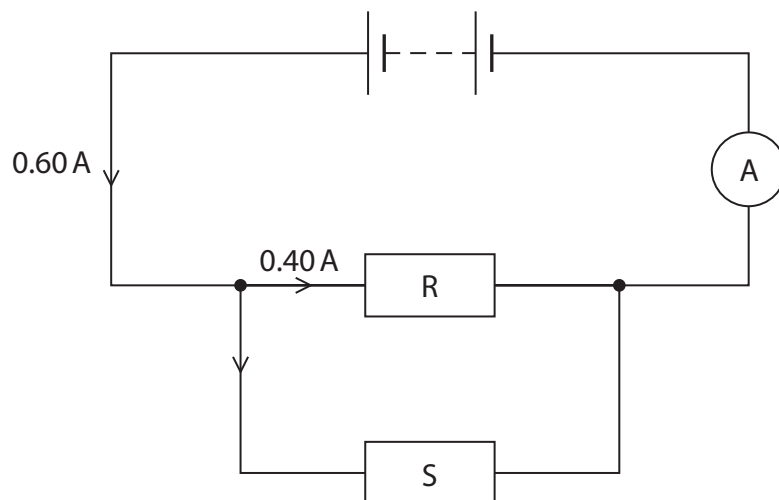
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Circuits

- 6 (a) The diagram shows a circuit with two resistors, R and S.



R has a resistance of 15Ω

- (i) Calculate the potential difference across R.

(2)

potential difference = V

- (ii) The unit of potential difference is the volt.

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

1 volt is equivalent to

(1)

- A 1 joule per second
- B 1 joule per amp
- C 1 joule per coulomb
- D 1 joule per ohm



(iii) Use information from the diagram to calculate the current in S.

(1)

current = A

(b) Explain why the temperature of a resistor rises when the current in it increases.

(2)

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* (c) The photograph shows some temporary traffic lights.



The lights are powered by a battery. These lights need to be very bright during the day so that they can be seen clearly. They do not need to be as bright at night. Explain how using a light-dependent resistor in series with the lights can make the energy stored in the battery last longer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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