EDEXCEL GCSE PHYSICS

PHYSICS



EXAM QUESTION PACK

UNIT P2 FOUNDATION TIER 5PH2F PAPERS

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Friday 26 January 2018 – Morning
Time: 1 hour

Paper Reference
5PH2F/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.
- 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 × 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

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

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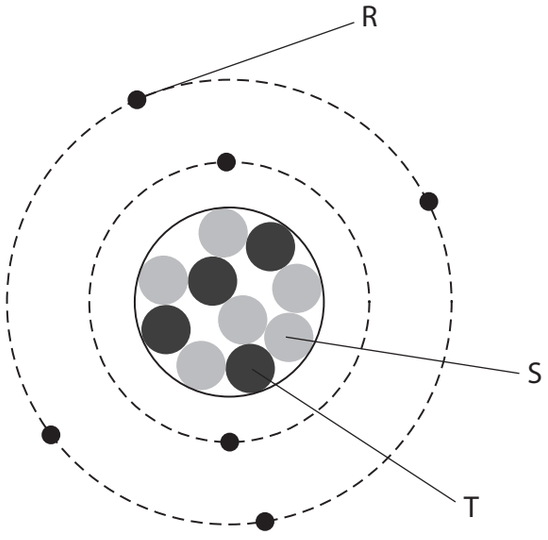
Answer ALL questions.

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 ☒.

Electric charges

1 (a) The diagram represents an atom.

The atom is neutral.



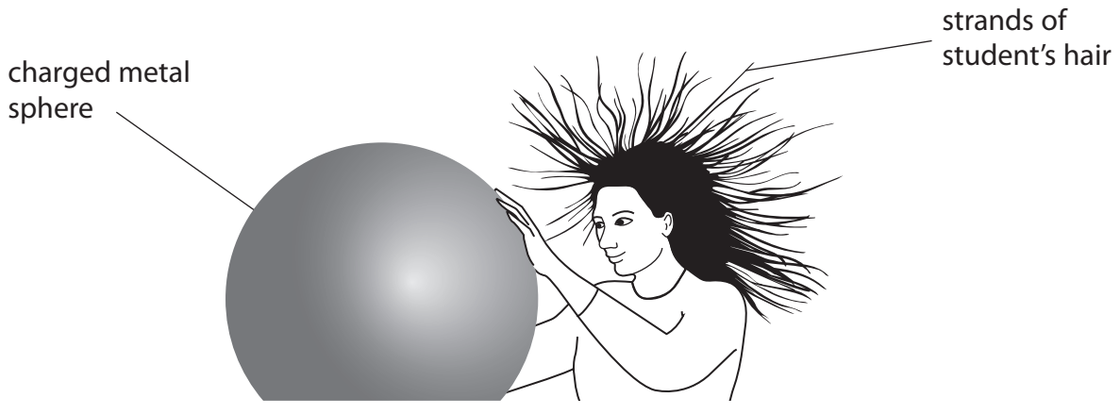
Draw **one** straight line from each **letter** box to the correct **particle** box.

(2)

letter	**particle**
R	proton
S	neutron
T	electron

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(b) A student touches a charged metal sphere. Her hair becomes charged.



The student moves away from the sphere.

The sphere has a negative charge.

The sphere is then connected to the ground with a metal wire.

This removes the negative charge from the sphere.

(i) State the name of the particles that flow from the sphere to the ground.

(1)

.....

(ii) State why the flow of particles in the wire is called a direct current (d.c.).

(1)

.....

.....

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

While the student was touching the sphere, strands of the student's hair repelled each other because they had

(1)

☒ **A** the same type of electric charge

☒ **B** different types of electric charge

☒ **C** the same type of magnetic charge

☒ **D** different types of magnetic charge

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(c) The metal sphere is charged using a rubber belt.

The belt is turned by a d.c. electric motor.

There is a current of 0.50 A in the motor for 3 minutes.

Calculate the charge passing through the motor in this time.

(3)

charge = ... C

(Total for Question 1 = 8 marks)

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Using radioactive materials

2 (a) Radioactive materials are used in nuclear power stations to generate electricity.

State **two** other uses of radioactive materials.

(2)

1 .....

2 .....

(b) A sample of nuclear waste from a nuclear reactor contains 16.0 mg of cobalt-60.

The half-life of cobalt-60 is 5 years.

Calculate the mass of cobalt-60 remaining after 10 years.

(2)

mass = ... mg

(c) Workers at a nuclear power station may be exposed to radiation from radioactive materials.

Explain why this could be dangerous to the workers.

(2)

.....

.....

.....

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(d) Nuclear power stations produce dangerous radioactive waste.

Describe **one** method of dealing with this radioactive waste safely.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

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Cars and safety

3 (a) The power of a car engine is measured in watts, W.

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

1 watt, W, is the same as

(1)

☒ **A** 1 joule per metre, J / m

☒ **B** 1 newton per second, N / s

☒ **C** 1 joule per second, J / s

☒ **D** 1 newton metre, N m

(b) A car engine produces an average driving force of 1400 N.

The car travels 6.0 m in the direction of the force.

(i) Calculate the work done by the driving force over this distance.

(2)

work done = ... J

(ii) The car has a mass of 1200 kg and travels at a velocity of 20 m / s.

Calculate the kinetic energy of the car.

(3)

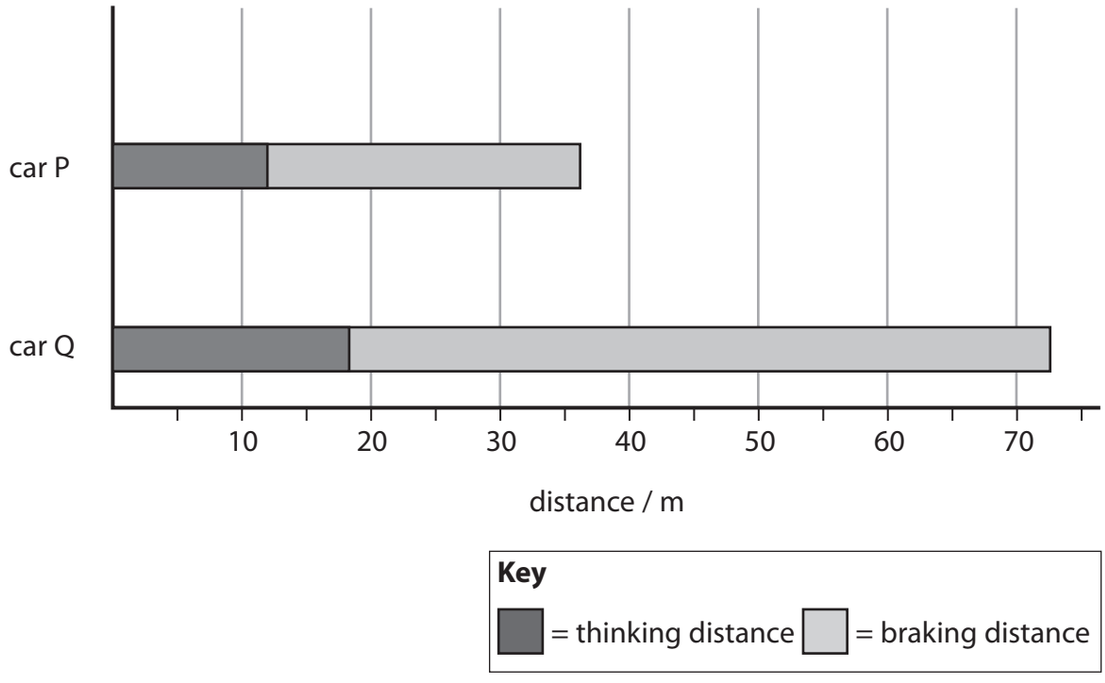
kinetic energy = ... J

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(c) Two cars, P and Q, are stopping suddenly from a speed of 40 miles per hour.

The chart shows the thinking, braking and stopping distances for the two cars.



Use the factors that can affect thinking and braking distances to explain the difference in stopping distance for car Q compared with car P.

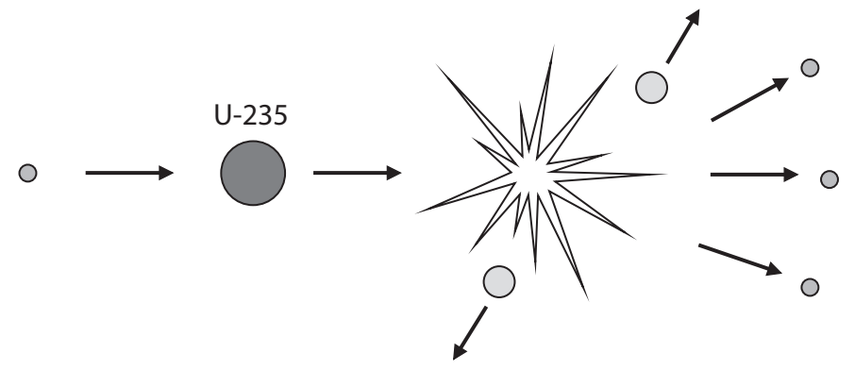
(4)

(Total for Question 3 = 10 marks)

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Nuclear fission

4 (a) A student produced this poster to give information about a typical nuclear fission.



1	2	3	4
a proton is captured and the nucleus splits	when the nucleus splits, (fission) is released	two sister nuclei are produced	three electrons are released
	energy		

One word is incorrect in each of the numbered boxes.

(i) Circle the incorrect word in each box.

Box 2 has been done for you.

(1)

(ii) Write the correct word in the space under each box.

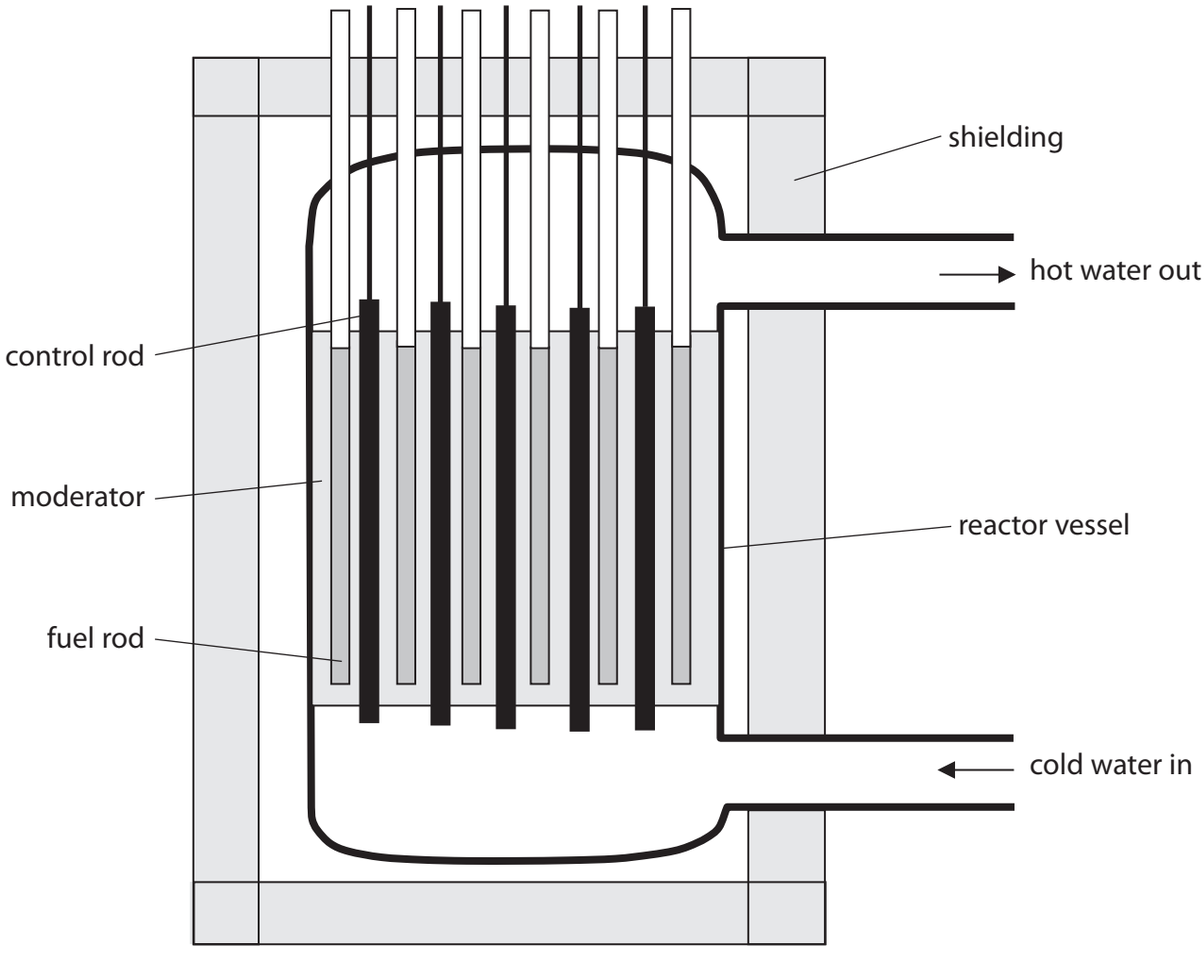
Box 2 has been done for you.

(2)

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(b) The diagram shows a nuclear reactor.



Chain reactions in the reactor release energy.

Explain how the control rods are used to control the chain reactions.

(3)

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(c) Strontium-90 is produced in the nuclear reactor.

A nucleus of strontium-90 can be represented as

$$^{90}_{38}Sr$$

Describe the structure of a nucleus of strontium-90.

(4)

(Total for Question 4 = 10 marks)

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5 (a) A boat is travelling across the water.



One of the forces acting on the boat is shown by the arrow.

(i) Which of these is the correct name for the force shown acting on the boat?

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

(1)

☒ **A** repulsion

☒ **B** weight

☒ **C** lift

☒ **D** friction

(ii) The boat is accelerating.

Which of these statements is correct for the horizontal forces acting on the boat?

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

(1)

☒ **A** the friction forces are zero

☒ **B** the friction forces are bigger than the forward force

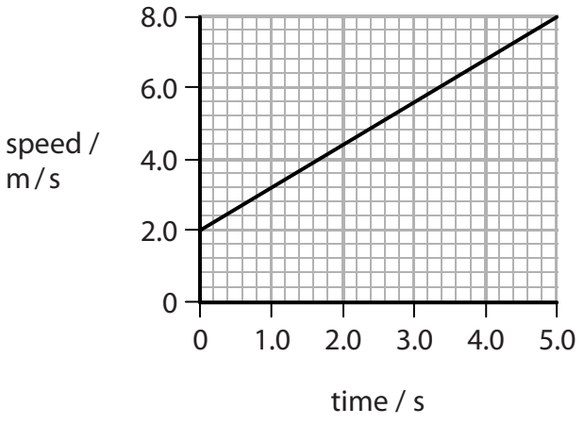
☒ **C** the friction forces are smaller than the forward force

☒ **D** the friction forces are the same size as the forward force

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(iii) The speed/time graph for the boat is shown.



Use the graph to determine the acceleration of the boat.

(2)

acceleration = ... m / s^2

(iv) The boat now accelerates at 3.5 m / s^2.

The total mass of the boat and driver is 720 kg.

Calculate the resultant force on the boat.

(2)

resultant force = ... N

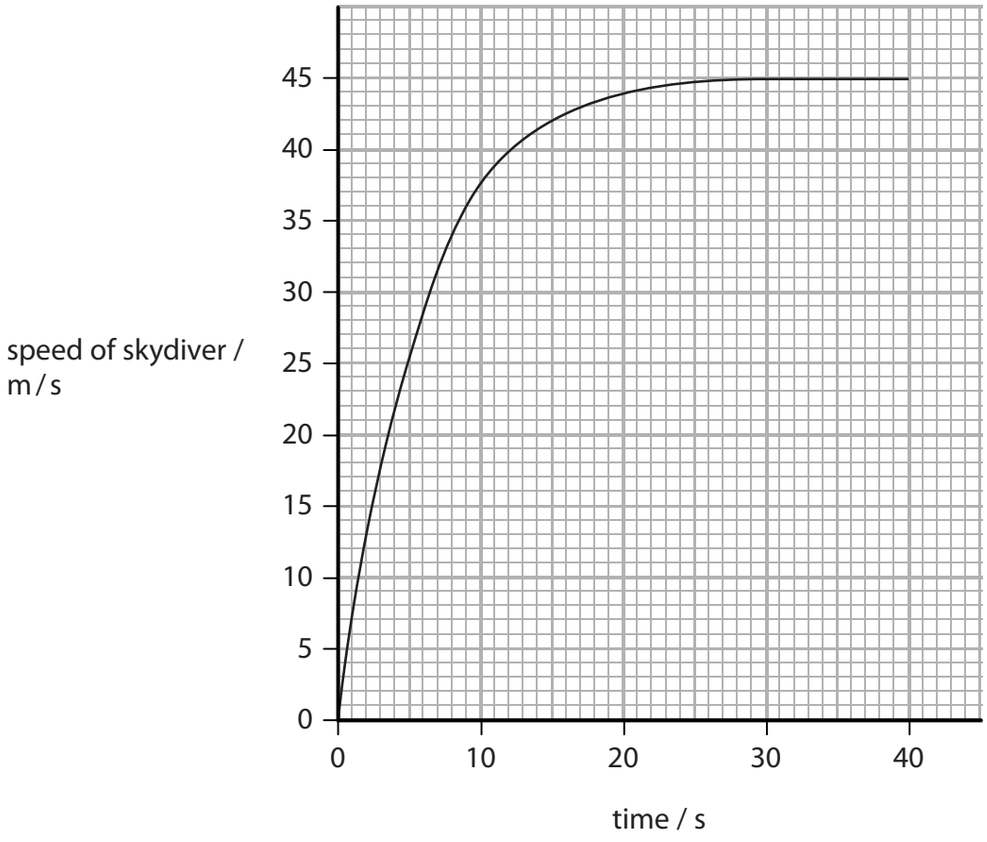
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*(b) The photograph shows a skydiver 40 seconds after jumping from an aeroplane.

He has not yet opened his parachute.



The graph shows how the speed of the skydiver changes during the first 40 seconds after jumping from the aeroplane.



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Describe what happens to the speed of the skydiver during the first 40 seconds of the jump.

Your answer should refer to points on the graph.

(6)

(Total for Question 5 = 12 marks)

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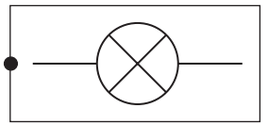
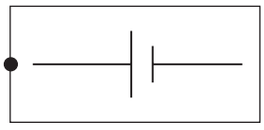
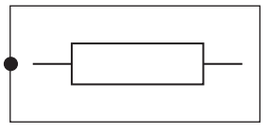
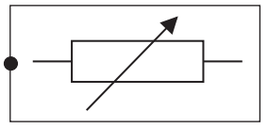
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Circuits

6 (a) Draw **one** straight line from each **name** box to the correct **circuit symbol** box.

(2)

name	**circuit symbol**
lamp	
fixed resistor	
	
	

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(b) A student investigates the resistance of a lamp.

She obtains these readings for the potential difference (p.d. or voltage) across the lamp and the current in the lamp.

potential difference (p.d. or voltage) across the lamp / V	current in the lamp / A
3.0	0.40

(i) Calculate the resistance, *R*, of the lamp.

(2)

$$R = \frac{V}{I}$$

resistance = ... Ω

(ii) Calculate the amount of energy transferred by the lamp in 50 s.

(2)

energy = ... J

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*(c) Describe how the student should investigate how the current in the lamp changes when the potential difference (p.d. or voltage) across the lamp is changed.

You may draw a circuit diagram to help with your description.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

P 5 7 5 8 6 A 0 2 1 2 4

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Mark Scheme (Results)

January 2018

Pearson Edexcel GCSE
In Physics (5PH2F)
Paper 01

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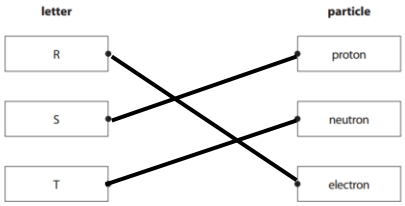
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Acceptable answers	Mark
1(a)		All 3 lines correct for 2 marks 1 OR 2 lines correct for 1 mark more than one line from/to any box loses the mark for that box	**(2)**

Question Number	Answer	Acceptable answers	Mark
1 (bi)	electron(s) (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (bii)	(direct current) is a movement of charge in one direction (only) (1)	the particles/charges / electrons or they (only) move {one way/one direction/from the sphere to the ground} ignore charges move directly {through the wire/to the ground} OR go straight to the ground/ go in a straight line	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (biii)	**A** the same type of electric charge		**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (c)	3 x 60 or 180 (1) Substitution: 0.50 x 180 (1) Evaluation 90 (C) (1)	accept 0.5 x 3 for 1 mark and 1.5 for 2 marks (ie cand has not converted mins to secs) Allow full marks for correct answer with no working shown.	**(3)**

Total for Q1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)	Any two from: (household) smoke/fire alarms irradiating food sterilisation of equipment gauging thicknesses tracing leaks in (underground) pipes diagnosis of cancer treatment of cancer {nuclear/atomic} weapons	accept both answers on one line allow any other correct use apply list rule ignore in hospitals ignore explosives	**2**

Question Number	Answer	Acceptable answers	Mark
2(b)	idea of halving mass (1) 4(.0) (mg) (1)	8(.0) (mg) allow a series e.g. 16, 8, 4,2,1, 0.5, 0.25.....for 1 mark accept idea of 2 half-lives for this mark ignore 60 ÷ 2 AND 10 ÷ 2 (too vague) for this mark allow both marks for correct answer with no working shown. no power of ten error on this item	**2**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking two from: Radiation/it is ionising (1) Radiation/it can cause specified damage e.g. cancer or damage/mutate DNA (1) if dose/exposure is too high (1)	 (causes) ionisation/(can) ionise cells/ tissue ignore death/make you ill accept radiation/it can {mutate/damage/kill} cells accept radiation poisoning/sickness ignore it/radiation is harmful/dangerous accept for both marks: too much radiation can cause cancer (after a while) OR {damage/kill} cells/ tissue if absorb(ing) too much (radiation) there are likely to be more pairs from candidates responses	**2**

Question Number	Answer	Acceptable answers	Mark
2(d)	a description including any **two** from: idea of initial treatment (1) idea of containment (1) idea of long term storage or reprocessing (1)	 (radioactive waste/fuel rods/it) put under water or vitrification any description of immobilising waste by combining with inert material eg put it in a concrete block/glass sealing in (stainless) steel (cylinder) accept suitable (sealed) {cylinder/box/ container/barrel} eg metal barrel (long term) storage (deep) underground put in (salt/coal) mines or any underground cavern (radioactive) waste is reprocessed/turned into new fuel can be combined with any of the above points to score up to two marks ignore keep it away from people/houses ignore dump it in the sea/send it into space/ burn it	**2**

Total for Q2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)	**C** 1 joule per second, J/s		**1**

Question Number	Answer	Acceptable answers	Mark
3(bi)	Substitution (work done =) 1400 x 6(.0) (1) Evaluation (1) 8400 (J) or 8.4×10^3 (J)	 8.4 x any other power of 10 = 1 mark 8.4 kJ for 2 marks Give full marks for correct answer with no working.	**2**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	substitution $0.5 \times 1200 \times 20^2$ (1) evaluation of v squared 0.5 x 1200 x 400 (1) evaluation 2.4×10^5 (J) OR 240 000 (J) (1)	 accept 400 seen anywhere for this mark e.g. 480 000 gets 1 mark (forgot ½) 2.4 x any other power of 10 = 2 marks Give full marks for correct answer with no working.	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking: thinking distance (for car Q) is greater (than car P) (1) With correct factor affecting thinking distance e.g. alcohol, drugs, tiredness (1) An explanation linking: braking distance (for car Q) is greater (than car P) (1) With correct factor increasing braking distance for car Q e.g. worn brakes, icy/muddy/slippy road surface, less friction between tyres and road surface, car Q has greater mass (1)	 accept reaction time is longer (for car Q) The thinking distance explanation and braking distance explanation can be in either order. If no other marks scored accept A statement that stopping distance for car Q is greater (than car P) for 1 mark accept reverse arguments correctly explained.	**(4)**

Total for Q3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	• box 1: proton circled • box 3: sister circled • box 4: electrons circled all three points for 1 mark		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	• box 1: neutron • box 3: daughter • box 4: neutron(s) **Note**: 3 correct for 2 marks 2 correct for 1 mark 1 correct for 0 marks		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	An explanation linking the following points: control rods raised or lowered (1) correct link to number of neutrons absorbed/captured (1) corresponding effect on rate of reaction (1)	 eg control rods raised (so) more neutrons captured or fewer neutrons available for fission reactions (therefore) fewer fission reactions take place less energy is released (as fewer fission reactions) (hence) temperature goes down control rods raised so reaction (rate)increases as fewer neutrons absorbed scores 3 marks	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)	A description including any four from: • (there are) 90 particles in the nucleus (1) • protons (1) • (there are) 38 (protons) (1) • neutrons (1) • (there are) 52 (neutrons) (1)	ignore all references to electrons (its) {mass/nucleon} number / A is 90 {atomic/proton} number / positive charge / Z = 38 Numbers must be correctly linked to gain credit e.g. 38 neutrons gets 1 mark (for neutrons) 52 protons and 38 neutrons gains two marks (for protons and neutrons)	**(4)**

	i.e. 38 protons and 52 neutrons gains four marks	90 protons and neutrons gets 3 marks (altogether there are) 90 protons and neutrons. 38 are protons gains 4 marks	

Total for Q4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**D** friction		**(1)**

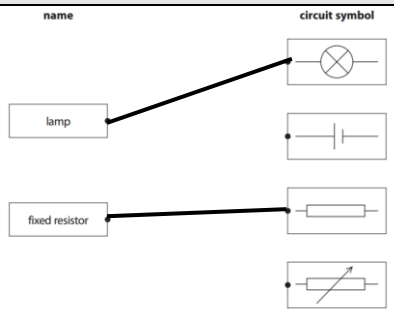
Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	**C** the friction forces are smaller than the forward force		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	Substitution: (8.0 -2.0) ÷ 5.0 OR 6.0 ÷ 5.0 OR 3.0 ÷ 2.5 (1) Evaluation 1.2 (m/s^2) (1)	Allow both marks for correct answer with no working shown. accept 1.6 (m/s^2) for 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iv)	substitution (force =) 720 x 3.5 (1) evaluation (1) 2500 (N)	 accept 2520 (N) Allow both marks for correct answer with no working shown.	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	A description including some of the following points • speed increases (at the start) • (speed increases)during the first (roughly) 20 seconds • speed is constant (at the end) • (speed is constant) after 27-30 seconds • acceleration is zero after 27-30 seconds • maximum speed is equal to 45 m/s • terminal velocity of 45 m/s • accelerates at start/up to 27-30 s • acceleration decreases from start/up to 27-30 seconds • skydiver will initially accelerate (downwards) • at 10 m/s^2 • (in first 2 seconds average) acceleration is between 6 m/s^2 and 7 m/s^2	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of one section of the graph e.g. the speed increases at the start • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description of at least two sections of the graph OR one section with numerical detail from the graph e.g. the speed increases at the start and is constant at the end OR the speed is constant at 45 m/s after 30 seconds • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of at least two sections of the graph with numerical detail from both axes on at least one section e.g. the speed increases at the start AND the speed is constant at 45 m/s after 30 seconds • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Q5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)		1 mark for each correct line more than one line from/to any box loses the mark for that box	**2**

Question Number	Answer	Acceptable answers	Mark
6(b) (i)	substitution: 3.0 ÷ 0.4 (1) evaluation 7.5 (Ω) (1)	allow both marks for correct answer with no working shown allow POT error for 1 mark	**2**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	substitution: 0.4 x 3.0 x 50 (1) evaluation 60 (J) (1)	1.2 x 50 allow both marks for correct answer with no working shown allow power of ten error for max 1 mark eg 6(.0) (J) or 0.6 (J) or 600 (J)	**2**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description including the following • variable power supply or power supply and variable resistor • lamp in series with variable power supply or power supply and variable resistor • ammeter in series with lamp • voltmeter in parallel with lamp • idea of changing (circuit) resistance • using variable resistor • measure p.d./voltage across lamp • current in lamp Level 2 can be achieved on the circuit diagram	**6**
Level	**0**	No rewardable content	
1	**1 - 2**	a limited description which gives one relevant fact about the investigation.e.g. name some of the apparatus needed • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description giving more than one fact about the investigation.e.g. name some of the apparatus needed AND how it is used • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	a detailed description of the investigation .e.g. name most of the apparatus needed AND how it is used AND how the p.d. is varied • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Q6 = 12 marks

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Surname	Other names

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Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Friday 16 June 2017 – Morning
Time: 1 hour

Paper Reference
5PH2F/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.
- 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 × 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

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 $\text{KE} = ½ \times m \times v^2$

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 ☒.

Motion and forces

1 The diagram shows a cyclist during a race.



(a) (i) Many quantities can be measured during the race.

Which of these quantities is a vector quantity?

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

(1)

☒ **A** velocity

☒ **B** mass

☒ **C** kinetic energy

☒ **D** distance

(ii) The total mass of the cyclist and the bicycle is 70.0 kg.

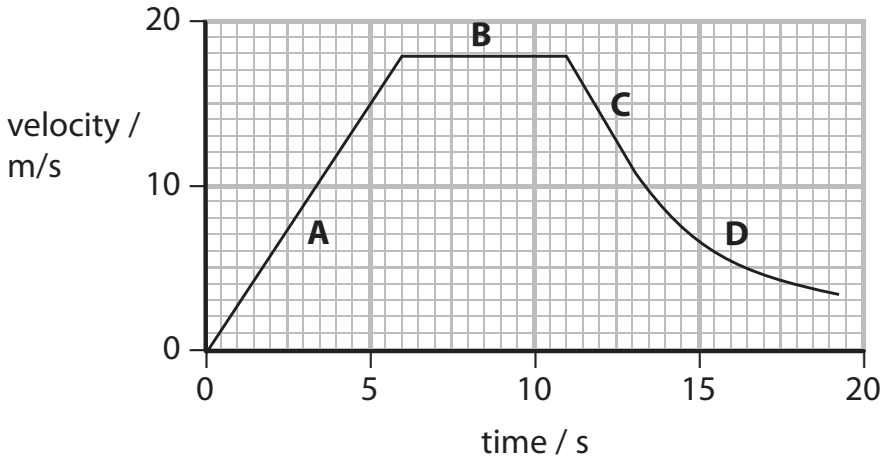
The cyclist is accelerating at 2.4 m/s^2.

Calculate the size of the resultant force that produces this acceleration.

(2)

force = ... N

(b) The velocity/time graph shows how the cyclist's velocity changes during part of the race.



(i) During which part of the race is the resultant force on the cyclist zero?

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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Calculate the acceleration of the cyclist during the first 4.0 s.

(2)

acceleration = ... m/s^2

(c) The diagram shows the horizontal forces acting on the cyclist in another part of the race.



Not to scale

Calculate the resultant force on the cyclist and state its direction.

(2)

force = ... N

direction = ...

(Total for Question 1 = 8 marks)

Electric charges

2 (a) Complete this table for the three particles in an atom.

The first row has been done for you.

(3)

particle name	charge	mass / mass unit
proton	+1 (positive)	1
neutron		
		$\frac{1}{1836}$

(b) A plastic rod is rubbed with a cloth.

The plastic rod and the cloth become charged.

(i) Describe how you could show that the rod is charged.

(2)

.....

.....

.....

.....

(ii) The plastic rod becomes positively charged.

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

(1)

Compared with the rod, the cloth has

☒ **A** an equal positive charge

☒ **B** an equal negative charge

☒ **C** a larger positive charge

☒ **D** a larger negative charge

(iii) Explain how friction between the cloth and the rod gives the rod a positive charge.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

3 A car is travelling along a straight road.

(a) (i) The driver has to brake suddenly.

The thinking distance is 18 m and the braking distance is 55 m.

Calculate the stopping distance of the car.

(1)

stopping distance = ... m

(ii) State **one** factor that could increase the driver's reaction time.

(1)

.....

(iii) State **one** factor that could increase the braking distance of the car.

(1)

.....

(b) Air bags help to reduce injuries in a collision.

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

(1)

Air bags reduce injuries to drivers in a collision by

☒ **A** decreasing the kinetic energy of the car

☒ **B** increasing the time a resultant force acts on the driver

☒ **C** decreasing the driver's thinking time

☒ **D** increasing the rate of change of momentum of the driver

(c) During braking, the car's brakes produce an average braking force of 14 500 N.

Calculate the work done by the brakes over a braking distance of 5.0 m.

(2)

work done = ... J

(d) After braking, the car accelerates.

The car's engine does 800 000 J of work in a time of 12.5 s.

Calculate the power output of the engine.

(2)

power output = ... W

(e) The car has a mass of 1600 kg.

Calculate the kinetic energy of the car when its velocity is 30 m/s.

(2)

kinetic energy = ... J

(Total for Question 3 = 10 marks)

Lamps in a circuit

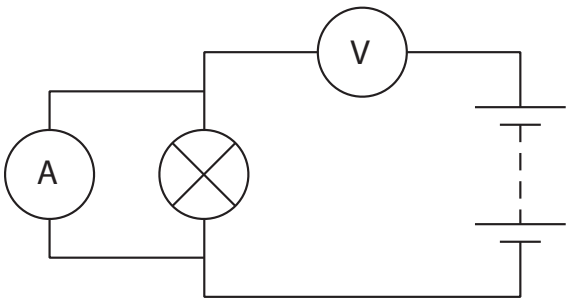
4 A student experiments with filament lamps in a circuit.

(a) She starts with one lamp.

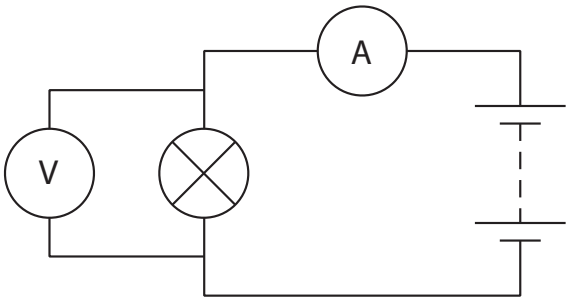
Which of these circuits will let her measure the current in the circuit and the potential difference (voltage) across the lamp?

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

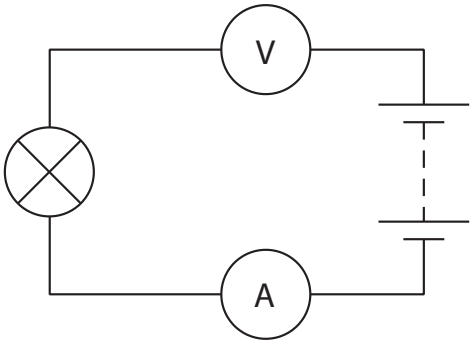
(1)



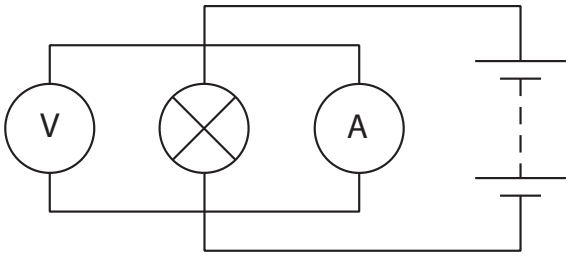
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(b) The student finds that the current in the lamp is 0.80 A.

(i) Calculate the amount of charge that passes through the lamp in 4.0 minutes.

(3)

charge = ... C

(ii) The student also finds that the potential difference across the lamp is 3.0 V.

Calculate the power of the lamp.

(2)

power = ... W

(c) The student replaces the lamp in the circuit with a different one.

The current in this lamp is 0.60 A when the potential difference across it is 3.0 V.

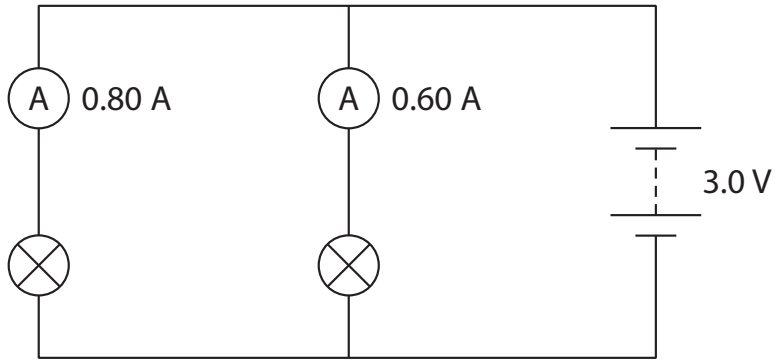
State how the resistance of this lamp compares to the resistance of the first lamp.

(1)

.....

.....

(d) The student connects both lamps in parallel to the 3.0 V battery as shown in the diagram.



What is the size of the current in the battery?

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

(1)

- ☒ **A** 0.2 A
- ☒ **B** 0.7 A
- ☒ **C** 1.4 A
- ☒ **D** 1.8 A

(e) A filament lamp is one example of a component in a circuit.

A light-dependent resistor (LDR) can be another component in a circuit.

A light is shone on a light-dependent resistor (LDR) in a circuit.

Explain how this changes the current in the circuit.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

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5 (a) One isotope of uranium is U-235.

The nucleus can be represented as $^{235}_{92}U$.

Complete the following sentence.

(2)

A nucleus of U-235 contains ..... protons and ..... neutrons.

(b) Uranium-235 decays by emitting an alpha particle.

(i) The table gives information about different types of radiation.

Tick (✓) **two** lines that are correct for an alpha particle.

(2)

information about radiation	**tick (✓)**
is an electron	
is electromagnetic radiation	
is two protons and two neutrons	
has a positive charge	
has a negative charge	
has no charge	

(ii) Describe the ionising **and** penetrating abilities of alpha particles.

(2)

.....

.....

.....

.....

*(c) Uranium-235 can be used in nuclear fission reactions but not in nuclear fusion reactions.

Describe a nuclear fission reaction and a nuclear fusion reaction.

Your answer should identify the differences between the two types of nuclear reaction.

(6)

(Total for Question 5 = 12 marks)

Uses and dangers of radioactivity

6 (a) Medical supplies, such as the bandage shown in the photograph, have to be sterilised before they are sold.



There are two ways of sterilising medical supplies:

- they can be heated to a high temperature in an oven
- they can be irradiated using a radioactive isotope.

(i) Suggest **one** advantage of using radiation rather than high temperatures to sterilise medical supplies.

(1)

.....

(ii) Cobalt-60 is a radioactive isotope used to sterilise medical supplies.

Cobalt-60 has a half-life of 5 years.

Calculate how long it takes for the activity of a sample of cobalt-60 to fall to one quarter (25%) of its original value.

(2)

time = ... years

(b) This is part of an article in a newspaper:

> A truck carrying a large quantity of cobalt-60 was stolen by thieves.
> The next day, a farmer found the stolen truck in his field.
> The cobalt-60 was on the ground, with its protective shielding removed.
> The cobalt-60 was later recovered by radiation specialists.

(i) State **one** way that the cobalt-60 could be a danger to the health of the farmer.

(1)

.....

.....

(ii) Suggest **two** precautions the radiation specialists should take when they recover the stolen cobalt-60.

(2)

1 .....

.....

2 .....

.....

*(c) The table shows information about cobalt-60 and two other radioactive isotopes.

isotope	type of radiation emitted	half-life
cobalt-60	gamma	5 years
radium-223	alpha	11 days
sodium-24	gamma	15 hours

Medical supplies in cardboard boxes are sterilised using radiation.

Use the information in the table to explain why cobalt-60 is better than the other two isotopes for this purpose.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Final)

Summer 2017

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	☒ **A** velocity **The only correct answer is A** **B** is not correct because mass is a scalar quantity **C** is not correct because KE is a scalar quantity **D** is not correct because distance is a scalar quantity		**(1)**

Question number	Answer	Acceptable answers	Marks
1 (a) (ii)	substitution 70.0 x 2.4 (1) evaluation 168 (N) (1)	award full marks for correct answer with no working 170 (N) accept power of 10 error for 1 mark e.g. 16.8 or 17 (N) do not accept 70 x 2.4^2	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (b) (i)	☒ **B** **The only correct answer is b** **A** is not correct because the cyclist is accelerating **C** is not correct because the cyclist is decelerating **D** is not correct because the cyclist is decelerating		**(1)**

Question number	Answer	Acceptable answers	Marks
1 (b) (ii)	substitution 12(.0) ÷ 4(.0) (1) evaluation 3.0 (m/s^2) (1)	award full marks for correct answer with no working accept any correct substitution from line e.g. 15(.0) ÷ 5(.0) or 18 /6 OR any numbers that lead to an answer in the range 2.8 to 3.1 3 (m/s^2) allow BOTH marks for an answer in the range 2.8 to 3.1 (m/s^2) allow 1 mark for an answer in the range 2.5 to 2.79 (m/s^2) OR 3.11 to 3.5 (m/s^2) allow 1 mark for (acceleration =) gradient of line/graph ignore change in velocity/time taken as this is on formula sheet	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (c)	150 (N) (1) (towards the) left (1)	 (in the) direction of the 400 (N) force accept an arrow to the left anywhere in the response ←	**(2)**

Total for question 1 = 8 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>particle name</th><th>charge</th><th>mass (mass unit)</th></tr>
<tr><td>(proton)</td><td>(+1)(positive)</td><td>(1)</td></tr>
<tr><td>(neutron)</td><td>0 or zero or none or neutral</td><td>1</td></tr>
<tr><td>electron</td><td>-1 or negative</td><td>(1/1836)</td></tr>
</table>
1 mark for each correct column
</td><td>(3)</td></tr>
</table>

Question number	Answer	Acceptable answers	Marks
2 (b) (i)	A description of a demonstration of electrostatic charge to include: a description of the scenario (1) a description of the expected outcome (1)	typical responses bring the rod near to: some (small) pieces of paper/ rod/object with same charge/ head or arm/ (uncharged stream of) water from a tap (pieces of) paper are {attracted/move} (to the rod)/ rod/object repel (one another) /hairs stand up or attracted/ water attracted or moves towards rod accept other valid scenarios and outcomes allow idea of attracting an oppositely charged object e.g. the cloth for 1 mark ignore see if it gives a shock to someone/earth it/touch it to some metal	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (b) (ii)	☒ **B** an equal negative charge **The only correct answer is B** **A** is not correct because the charge is opposite to that on the rod **C** is not correct because the charge must be the same size **D** is not correct because the charge must be the same size		**(1)**

Question number	Answer	Acceptable answers	Marks
2 (b) (iii)	An explanation linking: {electron(s)/negative charge(s)} have moved (1) from the rod/to the cloth (1)	no marks if the answer refers to {positive charge(s)/positive electron(s)/proton(s)} moving accept cloth rubs off electrons for both marks accept rod loses electrons for both marks	**(2)**

Total for question 2 = 8 marks

Question number	Answer	Acceptable answers	Marks
3 (a) (i)	73 (m) (1)		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (a) (ii)	Any one from: driving {too long/without a rest} or taking drugs/(prescribed) medication /alcohol/depressants or tiredness or distractions or using mobile phone (1)	 accept old age/illness ignore stimulants e.g. caffeine/coffee	**(1)**

Question number	Answer	Acceptable answers	Marks
3 (a) (iii)	Any one from: increasing speed (of car) poor/worn/faulty brakes carrying heavy load/increased weight or mass worn tyres/poor tread (depth) idea of decreasing contact with road surface eg mud/ice/water/rain (1)	 accept reduced braking force question asks for a factor that increases braking distance so ignore vague statements i.e. road conditions or weather or speed or weight or mass	**(1)**

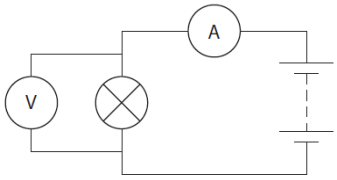
Question number	Answer	Acceptable answers	Marks
3 (b)	☒ **B** increasing the time a resultant force acts on the driver **The only correct answer is B** **A** is not correct because airbags do not alter the KE of the car **C** is not correct because airbags have no effect on thinking time **D** is not correct because airbags decrease the rate of change of momentum of the driver		**(1)**

Question number	Answer	Acceptable answers	Marks
3 (c)	substitution 14 500 x 5.0 (1) evaluation 73 000 (J) (1)	award full marks for correct answer with no working 72 500 (J) or 72.5 <u>kJ</u> or 73 <u>kJ</u> accept power of 10 error for 1 mark e.g. 725 or 73 (J)	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (d)	substitution 800 000 ÷ 12.5 (1) evaluation 64 000 (W) (1)	award full marks for correct answer with no working 64 <u>kW</u> accept power of 10 error for 1 mark e.g. 6400 (W)	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (e)	substitution ½ x 1600 x 30^2 (1) evaluation 720 000 (J) (1)	award full marks for correct answer with no working ½ x 1600 x 900 or 800 x 900 accept 30 m/s^2 as 30^2 72×10^4 (J) 720 kJ accept power of 10 error for 1 mark e.g. 720 (J)	**(2)**

Total for question 3 = 10 marks

Question number	Answer	Acceptable answers	Marks
4 (a)	☒ **B**  **The only correct answer is B** ***A*** *is not correct because voltmeter cannot be connected in series with lamp* ***C*** *is not correct because voltmeter cannot be connected in series with cell* ***D*** *is not correct because ammeter cannot be connected in parallel with lamp*		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (b) (i)	Conversion of time to correct unit: 240 (s) (1) substitution 0.8 x 240 (1) evaluation 192 (C) (1)	award full marks for correct answer with no working 0.8 x 4 gains 1 mark for sub of their time into correct eq'n 190 (C) or 1.9×10^2 (C) 3.2 (C) gains 2 marks (only mistake is not converting time to seconds) accept power of 10 error for 2 marks e.g. 19.2 (C) accept power of 10 error and time error for 1 mark e.g. 320 or 32 or .32 if no other mark scored correct attempt anywhere at converting minutes to seconds scores 1 mark e.g. 240 4 x 60 3.2 x 60	**(3)**

Question number	Answer	Acceptable answers	Marks
4 (b) (ii)	Substitution 3 x 0.8 (1) Evaluation 2.4 (W) (1)	award full marks for correct answer with no working accept power of 10 error for 1 mark e.g. 24 (W)	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (c)	the resistance (of the second lamp)/it is more (than the resistance of the first lamp) (1)	higher/bigger/increases(resistance) condone stronger reverse argument clearly stated e.g. the resistance of the first lamp is lower it is 5(.0) Ω compared to 3.75 Ω ignore references to current or power (in/of the lamps)/spurious calculations	**(1)**

Question number	Answer	Acceptable answers	Marks
4 (d)	☒ **C** 1.4 A **The only correct answer is C** ***A*** *is not correct because 0.2 A is the difference in currents* ***B*** *is not correct because 0.7 A is the average of the currents* ***D*** *is not correct because the sum of the currents is 1.4 A*		**(1)**

Question number	Answer	Acceptable answers	Marks
4 (e)	An explanation linking: the current will increase (1) (because) the resistance (of the LDR) will decrease (1)	 it is increased/bigger/higher condone stronger accept higher (rate of) flow of charge ignore references to the LDR changing light to energy ignore references to change in speed of the current ignore lamps get brighter/lighter	**(2)**

Total for question 4= 10 marks

Question number	Answer	Acceptable answers	Marks
5 (a)	92 (protons) 143 (neutrons)		**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b)(i)	<table><tr><th>information about radiation</th><th>tick (✓)</th></tr><tr><td>is an electron</td><td></td></tr><tr><td>is electromagnetic radiation</td><td></td></tr><tr><td>is two protons and two neutrons</td><td>✓</td></tr><tr><td>has a positive charge</td><td>✓</td></tr><tr><td>has a negative charge</td><td></td></tr><tr><td>has no charge</td><td></td></tr></table>	accept any clear indication of correct response e.g. crosses in 3rd and 4th boxes if more than two rows are ticked deduct one mark for each extra row.	**(2)**

Question number	Answer	Acceptable answers	Marks
5 (b)(ii)	A description including: (alpha particles) strongly ionising (1) (alpha particles) weakly penetrating/ short range (1)	many ions or many ion pairs produced (in short distance/few cm) accept most/very ionising or more ionising than beta AND gamma ignore good ioniser accept not very penetrating stopped by (a thin sheet of) paper/skin least penetrating/can't travel as far as beta AND gamma/doesn't penetrate as much as beta AND gamma (can only) travel (through) a few cm of air	**(2)**

Question Number		Indicative Content	Mark
***5 c QWC**	**exp**	A description to include some of the following points • (slow moving) neutron fired at/collides with U-235 nucleus • U-235 nucleus absorbs (slow moving) neutron • U-235 nucleus becomes unstable • nucleus splits • producing 2 daughter nuclei (eg barium and krypton) • and releasing 2 or 3 neutrons • these neutrons can go on to cause further fissions • initiating a chain reaction • the products of nuclear fission are radioactive • nuclear fusion is the creation of a larger nucleus/helium nucleus • from smaller nuclei • such as (isotopes of) hydrogen nuclei • the products of nuclear fusion are (usually) not radioactive • nuclear fusion reactions require a large amount of energy • to provide the high temperatures (and pressures) needed • to overcome (electrostatic) repulsion of protons Some points may come from higher tier statements	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of either fission or fusion which gives one or more limited statements/fact about fission and/or fusion reactions e.g. in fission a U-235 atom splits e.g. in fusion two atoms join e.g. in fission atoms split (apart) and in fusion atoms join (together) • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description giving more than one fact about nuclear fission OR more than one fact about nuclear fusion OR at least one fact about both e.g. in fission a U-235 atom splits into 2 daughter atoms e.g. in fusion two hydrogen atoms fuse/join to make a helium atom e.g. in fusion two small atoms fuse/join to make a bigger atom e.g. In fission a U-235 atom splits but in fusion 2 hydrogen atoms join/fuse • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description of giving more than one fact about nuclear fission OR nuclear fusion AND at least one fact about the other e.g. in fission a U-235 nucleus splits into 2 daughter nuclei and in fusion two hydrogen nuclei join/fuse e.g. in fusion two hydrogen nuclei fuse to make a helium nucleus. In fission a U-235 nucleus splits	

		• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately including nucleus or nuclei • spelling, punctuation and grammar are used with few errors

Total for question 5 = 12 marks

Question number	Answer	Acceptable answers	Marks
6(a)(i)	A suggestion to include one of: (packaging/bandage) not damaged/affected by radiation (1) idea that: (gamma radiation/it) will kill ALL bacteria in/sterilise ALL (the bandage) (1) idea of simplicity of operation e.g. boxes of bandages can pass radioactive source on conveyor belt (1) temperature of dressings unchanged (1)	accept heating could damage or burn or melt the packaging/ bandages/contents/(medical) supplies accept (radiation) kills MORE bacteria accept idea that: heating may NOT kill ALL bacteria in the bandage accept heating would require additional energy ignore it is quicker/easier/ cheaper/more efficient	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (a) (ii)	activity falls by 50% in one half-life (1) 10 years (1)	idea that two half-lives needed activity has halved / ½ (of the sample) has decayed in one half-life/5 years accept half (the sample) remains after one half-life/5 years ignore any halving of mass number (60) or half-life award full marks for correct answer with no working	**(2)**

Question number	Answer	Acceptable answers	Marks
6 (b) (i)	A description to include any **one** of: (increased risk of) cancer (1) radiation burns (1) radiation sickness (1)	 mutate cells/DNA/cause mutations/kills cells accept (cobalt-60) could be absorbed into soil/plants ignore it gives out radiation/is radioactive/is ionising ignore it damages cells/it damages crops radiation poisoning ignore pollution/it makes him ill/kills him/ health problems/damage his health/it's toxic	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (b) (ii)	A suggestion to include any **two** of the following: suitable shielding for the workers (1) (replacement) shielding for the source (1) limit (time of) exposure (1) method of remote working (1) control access by public (1) decontaminate surroundings (1)	Typical suggestions (protective) suits/hazmat suit/NBC suit/gloves/wear breathing apparatus/(face) masks/goggles/hood with visor accept special(ised) clothing (put cobalt-60) in a lead-lined or metal {box/container}/replace shield take it in turns/use exposure meter/badge (to measure exposure) use (long) tongs/robots/drones ignore do not touch it/keep a safe distance stop people coming close/cordon off area/evacuate people from (surrounding) area put all the soil into bags/remove soil	**(2)**

Question Number		Indicative Content	Mark
6 c QWC	*	An explanation to include some of the following points: • radium-223 emits alpha particles • alpha radiation would not penetrate the packaging • radium-223 has a half-life of 11 days • radium-223 would need replacing after a short time • sodium-24 emits gamma • gamma radiation will penetrate the packaging • sodium-24 has a half-life of only 15 hours • sodium-24 would need replacing very frequently • cobalt-60 emits gamma • cobalt-60 has a half-life of 5 years • cobalt 60 would not need replacing very frequently accept references such as cobalt lasts 5 years, radium lasts 11 days and sodium lasts 15 hours as references to appropriate half-lives ignore references to the strength of different types of radiation or how dangerous they are	**(6)**

Level	0	No rewardable content
1	1 - 2	• A limited explanation which gives at least one relevant fact about one of the sources e.g. cobalt (-60) emits gamma e.g. radium (-223) emits alpha e.g. sodium (-24) has a half-life of (only) 15 hours e.g. radium lasts for 11 days • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	A simple explanation which compares cobalt with either radium or sodium or both OR an explanation which qualifies a fact about half-life or penetrating ability with extra detail e.g. cobalt (-60) has a longer half-life than radium (-223). e.g. cobalt (-60) has the longest half-life (of the three sources) e.g. cobalt lasts longer than sodium and/or radium e.g. radium (-223) emits alpha which is less penetrating than gamma/least penetrating (of the 2 or 3 radiations) e.g. cobalt lasts 5 years so it doesn't need replacing often • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy

3	**5 - 6**	• A detailed explanation which gives more than one comparison of cobalt with either radium or sodium or both OR qualifies a comparison with extra detail OR qualifies more than one fact about half-life or penetration or more than one of each with extra detail e.g. the half-lives of radium (-223) and sodium (-24) are too short. Sodium (-24) also emits gamma radiation e.g. cobalt (-60) has the longest half-life and so it won't need replacing (very) often e.g. radium (-223) emits alpha which, unlike the gamma rays from cobalt, would not penetrate the packaging so it cannot kill the bacteria e.g. cobalt (-60) emits gamma (radiation) which unlike alpha can penetrate packaging and completely kill the bacteria e.g. sodium (-24) has the shortest half-life and would soon decay/its activity would decrease too quickly (to be of any use) e.g. cobalt (-60) lasts 5 years so it doesn't need replacing often and gamma can penetrate the box • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Friday 17 June 2016 – Morning
Time: 1 hour

Paper Reference
5PH2F/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.
- 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 × 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

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 ☒.

Electricity

1 (a) (i) Which of these is a source of direct current (d.c.)?

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

(1)

☐ **A** a battery

☐ **B** a light-dependent resistor (LDR)

☐ **C** a thermistor

☐ **D** a voltmeter

(ii) Explain what is meant by a direct current (d.c.)

(2)

.....

.....

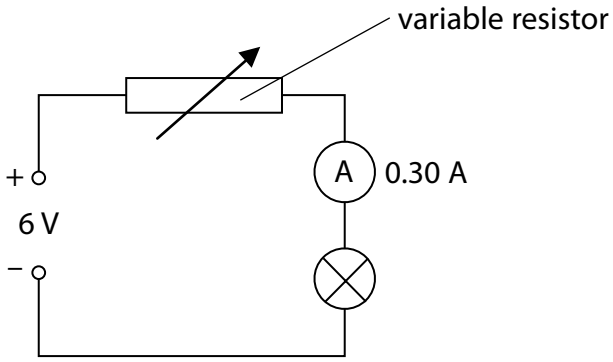
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(b) The diagram shows an electric circuit.



(i) The current in the lamp is 0.30 A.
Calculate the charge flowing through the lamp in 30 seconds.
State the unit.

(3)

charge = ... unit .....

(ii) The resistance of the variable resistor is increased.

State the effect on the ammeter reading.

(1)

.....

.....

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

The particles moving through the metal wires are

(1)

☐ **A** atoms

☐ **B** electrons

☐ **C** neutrons

☐ **D** protons

(Total for Question 1 = 8 marks)

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

When atoms gain or lose electrons they become

(1)

☒ **A** protons

☒ **B** neutrons

☒ **C** molecules

☒ **D** ions

(b) The nuclei of some atoms can change.

These nuclei are unstable and may emit an alpha particle during radioactive decay.

Complete the table for the particles that make up an alpha particle.

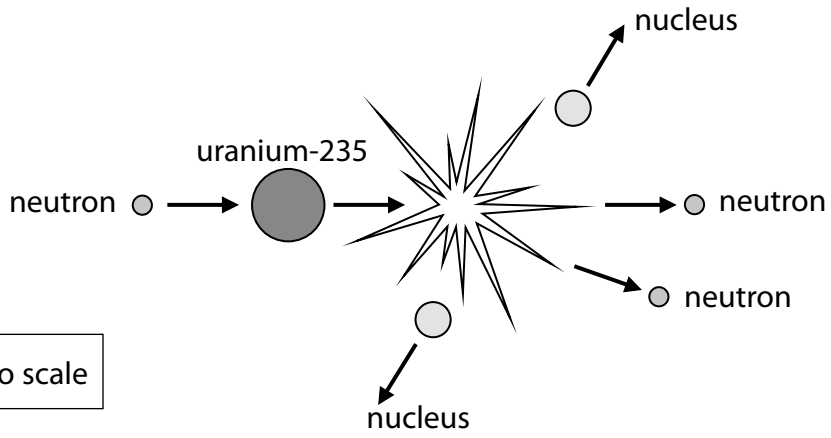
(2)

name of particle	number of particles
proton	
	2

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(c) Nuclear fission can cause changes to nuclei.

The diagram shows the fission of a uranium-235 nucleus.



Not to scale

Describe how this fission could cause a chain reaction.

(2)

(d) Nuclei can also be changed by nuclear fusion.

Describe what happens during nuclear fusion.

(3)

(Total for Question 2 = 8 marks)

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3 (a) A boat is travelling across the water.

One of the forces acting on the boat is shown by the arrow.



Which of these is the correct name for the force shown acting on the boat?

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

(1)

☒ **A** repulsion

☒ **B** weight

☒ **C** lift

☒ **D** drag

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(b) (i) The boat is travelling at a constant velocity.

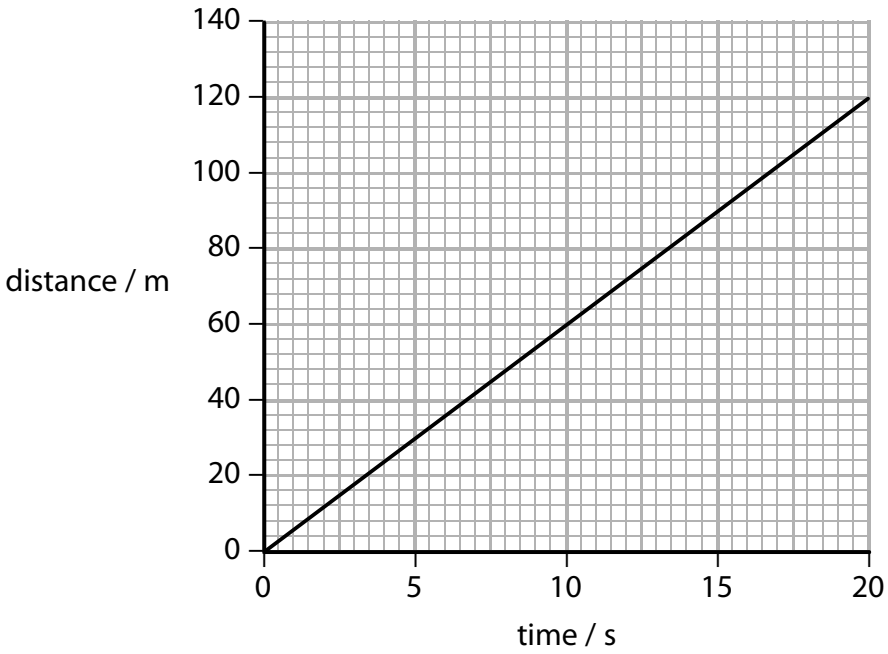
Which of these statements is correct for the horizontal forces acting on the boat?

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

(1)

- ☐ **A** the friction forces are zero
- ☐ **B** the friction forces are bigger than the forward force
- ☐ **C** the friction forces are smaller than the forward force
- ☐ **D** the friction forces are the same size as the forward force

(ii) The graph shows the distance/time graph for the boat.



Use the graph to find the speed of the boat.

(2)

speed = ... m/s

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(c) (i) The boat now accelerates at 3.8 m/s^2.

The total mass of the boat and driver is 680 kg.

Show that the resultant force on the boat is about 2600 N.

(2)

(ii) The diagram represents the horizontal forces acting on the boat as it accelerates.

(2)

Arrows not to scale



thrust

frictional forces
1200 N

The size of the resultant force is 2600 N.

Calculate the size of the thrust.

thrust = ... N

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(d) The boat stops near the bank of the river.
The driver jumps out towards the bank without tying up the boat.

This makes the boat move away from the bank.

Explain why the boat moves away from the bank.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

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Radioactivity and its uses

4 Some nuclear reactors used to generate electricity also produce cobalt-60.

(a) (i) When cobalt-60 decays it releases high energy gamma rays.

Which of these is a correct use of gamma rays?

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

(1)

- ☐ **A** smoke detectors
- ☐ **B** monitoring the thickness of paper
- ☐ **C** sterilising hospital equipment
- ☐ **D** reducing background radiation

(ii) Explain why gamma rays are dangerous.

(2)

.....

.....

.....

.....

(iii) A sample of nuclear waste contains 2.0 mg of cobalt-60.

The half-life of cobalt-60 is 5 years.

Calculate the mass of cobalt-60 remaining after 10 years.

(2)

mass = ... mg

(iv) State one safety precaution that should be taken when storing cobalt-60.

(1)

.....

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(b) The main purpose of nuclear reactors is to generate electricity.

(i) Describe two advantages of generating electricity using nuclear reactors compared to generating electricity using fossil fuels.

(2)

1 .....

.....

2 .....

.....

(ii) Nuclear reactors used to generate electricity produce dangerous radioactive waste.

Describe one method of dealing with this radioactive waste safely.

(2)

.....

.....

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.....

(Total for Question 4 = 10 marks)

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Electrical measurements

5 (a) A student investigates the resistance of a lamp.
She obtains these readings for the potential difference (voltage) across the lamp and the current in the lamp.

voltage in V	current in A
6.0	0.40

(i) Calculate the resistance, R, of the lamp.

(2)

$$R = \frac{V}{I}$$

resistance = ... Ω

(ii) Calculate the power supplied to the lamp.

(2)

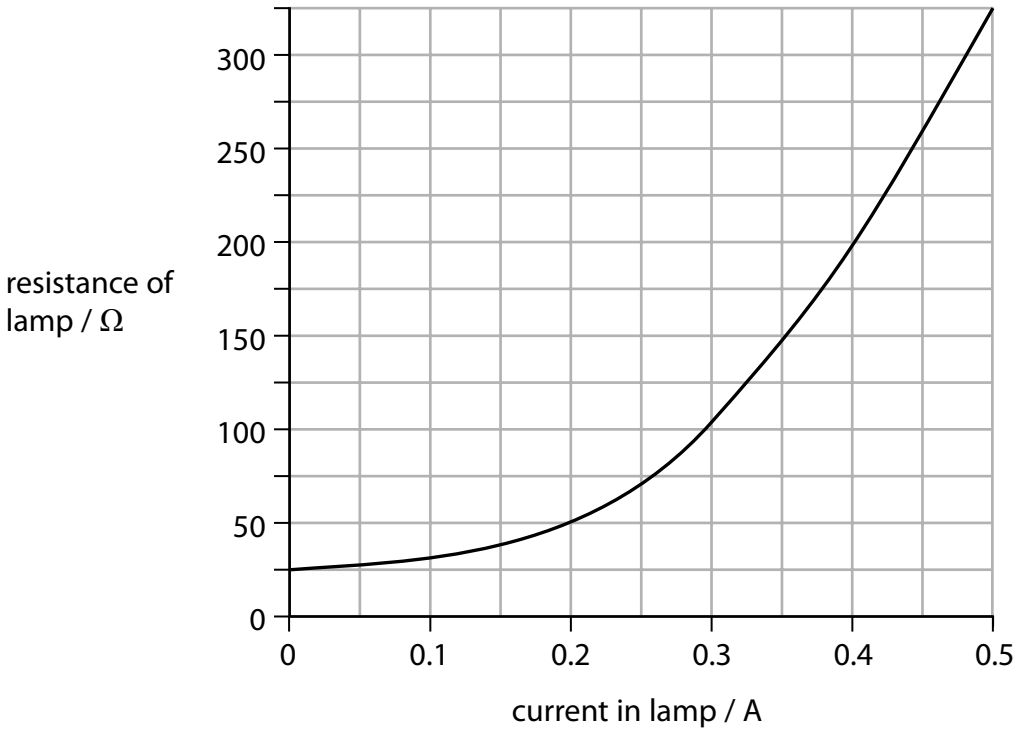
power = ... W

(iii) Calculate the amount of energy transferred by the lamp in 40 s.

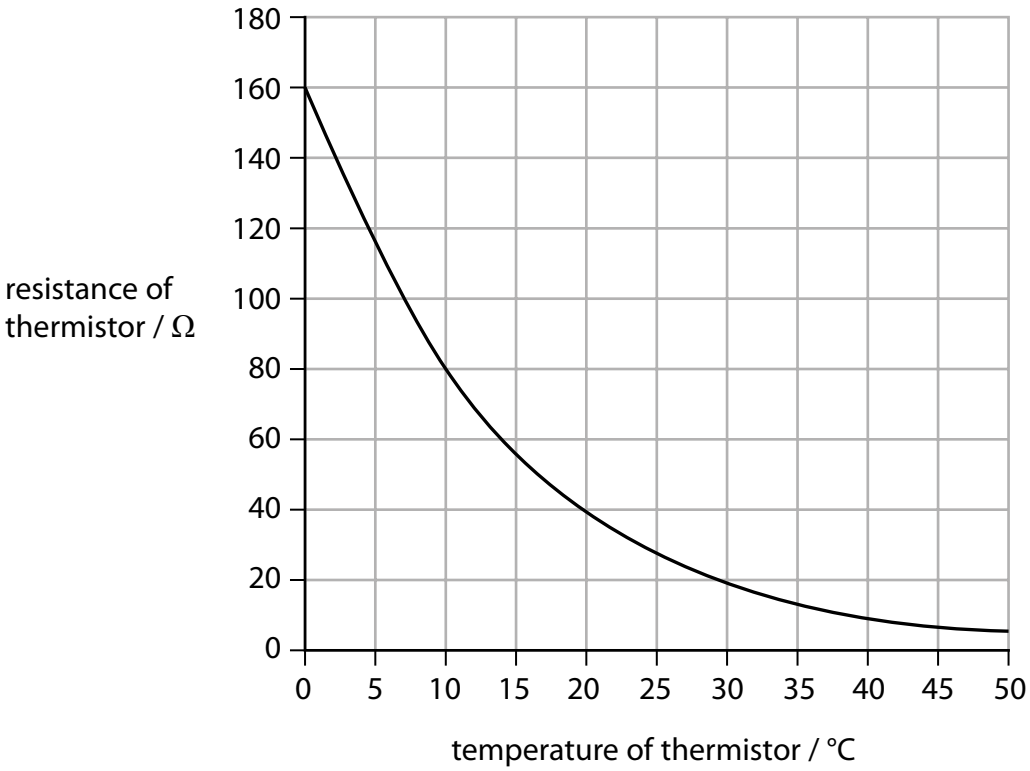
(2)

energy = ... J

*(b) The student produces this graph, showing how resistance of another lamp varies with the current in the lamp.



The student researches resistance and finds this graph, which shows how the resistance of a thermistor varies with temperature.



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Describe how the resistance changes for the lamp and how the resistance changes for the thermistor.

(6)

(Total for Question 5 = 12 marks)

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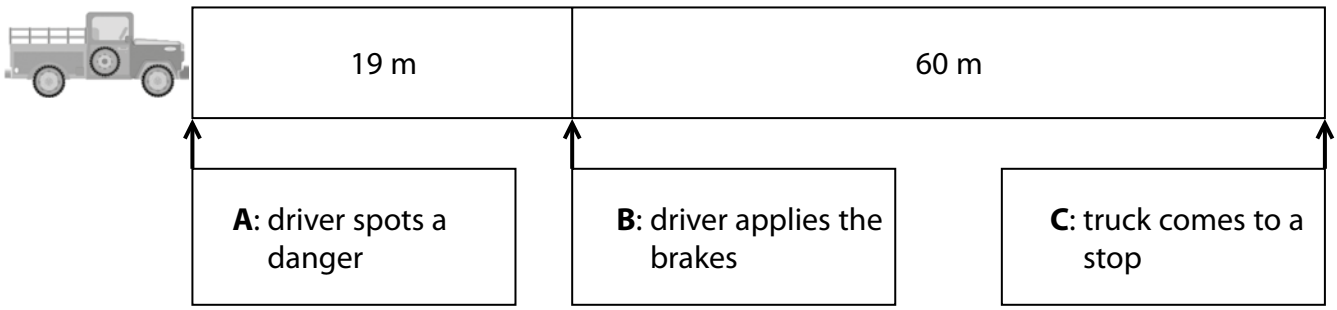
Road safety

6 (a) The diagram shows what happens to a truck being driven at a constant speed along a flat, straight road.

At **A** the driver spots a danger.

At **B** the driver applies the brakes.

At **C** the truck comes to a stop.



(i) State what is happening between **A** and **B**.

(1)

.....

.....

(ii) The brakes exert a constant force of 700 N on the truck from when they are applied until the truck comes to a stop.

Calculate the work done by the brakes.

(2)

work done = ... J

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(iii) The diagram gives information about the stopping of the truck when it is not carrying a load.

Explain how the stopping distance is different when the truck, moving at the same speed, carries a heavy load.

(3)

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*(b) Airbags in cars have reduced the injuries to people involved in car crashes.

Explain how airbags reduce the injuries to people involved in car crashes.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Physics (5PH2F) Paper 01
Unit P2: Physics for your future

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(ai)	**A** a battery (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (aii)	an explanation linking: in one direction (1) second mark can only be scored if first mark is scored movement of charges/electrons (1)	 from negative to positive or positive to negative or in {one/same} {direction/way} ignore it goes straight/directly to..... {charge(s)/electrons} {moving/flowing} condone current /idea of movement ignore electricity NOT energy/power/voltage/p.d. or atoms	**(2)**

Question Number	Answer	Acceptable answers	Mark
1 (bi)	substitution: 0.3 x 30 (1) evaluation 9 (1) C (1)	in all calculations if the candidate gives two different methods and writes the wrong answer in the answer space award no marks if the candidate writes correct answer they will gain full marks allow both marks for correct answer with no working shown. allow POT error for 1 mark coulomb(s)/Coulomb(s) condone lower case c, amp second or As NOT A/s unit mark is independent of value	**(3)**

Question Number	Answer	Acceptable answers	Mark
1 (bii)	(ammeter reading/it) decreases (1)	accept (ammeter reading or amps or current) less/lower/smaller/weaker or not as big accept charge transferred is less/ lower/decreases ignore slow down ignore references to any other quantities accept number less than 0.3 (A) BUT do not accept negative values of current	**(1)**

Question Number	Answer	Acceptable answers	Mark
1 (biii)	B electrons (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)	**D** ions		**1**

Question Number	Answer	Acceptable answers	Mark
2(b)	<table><tr><th>name of particle</th><th>number of particles</th><th></th></tr><tr><td>(proton)</td><td>2</td><td>(1)</td></tr><tr><td>neutron(s)</td><td>(2)</td><td>(1)</td></tr></table>		**2**

Question Number	Answer	Acceptable answers	Mark
2(c)	a description to include: neutron(s) (from the fission) (1) (neutrons from fission go on to) collide with/be absorbed by another uranium(-235) nucleus (1)	 2/3 neutrons references to the neutron on the diagram colliding with the uranium-235 nucleus do not score. The answer must imply neutrons from fission cause more fissions/splitting alternative descriptions of collisions eg hit/bump into/smash into etc condone (go on to) collide with another uranium(-235 atom) new neutrons {cause fission/repeat this process} scores both marks ignore react/chain reaction	**2**

Question Number	Answer	Acceptable answers	Mark
2(d)	a description to include any **three** of the following: (two light/small) nuclei (1) fuse (together) (1) (to produce a) heavier nucleus (1) releasing energy (1)	 condone atoms for nuclei throughout this item named examples {eg hydrogen/ deuterium/tritium} or identifiable symbols {join/merge/bind/bond/combine} (together) (to produce) helium/He (nuclei/atoms) condone bigger/larger {make/create/produce} energy condone gives off energy accept any reasonable form of energy eg thermal/heat or light or KE	**3**

Question Number	Answer	Acceptable answers	Mark
3(a)	**B** Weight		**1**

Question Number	Answer	Acceptable answers	Mark
3(bi)	**D** the friction forces are the same size as the forward force on the boat		**1**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	divide any suitable pair of values eg 60÷10 or 120÷20 (1) evaluation (1) 6 (m/s)	no credit for speed = distance÷time as on formulae page allow both marks for correct answer with no working shown. answers in range 5.8 to 6.2 (m/s) allow POT error for 1 mark but not if clear they have multiplied 60 and 10 no marks for a correct evaluation of a wrong pair of numbers eg 140/20 =7 scores zero	**2**

Question Number	Answer	Acceptable answers	Mark
3(ci)	substitution (force =) 680 x 3.8 (1) evaluation (1) 2584 (N) (which is about 2600 N)	accept alternative explanations 2600 ÷ 680 seen for one mark = 3.82(m/s^2) (which is about 3.8 (m/s^2)) for both marks OR 2600 ÷ 3.8 seen for one mark = 684(.2) (kg) (which is about 680 (kg)) for both marks 2580 (N) ignore 2600 (N) for the second mark accept 2584 (N) with no working seen for both marks	**2**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	combining vectors (1) evaluation (1) 3800 (N)	2600 + 1200 or 2600 – 1200 or 1200 – 2600 not divide or multiply eg 1400 (N) for 1 mark allow both marks for correct answer with no working shown. accept 3784 (N)	**2**

Question Number	Answer	Acceptable answers	Mark
3(d)	an explanation linking 1st marking point with either of the 2nd two: • driver (exerts an unbalanced) force (on the boat) (1) second mark can only be scored if first mark is scored • (in the) opposite direction (to which he moves) (1) • (unbalanced force) accelerates the boat (away from bank) (1)	ignore 'causing the boat to move away from the bank' unless linked to push from driver as this is in the question ignore references to currents in river driver (produces) a push/thrust (on the boat) backwards/(in a direction) away (from the bank/himself) take negative velocities/speeds as away from bank action/reaction (forces) (unbalanced force) changes the speed/ momentum (of boat) explanations in terms of momentum can score up to two marks	**2**

Question Number	Answer	Acceptable answers	Mark
4(ai)	**C** sterilising hospital equipment		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(aii)	an explanation linking any **two** of the following: • (gamma rays are) ionising (1) • (gamma rays are very/highly) penetrating (1) • cause {DNA/cells} to mutate (1) • cause cancer (1)	accept reverse arguments eg difficult to shield against as reverse to penetrating ignore radioactive ignore high energy as in stem penetrate body/tissue/skin/cells/paper /aluminium/lead accept damage your insides for idea of penetration only mutates/damages {DNA/cells/tissue/ organs} condone kills cells/cause mutation(s) ignore harm cells/kill you tumours damage cells inside your body scores two marks for damage cells and penetration	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(aiii)	idea of halving mass (1) 0.5(0) (mg) (1)	1(.00) (mg) accept idea of 2 half-lives for this mark ignore 60 ÷ 2 AND 10 ÷ 2 for this mark allow both marks for correct answer with no working shown. no power of ten error on this item	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(aiv)	any **one** from: • use a lead (-lined) box **(1)** • warning signs **(1)** • restricted access owtte **(1)** • locked room/cupboard **(1)**	ignore references to temperature/safety goggles/gloves/don't touch it/keep it at a distance/protective clothing/(face) mask sealed/secure container eg metal-lined box or in concrete (block) or behind lead (walls) keep people away / keep away from people	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	any **two** advantages from: • no carbon dioxide (produced) (1) • no {sulphur dioxide/nitrogen oxides} (produced) (1) • conserves fossil fuels (1) • reduces dependence on foreign supplies of energy (1) • good safety record (under normal operating conditions) (1) • uses less fuel (1)	less/no {greenhouse gases/global warming} less/no {acid rain/atmospheric pollution} condone no harmful gases released ignore less pollution fossil fuel (reserves) will last longer owtte condone nuclear fuel (reserves) will last longer than (those for fossil fuels) accept nuclear power is more efficient (per kg of fuel used) ignore references to more power/reliability/energy/electricity generated or cost and vague terms such as environmentally friendly ignore nuclear energy is (a) renewable (energy source)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	a description including any **two** from: idea of initial treatment (1) idea of containment (1) idea of long term storage or reprocessing (1)	 (radioactive waste/fuel rods/it) under water or vitrification any description of immobilising waste by combining with inert material eg put it in a concrete block/glass sealing in (stainless) steel (cylinder) condone suitable (sealed) {cylinder/box/ container/barrel} eg metal barrel (long term) storage (deep) underground put in (salt/coal) mines or any underground cavern (radioactive) waste is reprocessed/turned into new fuel can be combined with any of the above points to score up to two marks ignore keep it away from people/houses ignore dump it in the sea	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	substitution: 6.0 ÷ 0.4 (1) evaluation 15 (Ω) (1)	 allow both marks for correct answer with no working shown allow POT error for 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	substitution: 0.4 x 6.0 (1) evaluation 2.4 (W) (1)	 allow both marks for correct answer with no working shown allow power of ten error for max 1 eg 0.24 (W) or 0.024 (W) or 240 (W) accept fractions eg 12/5	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	substitution: 0.4 x 6.0 x 40 (1) evaluation 96 (J) (1)	 2.4 x 40 ecf from 5(a)(ii) ie answer to 5aii x 40 correctly evaluated gains both marks allow both marks for correct answer with no working shown allow power of ten error for max 1 mark eg 9.6 (J) or 0.96 (J) or 960 (J) or 9600 (J)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	a description including some of the following points • resistance of filament changes slowly at low currents • values of resistance taken from graph • resistance of filament almost constant at low currents • comparison of lamp resistance values at different currents e.g. resistance of lamp 100% greater at 0.2 A compared to that at 0.1 A or double that at 0.1 A • resistance of lamp increases with increasing current • higher currents produce higher temperatures/heating in lamp • resistance of lamp increases with increasing temperature • resistance of thermistor decreases with temperature • rate at which resistance of thermistor decreases is lower at higher temperatures • values of thermistor resistance taken from graph • comparison of thermistor resistance values at different temperatures • rate at which resistance of thermistor decreases is greater at lower temperatures • idea of resistance of thermistor halving every 10 degrees C NOTE: In the absence of any other rewardable content: resistance of lamp has a positive correlation AND resistance of thermistor has a negative correlation is only acceptable for level 1: 2 marks and does not contribute to marks at higher levels	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description giving one fact OR two simple statements about the graphs e.g. The resistance of thermistor decreases with temperature OR resistance of lamp increases with current OR the resistance of the lamp increases AND the resistance of the thermistor decreases • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	

2	**3 - 4**	• a simple description giving more than one fact, about resistance of the filament lamp or thermistor OR at least one fact about both. e.g. The resistance of the lamp increases with current, the resistance of the thermistor decreases with temperature. OR The resistance of lamp is almost steady at low current but increases at high(er) currents. OR The resistance of the thermistor decreases from 160 Ω to almost zero (at 50 ^{0}C). • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.
3	**5 - 6**	• a detailed description giving more than two facts about the resistance of either device OR a description involving more than one fact about the resistance of one component AND at least one fact about the resistance of the other component. e.g. The resistance of lamp is almost steady at first. This resistance is about 25 ohms. The resistance increases at high(er) currents. OR Higher currents produce higher resistance in lamp. The resistance of the lamp increases rapidly after 0.1. The thermistor's resistance gets lower as the temperature gets higher. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors.

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	(driver was) reacting (to danger) (1)	thinking (about stopping) / getting ready (to brake) condone (it is the driver's) reaction time condone thinking distance/time accept speed is constant/continues at steady speed ignore references to braking/slowing unless clearly referring to A-B	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	substitution 700 x 60 (1) evaluation (1) 42 000 (J) or 42 k(J)	allow one mark for evaluation of 55 300 (J) (ie using distance of 79m) allow both marks for correct answer with no working shown. allow power of ten error for max 1 mark eg 42 (J) or 420 (J) or 4200 (J) or 420 000 (J)	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	an explanation linking any **three** of the following: same thinking distance (1) braking distance increases (1) (so) greater (stopping) distance (1) greater mass (1) (so) greater momentum OR greater kinetic energy (1) more work done by brakes (1) for same (braking) force (1)	accept reverse argument ignore references to gravitational and friction forces between tyres and surface condone references to time for distances eg same thinking time brakes (still) applied at B C is further (away) condone longer for further accept longer (stopping) distance condone takes longer to stop it's longer scores 1 mark as question asks about stopping distance ignore slower {braking/stopping} distance ignore heavier as this idea is in the stem brakes {work harder/transfer more energy} condone brakes use more energy braking force is (always) 700 N	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	an explanation linking some of: • air bags are released when the car stops suddenly / is in a crash OR airbags inflate rapidly • people have momentum / kinetic energy • (when car stops/brakes suddenly or is in an accident) the driver keeps moving (forwards) • force is needed to reduce (the driver's) momentum / KE to zero • force = rate of decrease of momentum • airbags reduce momentum gradually • air bags increase the time taken for people to stop • this reduces the deceleration/speed decreases at a slower rate • air bags increase the distance through which stopping force acts • force/impact on people is reduced NOTES: condone absorb the force / impact for reduce the force condone driver/passenger stops (more) slowly for reduces deceleration ignore references to crumple zones and seat belts In the absence of any other rewardable content: references to cushioning /break your fall or stop you hitting the dashboard/steering wheel/windscreen/something hard are only acceptable for level 1: 2 marks and do not contribute to marks at higher levels	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation which gives one relevant fact about how injuries are reduced e.g. air bags are released when the car crashes OR airbags stop the driver slowly OR there is a smaller impact/force (on the passenger) • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation giving more than one fact about how injuries are reduced e.g. air bags are released when the car crashes. The impact/force (on the driver/passenger) is less. OR the driver keeps moving (forwards). The airbag inflates rapidly. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation giving more than two facts about how injuries are reduced e.g. air bags inflate rapidly and increase the time it takes the driver to stop. This reduces the force (on the driver). OR air bags are released when the car crashes. The force (on the driver/passenger) is less as the bag stops them slowly. OR the time taken (for the driver) to stop is increased. This makes the deceleration smaller and so the force (on the passenger) is less. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Friday 12 June 2015 – Afternoon
Time: 1 hour

Paper Reference
5PH2F/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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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

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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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 ☒.

Investigating motion

1 Some students investigate the speed of cars.
They measure the time it takes each car to travel a distance of 80 m.

(a) State **two** measuring instruments the students should use.

(2)

1 .....

2 .....

(b) The table shows some of their results.

colour of car	distance travelled / m	time / s
green	80	5.0
red	80	4.0
blue	80	5.5
black	80	4.3
white	80	5.6

(i) State the colour of the slowest car.

(1)

colour of the slowest car .....

(ii) Calculate the speed of the black car.

(2)

speed of the black car = ... m/s

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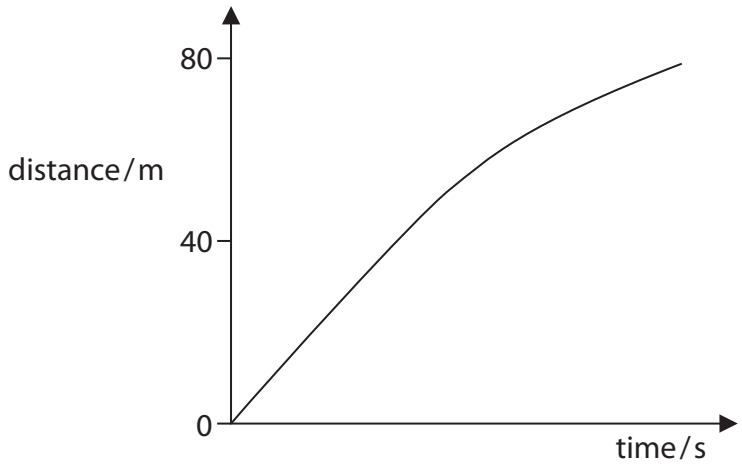
(iii) 20 miles per hour is approximately 9 m/s.

Estimate the speed, in miles per hour, of the black car.

(1)

speed of the black car = ... miles per hour

(c) The distance-time graph for another car is shown below.



Describe what the graph shows about the speed of the car as it travels the 80 m.

(2)

.....

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

Electric charge

2 (a) A plastic rod and a piece of cloth are both uncharged.

A student rubs the plastic rod with the cloth.

The plastic rod becomes negatively charged.

(i) Compared with the plastic rod, which row of the table is correct for the charge on the cloth?

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

(1)

	sign of charge	size of charge
☒ **A**	positive	equal
☒ **B**	negative	equal
☒ **C**	positive	bigger
☒ **D**	negative	bigger

(ii) Explain how the plastic rod becomes negatively charged.

(2)

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(iii) The student then holds the plastic rod near to a stream of water coming from a tap.

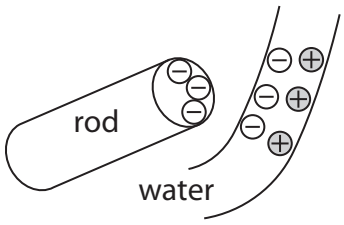
The stream of water bends towards the plastic rod.



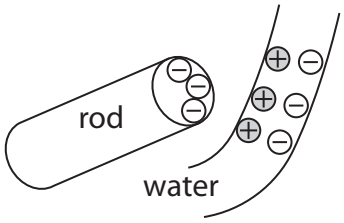
Which picture shows the correct arrangement of charges in the stream of water?

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

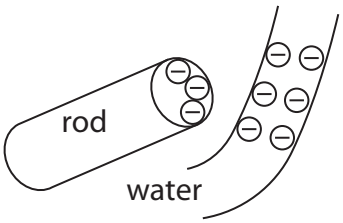
(1)



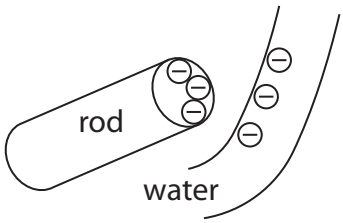
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(iv) The student puts the plastic rod into the stream of water and pulls it out.

Now, when he holds the plastic rod near the stream of water, the stream of water does not bend.

Suggest why the stream of water does not bend.

(1)

.....

.....

(b) A torch has a battery and a bulb.

The current in its circuit is 0.08 A.

Calculate the amount of charge passing a point in this circuit in 2 minutes.

(3)

charge = ... coulombs

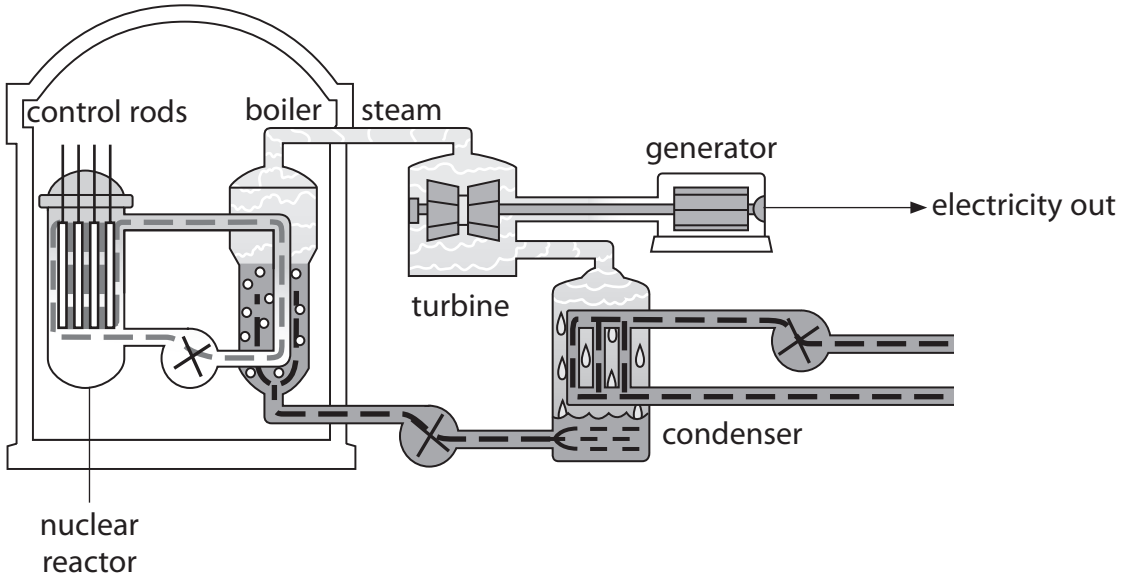
(Total for Question 2 = 8 marks)

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Nuclear fission and radiation

3 The diagram shows parts of a nuclear power station.



(a) (i) Which part of the power station provides thermal (heat) energy from a chain reaction?

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

(1)

- ☒ **A** nuclear reactor
- ☒ **B** turbine
- ☒ **C** generator
- ☒ **D** condenser

(ii) Which part of the power station transfers kinetic energy into electrical energy?

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

(1)

- ☒ **A** nuclear reactor
- ☒ **B** boiler
- ☒ **C** turbine
- ☒ **D** generator

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(b) An isotope of krypton, krypton-89, is produced in the nuclear reactor.
A nucleus of this isotope can be represented as

$$^{89}_{36}Kr$$

Describe the structure of a nucleus of krypton-89.

(4)

(c) Use words from the box to complete the following sentence.

The words may be used once, more than once, or not at all.

(2)

alpha	atom	beta
molecule	neutron	nucleus

During nuclear fission, a uranium-235 ..... splits

when it absorbs a slow moving .....

(d) There are many control rods in a nuclear reactor.

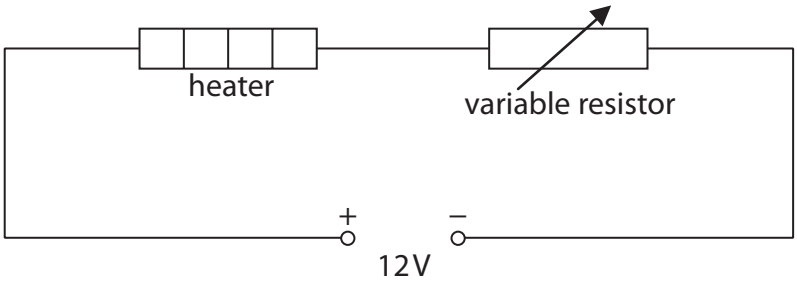
Explain how control rods are used to reduce the number of nuclear reactions in the reactor.

(2)

(Total for Question 3 = 10 marks)

4 (a) A technician investigates the potential difference (voltage) across an electrical heater.

This circuit diagram shows the circuit the technician uses.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the heater.

(2)

(ii) The resistance of the heater is 15 Ω.

The current in the heater is 0.56 A.

Calculate the potential difference (voltage) across the heater.

(2)

potential difference = ... V

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(iii) The technician changes the value of the variable resistor.

She measures the new voltage across the heater and the new current in it.

Here are her results:

voltage = 6.0 V current = 0.40 A.

Calculate the amount of electrical energy transferred in 30 s by the heater.

(2)

energy transferred = ... J

(iv) The total energy supplied by the battery in 30 s is 144 J.

Explain why your answer in (iii) is not the same as the total energy supplied by the battery.

(2)

.....

.....

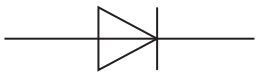
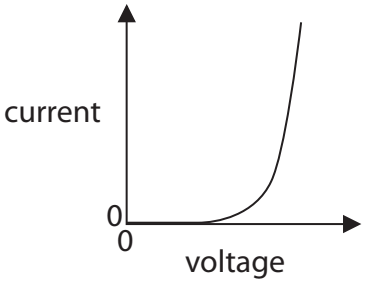
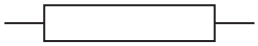
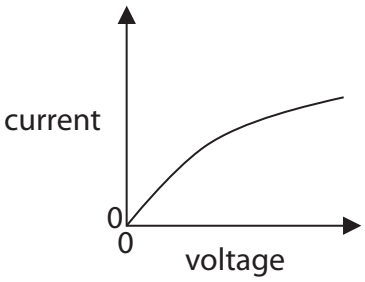
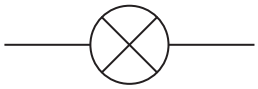
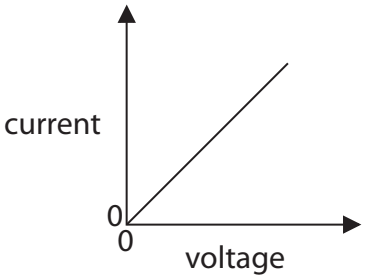
.....

.....

(b) The graphs show how the current in a component changes with the voltage applied across the component.

Draw a line from each component to its correct graph.

(2)

component	**graph**
 diode	
 resistor	
 lamp	

(Total for Question 4 = 10 marks)

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Cars and safety

5 (a) Which of these situations can increase the reaction time of a driver?

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

(1)

- ☒ **A** an icy road
- ☒ **B** worn tyres on his car
- ☒ **C** stopping for a cup of coffee
- ☒ **D** driving for a long time without taking a break

(b) (i) A car engine produces an average driving force of 1200 N.

The car travels 8.0 m.

Calculate the work done by the force over this distance.

(2)

work done = ... J

(ii) The car has a mass of 1400 kg and travels at a velocity of 25 m/s.

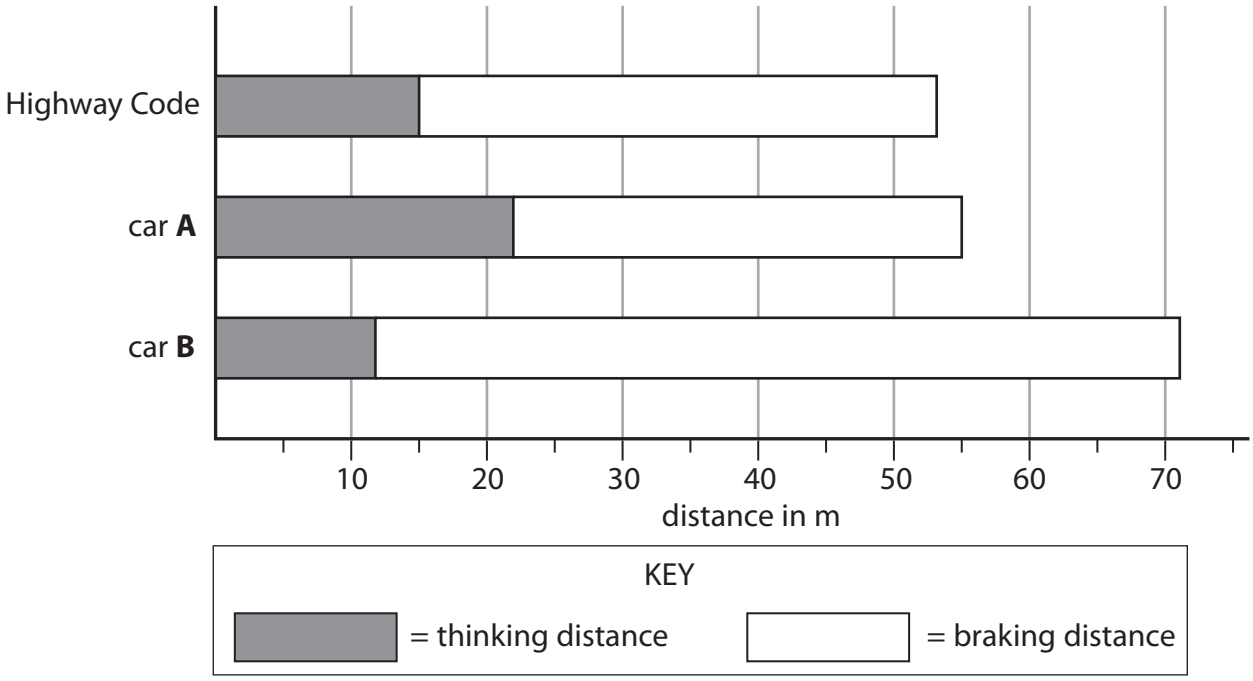
Calculate the kinetic energy of the car.

(3)

kinetic energy = ... J

*(c) The chart shows the thinking, braking and stopping distances for an average car and driver stopping from 50 miles per hour as shown in the Highway Code.

It also shows the thinking, braking and stopping distances for drivers of cars **A** and **B**, both stopping from 50 miles per hour.



A and **B** are different cars on different roads.

Use the factors that can affect thinking and braking distances to explain the differences in stopping distances for cars **A** and **B**.

(6)

(Total for Question 5 = 12 marks)

Using radiation in hospitals

6 Hospitals use ionising radiation for many purposes.

(a) State **one** use of ionising radiation in a hospital.

(1)

.....

(b) An isotope of technicium, technicium-99, has a half-life of 6 hours.

A hospital has a sample which contains 40 mg of technicium-99.

Calculate how much technicium-99 will be in this sample after 12 hours.

(2)

amount remaining = ... mg

(c) Every hospital radiographer who works with radiation wears a radiation badge.

The badge is used to monitor the amount of radiation the radiographer absorbs each month.

(i) Explain why it is important to monitor the amount of radiation a radiographer absorbs each month.

(2)

.....

.....

.....

.....

(ii) Radiographers are restricted to a smaller annual dose of radiation nowadays compared to 50 years ago.

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

This is because nowadays,

(1)

☒ **A** the radioactive sources have decayed

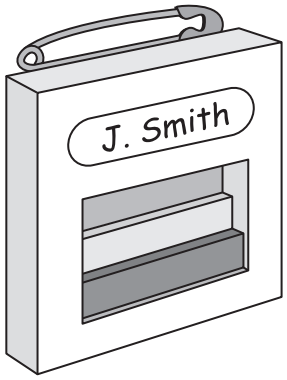
☒ **B** we can measure radiation more accurately

☒ **C** we have a better understanding of the risks from radiation

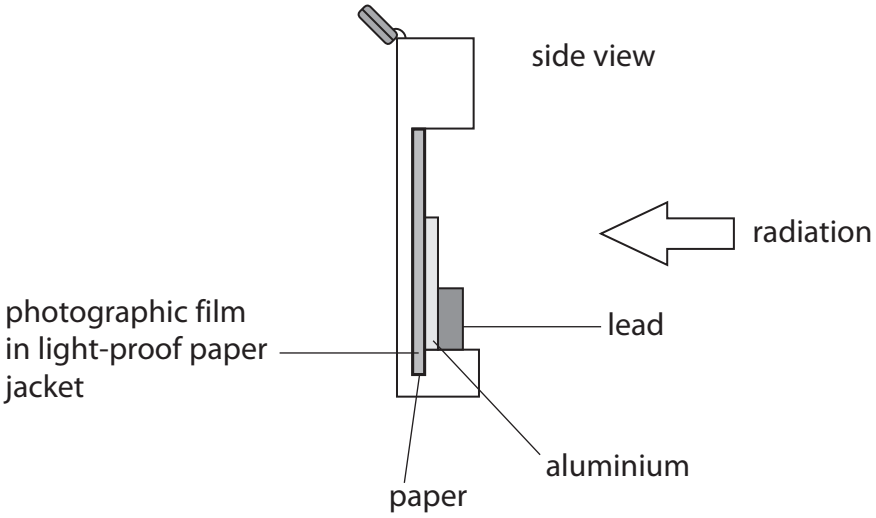
☒ **D** we have more effective ways of shielding against radiation

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*(iii) The radiation badge contains a photographic film which is sensitive to radiation.



radiation badge



The radiation badge is sent to a laboratory after a month and the film is checked.

Explain how the badge shows the amount of different types of radiation that the radiographer has been exposed to.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Physics (5PH2F) Paper 01 Unit P2: Physics for your future

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	stopwatch /stopclock (1) {trundle/measuring} wheel/measuring tape or tape measure (1) ignore speedometer/speed camera/radar	(electronic) timer timing app (on 'phone) clock and watch on their own are insufficient any suitable length measuring device e.g. accept metre {rule(r)/stick} but ruler on its own is insufficient **Answers may be in either order**	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	white (car) (1)	Allow the use of other columns that identify correct car e.g. 5.6(s)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	substitution (1) 80 ÷ 4.3 evaluation (1) 19 (m/s) Throughout the paper do not penalise answers to many places of decimal e.g. here 18.604651 gets both marks	Allow full marks for correct answer with no working seen. accept 18.6 (m/s) ignore 18 and 18.0 as incorrect rounding accept any power of 10 error for 1 mark	**(2)**

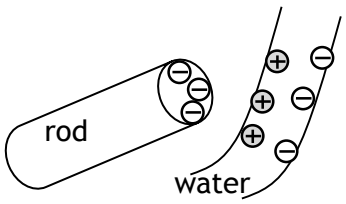
Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	40 (miles per hour) (1)	accept answers in range 39 – 43 (miles per hour) ecf from b(ii) multiply bii by 2.222 range +/- 2.0	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	{steady/constant} speed (at first) (1) (then) slows down (1)	accept velocity for speed ignore as time increases distance travelled increases (then) slower/less speed/decelerates/negative acceleration	**(2)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	**A** positive : equal (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking negative charge(s)/electrons (1) (move/ transfer) {to (plastic) rod / to it / from cloth} (1)	Any reference to positive charges, positive electrons or protons moving scores zero marks for question ignore contradictions to Q i.e. cloth is negatively charged attract is insufficient for transfer e.g. {rod /it} gains/gets electrons (from cloth) for 2 marks the cloth loses electrons (to the rod) for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(iii)	B  		**(1)**

Question Number	Answer	Acceptable answers	**Mark**
2(a)(iv)	a suggestion including: plastic rod has {become neutral/ discharged/no longer charged/not negatively charged (anymore)} OR {charge/electrons} {transferred/ taken} from rod (to/by the water) (1)	Any reference to positive charges, positive electrons or protons moving scores zero marks for question accept the rod loses its charge/ electrons OR rod is 'earthed'/ 'grounded' ignore has same charge as water the water removes/washes away the electrons/charge	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	Conversion to correct units: 120 seen anywhere (1) Substitution: 0.08 x 120 (1) Evaluation: 9.6 (C) (1) accept 10 C	Allow full marks for correct answer with no working seen. 0.08 x 2 gains 1 mark for sub of their time into correct eq'n 0.16 (C) gains 2 marks (only mistake is not converting time to seconds) accept any power of 10 error for 2 marks e.g. 960 (C)	**(3)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**A** nuclear reactor		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	**D** generator		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description including any four from: (there are) 89 particles in the nucleus (1) protons (1) (there are) 36 (protons) (1) neutrons (1) (there are) 53 (neutrons) (1) i.e. 36 protons and 53 neutrons gains four marks	ignore all references to electrons (its) {mass/nucleon} number / RAM / A_r / A is 89 {atomic/proton} number / positive charge / Z = 36 Numbers must be correctly linked to gain credit e.g. 36 neutrons gets 1 mark (for neutrons) 53 protons and 36 neutrons gains two marks (for protons and neutrons) 89 protons and neutrons gets 3 marks (altogether there are) 89 protons and neutrons. 36 are protons gains 4 marks	**(4)**

Question Number	Answer	Acceptable answers	Mark
3(c)	nucleus (1) neutron (1)	**Answers in this order only**	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking two of the following: control rods absorb neutrons (1) control rods moved into / inserted (into reactor core) (1) to capture <u>more</u> neutrons / increase (surface) area (of control rods) (1) (and so) fewer neutrons left (to cause fission) (1)	Ignore 'to control/reduce the reaction(s)' as paraphrase of stem accept control rods take in/soak up neutrons ignore slow down neutrons accept lowered/pushed down (into reactor) NOT move(d) up AND down accept {stops / reduces number (of)} neutrons colliding (with uranium nuclei)	**(2)**

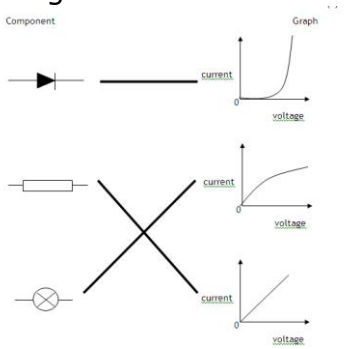
Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	(correct) voltmeter symbol seen anywhere (1) voltmeter symbol connected in parallel / across heater (1)	accept symbols that are attempts at circles. accept line through symbol accept for second mark: any symbol or diagram of meter or box provided it is just from one side of the heater to the other	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	Substitution (into V = I x R) V = 0.56 x 15 (1) Evaluation = 8.4 (V) (1)	Allow full marks for correct answer with no working shown accept any power of 10 error for 1 mark e.g. 84 (V) or 0.84 (V) scores 1 mark accept rounding to 8 (V) for both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	Substitution Energy = 6.0 x 0.40 x 30 (1) Evaluation 72(J) (1)	accept any power of 10 error for 1 mark e.g. 720 or 7200 (J) scores 1 mark Allow full marks for correct answer with no working shown	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iv)	An explanation linking any two from: (there is the same) current in the (variable) resistor/ wires (1) (so) <u>energy</u> is {transferred/used/goes to/ lost/ wasted} in the <u>{(variable) resistor/wires}</u> (1) (so) <u>{(variable) resistor / wires}</u> gains/loses thermal energy (1)	 accept there is a p.d. across the (variable) resistor or {p.d./voltage} across heater is different to battery {p.d./voltage} ignore references to voltmeter and heater ignore 'energy wasted as heat' without qualification accept {resistor/wires} {heats/warms} (up) gains 1 mark energy lost in (variable) {resistor/ wires} as heat gains both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	Connecting lines as shown  (2)	all 3 for 2 marks allow one mark if one or two lines correct more than one line from any component or to any graph is incorrect, so a maximum of 1 mark is possible	**(2)**

Total for Question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)	**D** driving for a long time without taking a break		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	substitution 1200 x 8(.0) (1) evaluation 9600 (J) OR 9.6 x 10^3 (J) (1)	Give full marks for correct answer with no working. 9.6 x any other power of 10 = 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	substitution 0.5 x 1400 x 25^2 (1) evaluation of v squared 0.5 x 1400 x 625 (1) evaluation 4.4 x 10^5 (J) (1) OR 440 000	Give full marks for correct answer with no working. accept 625 seen anywhere for this mark e.g. 875 000 gets 1 mark (forgot ½) 437 500 (J) 4.4 x any other power of 10 = 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	An explanation including some of the following points: • Statement of what is meant by stopping distance Factors affecting driver • factors affecting driver's thinking distance/reaction time Factors dependent on the car • factors affecting braking distance e.g. tyre tread, condition of brakes • cars may be carrying different loads • cars may have different masses External factors • road surface • weather • uphill / downhill Use of data • calculation of thinking, braking and or stopping distances for average driver • calculation of thinking, braking and or stopping distances for driver A • calculation of thinking, braking and or stopping distances for driver B	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation of the differences using one fact OR one piece of data from the chart OR factor(s) affecting thinking/braking distance. e.g. A has a longer thinking distance OR B is a longer braking distance OR thinking distance can be affected by a driver using their phone • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• a simple explanation, giving more than one fact using data from the chart about either car OR at least one piece of data about each OR using one piece of data from the chart about one car AND at least one factor affecting thinking/braking distance OR a statement linking data from the chart to the cause for one car but nothing correct about the other car e.g. A has a braking distance of (about) 33 m, its thinking distance is longer than an average car. OR B has a longer stopping distance. B's reaction time is faster than the Highway code. OR B has a very short thinking time. Car B's brakes may be worn out OR Driver A may have drunk alcohol making his reaction time slower. Car B has better brakes (NB 2nd sentence is incorrect) • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation linking data from the chart to the cause for one car AND at least one statement about the other OR two statements linking data from the chart to the cause for one car e.g. B has a braking distance of (about) 60 m. This means B might be on a wet road. A has a longer thinking distance. OR B has a shorter thinking distance than A. A has a longer thinking distance compared to the average (in highway code). He may be a drink driver. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	Any one of Treatment of cancer / radiotherapy Imaging e.g.: looking at broken bones, tracers sterilizing (equipment/dressings) (1)	NOT ultrasound applications/ chemotherapy accept(to) cure/kill/detect cancer (cells) accept X-ray(s)/X-ray machine accept PET/CT scans ignore MRI scans accept (to) kill bacteria ignore medical treatment and similar vague statements	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	12 hours = 2 half lives (1) 10 (mg) (1)	idea of halving seen e.g. 40 ÷ 2 or 20 (mg) ignore 80 (mg) and 99 ÷ 2 OR idea of 2 half lives seen or 40/4 OR (6 is 1 half-life and)12 is 2 (half-lives) OR 1/4 Give full marks for correct answer with no working.	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)(i)	An explanation to include two from: Radiation is ionising (1) Radiation can cause specified damage e.g. cancer or damage/mutate DNA (1) if dose/exposure is too high (1)	 (causes) ionisation/ (can) ionise/ mutate cells/tissue ignore radiation poisoning/death/make you ill ignore {damage/kill} cells/tissue if absorb(ing) too much (radiation) or so you don't absorb too much (radiation) Accept for both marks: Too much radiation can cause cancer (after a while)	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)(ii)	☒ **C** we have a better understanding of the risks from radiation (1)		**(1)**

Question Number		Indicative Content	Mark
QWC	***6(c)(iii)**	An explanation including some of the following points • identification of alpha, beta, gamma as possible types of radiation • identification of X-rays as possible type of radiation • film is dark(er)/changes colour where radiation is absorbed • different areas of the film are exposed to different types of radiation • gamma (or X-rays) affect all areas of film • beta absorbed/stopped by aluminium/passes through paper • beta only reaches (top) part of film • alpha unlikely to be detected at all • the lead will stop (some of) gamma or (some) gamma will pass through lead/aluminium/paper • the paper will stop/absorb alpha throughout the question accept symbols for types of radiation	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation which gives one relevant fact about types of radiation or the film badge e.g. types of radiation are alpha, beta and gamma OR beta absorbed by aluminium OR the radiation affects the film OR gamma can pass through lead • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• A simple explanation, giving more than one relevant fact about types of radiation OR the film badge OR at least one fact about both. e.g. The 3 types of radiation are alpha, beta and gamma. Gamma can pass through lead. OR The 3 types of radiation are alpha, beta and gamma. Radiation makes the film change colour. OR beta will get through the paper but alpha will be stopped (by paper). OR Radiation makes the film change colour. The lab. will compare how much got through the paper, aluminium and lead • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• a detailed explanation giving more than two relevant points about the film badge OR at least one fact about the types of radiation AND more than one about the film badge e.g. Beta will get through the paper but alpha will be stopped (by paper).Gamma can penetrate the aluminium. OR The film detects radiation. The aluminium will stop beta but, not gamma. OR The 3 types of radiation are alpha, beta and gamma. Beta will get through the paper but alpha will be stopped (by paper). • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 6 = 12 marks

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Centre Number | | | | | |

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Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Thursday 12 June 2014 – Morning
Time: 1 hour

Paper Reference
5PH2F/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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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

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 ☒.

Current electricity

1 A student is investigating a filament lamp.

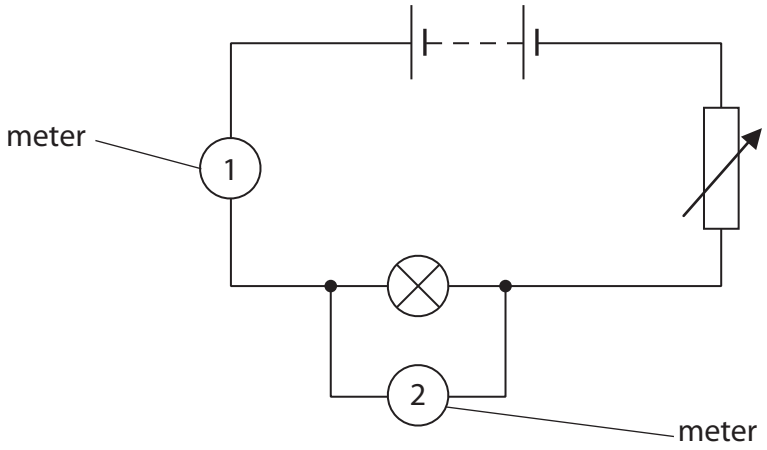
(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The current in the filament lamp is a flow of

(1)

- ☒ **A** protons
- ☒ **B** neutrons
- ☒ **C** electrons
- ☒ **D** atoms

(ii) The student uses this circuit in his investigation.



State what is measured by the meters.

(2)

Meter 1 measures .....

Meter 2 measures .....

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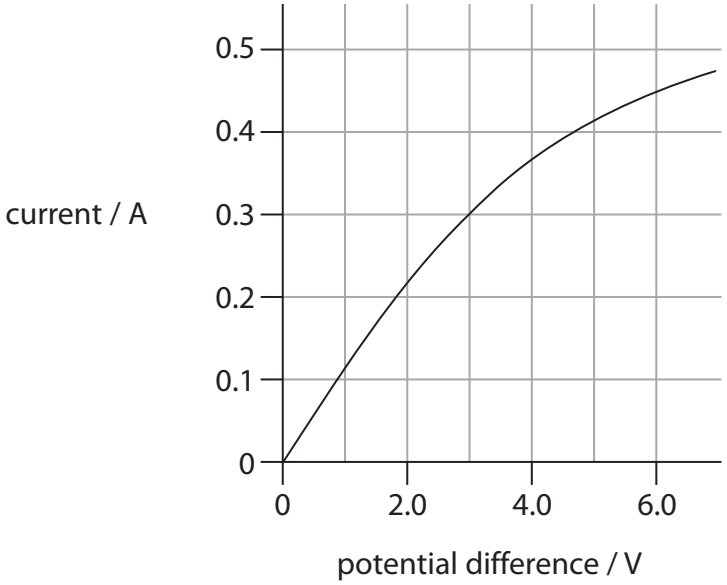
(b) The normal operating potential difference (voltage) and current of the filament lamp is 6 V, 0.4 A.

Calculate the energy supplied to the lamp under these conditions in 20 s.

(2)

energy = ... J

(c) The graph shows how current varies with potential difference (voltage) for another filament lamp.



Calculate the resistance of the lamp when the current in the lamp is 0.3 A.

resistance = potential difference ÷ current $(R = V / I)$

(3)

resistance = ... Ω

(Total for Question 1 = 8 marks)

2 In many sports events, an athlete tries to throw an object as far as possible.



(a) Sport scientists can use many words to describe the throwing of an object.
Four of these words are shown in the box.
Only one of these is a vector.

energy	momentum	power	speed

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

The vector is

(1)

☒ **A** energy

☒ **B** momentum

☒ **C** power

☒ **D** speed

(ii) Complete the sentence by using a word from the box above.

(1)

The rate of doing work is called .....

(b) A javelin has a mass of 0.8 kg. In one throw, the javelin left the athlete's hand at a velocity of 25 m/s.

(i) Calculate the kinetic energy of the javelin as it left the athlete's hand. State the unit.

(3)

kinetic energy = ... unit .....

(ii) State the amount of work done by the athlete on the javelin to get it to a velocity of 25 m/s.

(1)

work done = ...

(iii) A good javelin thrower will try to extend their arm as much as possible before releasing the javelin.

Explain why this allows them to do more work on the javelin.

(2)

.....

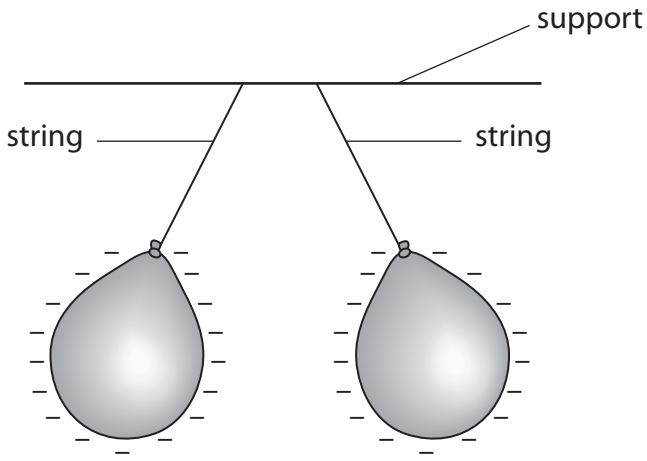
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(Total for Question 2 = 8 marks)

Static electricity

3 (a) A student ties two balloons to a support with some string.
The student rubs both balloons with a dry cloth which gives the balloons a negative charge.
The diagram shows the balloons after they were rubbed.



Use words from the box to complete the sentences.

(4)

attract	charge	electrons	negative	neutral
neutrons	positive	protons	repel	support

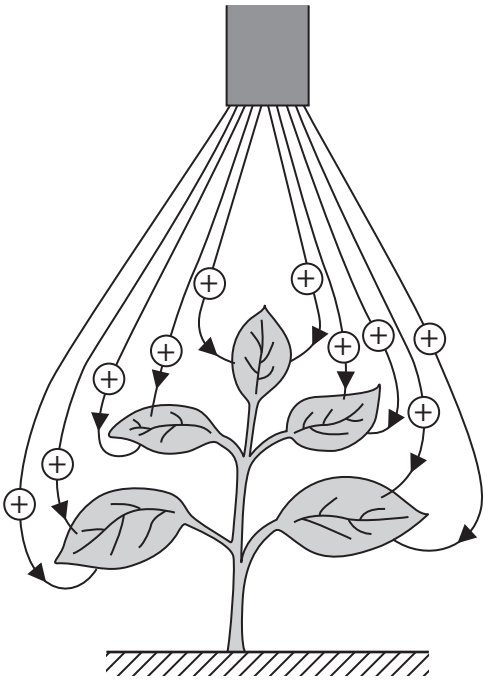
The balloons ..... each other because they have the same .....

The cloth is left with a ..... charge.

The charged particles that are transferred from the cloth to the balloons are called .....

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(b) The diagram shows an electrostatic insecticide spray being used on a plant.
The plant is initially uncharged.
Each droplet of spray is given a positive charge.



(i) Explain the advantages of using an electrostatic insecticide spray compared to an uncharged insecticide spray.

(3)

.....

.....

.....

.....

.....

.....

.....

(ii) There is a current of 0.008 A in the sprayer for a time of 10 minutes.

Calculate the charge supplied to the sprayer in this time.

(3)

charge = ... C

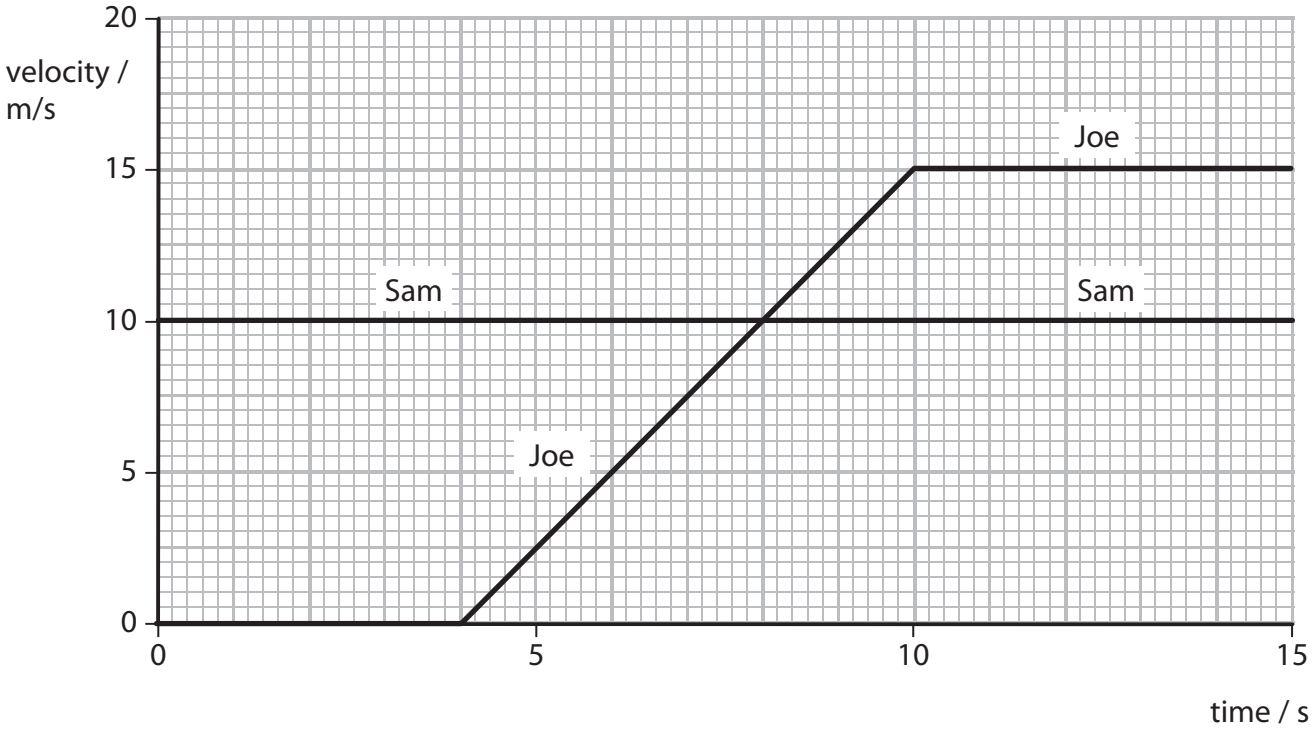
(Total for Question 3 = 10 marks)

4 Sam and Joe are on their bikes. They are on a flat, straight road.

(a) Joe is stationary when Sam rides past at a constant velocity of 10 m/s.

Joe waits for 4 s and then follows Sam.

This is a velocity/time graph of their motion.



(i) How far did Sam travel during these 15 s?

distance = velocity × time

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

(1)

☒ **A** 1.5 m

☒ **B** 10 m

☒ **C** 100 m

☒ **D** 150 m

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(ii) At which of these times is the resultant force on Joe bigger than the resultant force on Sam?

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

(1)

☒ **A** at 3 s

☒ **B** at 7 s

☒ **C** at 11 s

☒ **D** at 15 s

(iii) For how many seconds was Joe accelerating?

(1)

number of seconds = ... s

(iv) Calculate Joe's acceleration during this time.

(2)

Joe's acceleration = ... m/s^2

(b) The diagram shows the horizontal forces acting on Joe at one point while he is accelerating.



(i) Calculate the size of the resultant horizontal force acting on Joe and his bike.

(2)

size of resultant force = ... N

(ii) The total mass of Joe, his heavy bag, and his bike is 55 kg.

Calculate the total weight.

Gravitational field strength, g = 10 N/kg

(1)

total weight = ... N

(c) On another day, Joe is riding the same bike on the same piece of road.

This time he does not have the heavy bag on his back.

He finds that it is easier to accelerate.

Explain why Joe finds it easier to accelerate.

(2)

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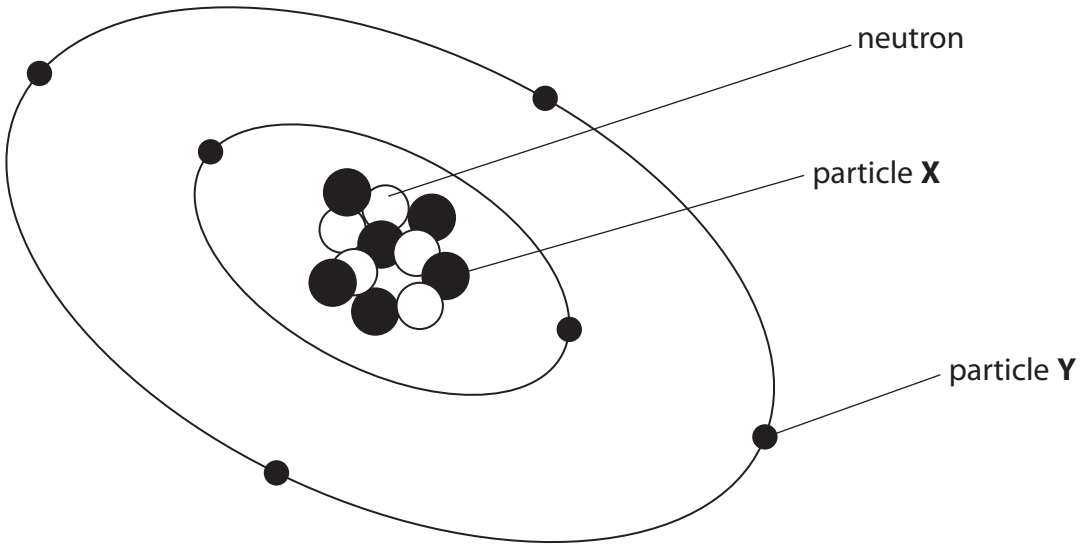
(Total for Question 4 = 10 marks)

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Radioactive material

5 (a) The diagram represents an atom of carbon.



NOT to scale

(i) State the name of particle **X**.

(1)

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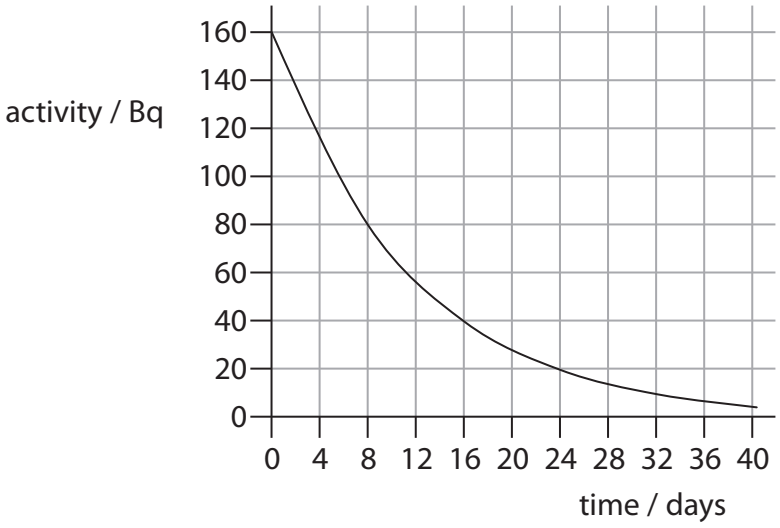
(ii) State the name of particle **Y**.

(1)

.....

(b) Iodine-131 is a radioactive isotope of iodine.

The graph shows how the activity of a sample of iodine-131 decreases with time.



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

(2)

half-life = ... days

(ii) Another sample of iodine-131 has an activity of 800 Bq.

Calculate how long it will take before its activity decreases to 200 Bq.

(2)

time = ... days

*(c) There are plans to build more nuclear power stations to supply electricity to the National Grid.

Discuss the advantages and disadvantages of using nuclear power to generate electricity.

(6)

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(Total for Question 5 = 12 marks)

Nuclear fusion and nuclear fission

6 (a) The nucleus of a hydrogen atom can be represented by this symbol:

$$^{1}_{1}\mathrm{H}$$

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

The symbol shows that the nucleus consists of

(1)

☒ **A** 1 proton and 1 neutron

☒ **B** 1 proton only

☒ **C** 1 neutron only

☒ **D** 1 neutron and 1 electron.

(ii) Two other isotopes of hydrogen are deuterium (D) and tritium (T).

Their nuclei can be represented by these symbols:

$$^{2}_{1}\mathrm{D} \qquad\qquad ^{3}_{1}\mathrm{T}$$

State how these symbols show that they are isotopes of hydrogen.

(1)

.....

.....

(b) Nuclear fusion can occur if a deuterium and a tritium nucleus can be brought close enough to each other.

This fusion produces a helium nucleus and releases a neutron.

(i) Compare the charges of a helium nucleus and a neutron.

(2)

.....

.....

.....

.....

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(ii) Nuclear fusion is an important process.
Scientists have said '*without nuclear fusion, there would be no life on Earth*'.

Explain why nuclear fusion is important to life on Earth.

(2)

.....

.....

.....

.....

Question 6 continues on the next page.

*(c) Neutrons are also released during nuclear fission.
Describe how the neutrons released in nuclear fission are used to produce a controlled chain reaction in a nuclear reactor.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2014

Pearson Edexcel GCSE in Physics (5PH2F) Paper 01

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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**C** electrons (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	current (1) potential difference/voltage (1) Note: award one mark if these answers are in the wrong order	amps / A /mA/ amperage/ampage accept rate of flow of charge but, charge flowing is insufficient ignore electricity ie rate of flow of electricity does not score pd / p.d./ volts / V/ mV / kV etc can accept e.m.f / emf just potential is insufficient accept numerical responses with correct unit award one mark for: meter 1 = ammeter NOT ampmeter AND meter 2 = voltmeter NOT voltameter	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution 0.4 x 6 x 20 (1) evaluation 48 (J) (1) Ignore any unit given by the candidate	 Ignore power of 10 until evaluation e.g. 1 mark for 4.8 Give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	p.d. for current of 0.3 A = 3.0 (V) (1) substitution 3.0 ÷ 0.3 (1) evaluation 10 (Ω) (1) Ignore any unit given by the candidate	3 (V) seen in any calculation is enough for a mark check graph if no other mark 3 ÷ 0.3 gains two marks 0.3 ÷ 3 (= 0.1) gains 1 mark (for 3 V) or bald 0.1 scores 1 mark (for 3V) Allow clear ecf from incorrect reading from graph for maximum 2 marks ie their reading ÷ 0.3 but 0.3 ÷ 0.3 does NOT score unless 0.3 written on graph Give full marks for correct answer, no working DO NOT award any marks for POT error where there is no working.	**(3)**

(Total for Question 1 =8 marks)

Question Number	Answer	Acceptable answers	Mark
2(ai)	**B** momentum (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (aii)	power (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (bi)	Substitution: ½ x0.8 x 25^2 (1) Evaluation 250 (1) 0.25 kJ scores 3 marks J bod j (1)	 Allow both marks for correct answer with no method shown. Ignore power of 10 until evaluation e.g. 2 marks for 25 J 1mark for 25 W Nm ignore kg $(m/s)^2$ Unit mark is independent of numerical answer.	**(3)**

Question Number	Answer	Acceptable answers	Mark
2 (bii)	250 (1) Ignore any unit given by the candidate	Allow ecf from 1(bi)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (biii)	A suggestion to include: work done = force x distance (1) (force) used over a longer distance (1)	 ignore references to more power, greater speed, longer time, larger force, momentum and how far javelin travels. the longer they are pushing (it/the javelin) [bod distance] they can push the javelin (forward) for longer [bod distance] the arm can move further	**(2)**

(Total for Question 2 =8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)	repel (1) charge (1) positive (1) electrons (1)		**(4)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	An explanation linking any **three** from the following: • Droplets have same charge (1) • (droplets) repel (one another) (1) • (This produces) a fine spray/mist (1) • attraction between droplets and plant (1) • This improves coverage OR Spray covers whole [leaf /plant] top and underside of leaf/ gives a fine coating/ even coat (1) • Less spray used/wasted/ falls onto soil (so saves money) (1)	Ignore references to attracting or repelling insects. ignore droplets are positive /negative droplets spread out (produce an) even spray droplets attracted to negative/opposite charge (on plant) or spray will stick to leaves/plant better/more chance of spray landing on/hitting plant or spray (lands) evenly on plant none is wasted/Less will run off the leaves/Same amount of spray will cover a larger area(so saves money)	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	10 minutes = 600 seconds (1) substitution 0.008 x 600 (1) evaluation 4.8 (C) (1) Ignore any unit given by the candidate	 ECF from their time eg 2 marks for 0.08 if their time is 10 0.8/8/8.0/80 gains 1 mark (bod POT error) Power of ten error max of 2 marks eg 480 gains 2 marks Award 3 marks for correct answer, no working No power of ten error mark if answer less than 0.008 as probably dividing Award 2 marks for 0.08, no working	**(3)**

(Total for Question 3 =10 marks)

Question Number	Answer	Acceptable answers	Mark
4(ai)	**D** 150 m **(1)**		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(aii)	**B** at 7 s **(1)**		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(aiii)	6 (s) **(1)**		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(aiv)	Substitution: 15 ÷ 6 (1) Evaluation 2.5 (m/s^2) (1)	Allow ecf from 4(aiii) Must be 15 divided by their 4(aiii) ECF allowed from first marking point ie evaluation of 15 divided by their answer from 4(aiii) Award 2 marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(bi)	100 - 30 (1) 70 (N) (1)	100 + 30 or 130 gains 1 mark Award 2 marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(bii)	550 (N) (1)	539 (N) allow use of g = 9.8 N/kg 539.55 (N) for use of g = 9.81N/kg Award mark for correct answer, no working	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	An explanation linking (combined) mass is less (1) smaller force required for same acceleration OR more acceleration from same force (1)	ignore references to weight, friction or backwards force ignore "easier to accelerate" as in stem less force needed (to accelerate)	**(2)**

(Total for Question 4 =10 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	proton(s) (1)	NOT photon	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	electron(s) (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	evidence of halving activity eg line on graph at 80 (Bq) or two lines at, say, 100 and 50. (1) 8 (days) gains both marks (2)	accept halving in answer space e.g. 160 -> 80 or 80 -> 40 or 160 ÷ 2 = 80 NOT 160 ÷ 40 or 131 ÷ {2 or 4} or 40 ÷ 2 (unless clearly an activity)	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	idea of two half-lives (1) but, 16 (days) gains both marks (2)	halving of 800 twice, e.g. 400 AND 200 seen Allow ECF from graph eg allow half-life from graph x 2 for both marks	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A discussion including some of the following points Advantages - (currently) large resources of **fuel**/ **fuel** (reserves) will last a long time - (Produces) large amount of (electrical) energy/electricity - Does not produce (much/any) carbon dioxide - Does not produce (much/any) sulphur dioxide - Does not add to global warming/climate change - Good safety record (under normal operating conditions) - Only small amount of fuel needed to produce large amount of energy/electricity - Reliable supply/provides continuous supply of electricity (for a long time) - Reduces dependence on foreign supplies of energy - Conserves fossil fuel supplies - (Spent) fuel can be processed (to produce fuel for other reactors) - Provides employment/jobs Disadvantages - Produces nuclear/radioactive {waste/materials} - nuclear/radioactive waste/materials can cause mutations in DNA/cells/people/animals - Non- renewable (energy source) - Difficulties in transporting nuclear/radioactive waste/material - Difficulty in (safely) storing/disposing nuclear waste/material - Nuclear accidents (can) pollute large areas - Nuclear accidents pollute for a long time - Accept named example of accidents eg Fukishima, Chernobyl, 3-mile island - Mining and processing fuel both produce large amounts of carbon dioxide - Expensive to build and/or decommission (nuclear power stations) - Reference to target for terrorist attacks - Produces material which can be used to develop nuclear weapons/by terrorists - Negative public perception OWTTE ignore references such as unsightly, large area needed, noisy as true for most large buildings. Ignore cost of generation or restating stem ie generates electricity or supplies electricity to homes etc.	**(6)**

Level	0	No rewardable content
1	1 - 2	• A limited discussion giving one fact e.g. they give people jobs (in that area) OR they can have accidents like in Japan (after the tsunami). • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• A simple discussion that states one advantage and one disadvantage OR states more than one advantage OR states more than one disadvantage. e.g. they are a reliable energy source and do not produce any carbon dioxide. OR they do not cause any global warming as they do not produce sulphur dioxide. OR they produce radioactive waste and many people don't want them built. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	• A detailed discussion of either advantages or disadvantages AND at least a mention of the other one. e.g. They produce large amounts of electricity and don't produce carbon dioxide but they produce radioactive materials (in the fuel rods). OR They are a reliable source of energy but they can damage large areas if there is an accident and the fuel is non-renewable. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

(Total for Question 5 =12 marks)

Question Number	Answer	Acceptable answers	Mark
6(ai)	**B** 1 proton only **(1)**		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(aii)	Same number of protons (as hydrogen) or same atomic number(as hydrogen) **(1)**	Same proton number(as hydrogen) / (they all) have one proton / (their) proton number is 1 accept bottom number is 1/the same NOT same mass / nucleon number NOT same atomic mass ignore references to electrons / neutrons	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	Helium (nucleus has) positive/+ (charge) **(1)** Neutron has no/zero/0 (charge) **(1)**	helium is +(any number >0 and <5) helium has a larger/bigger charge neutron is neutral /neutrally charged/uncharged ignore references to nuclear fusion or masses	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	An explanation linking (Nuclear fusion/it) occurs in the Sun (1) (The Sun / Fusion provides) energy/heat/light (needed for life on Earth) (1)	 (nuclear fusion/it) is the Sun's energy source OR (it) occurs in stars any valid use of fusion in Sun or stars e.g. • without heat (from Sun) Earth would freeze/have no life • new/heavier elements are made (by fusion/ in stars) eg creates helium	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description including some of the following points Stages involved in a chain reaction: o (neutrons released go on to) collide with other nuclei o causes nuclei to become unstable o (nuclei) split/fission (into daughter nuclei) o releases **more** neutrons o releases energy Control: -Action of the moderator o neutrons need to be slowed down/turned into thermal neutrons o to increase chance of collision o this is achieved with a moderator o carbon/graphite/water/heavy water can be used -Action of control rods o number of neutrons available for collision needs to be controlled o so that reaction proceeds at a steady rate / does not increase o this is achieved by control rods absorbing neutrons o boron / silver/indium/cadmium can be used. Many candidates repeat parts of the question Do NOT give credit for these statements eg neutrons are released during fission	**(6)**

Level	0	No rewardable content
1	1 - 2	• A limited description which gives one relevant fact e.g. (neutrons) cause atoms to split. OR (during fission of uranium atom) neutrons collide with atoms OR (nuclear fission) releases energy OR (3) neutrons are released and two of them are absorbed/taken away • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	3 - 4	• A simple description, giving more than one fact, about a chain reaction or control OR at least one fact about both. e.g. a neutron collides with (uranium) atoms and causes them to split (into daughter nuclei) OR atoms split releasing **more** neutrons OR an atom splits and releases energy OR (neutrons) cause atoms to split and there are (control) rods to control the neutrons. OR control rods can be lowered into the reactor to absorb neutrons • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	5 - 6	A detailed description involving:- • more than two stages of the chain reaction • OR a description involving more than one stage of the chain reaction AND at least one detail about control. • OR a description involving more than one detail about control AND at least one detail about the chain reaction. e.g. Neutrons are slowed down by graphite/water. This makes them more likely to collide with other nuclei. OR neutrons collide with other nuclei and cause them to split releasing more neutrons AND these neutrons hit another nuclei causing it to split OR neutrons collide with other nuclei and cause them to split releasing more neutrons AND there are (control) rods to control the neutrons OR neutrons collide with uranium nuclei causing them to split and release more neutrons. Control rods of boron absorb some of the neutrons. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. uses nuclei split and not atoms split. • spelling, punctuation and grammar are used with few errors.

(Total for Question 6 =12 marks)

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Tuesday 18 June 2013 – Morning
Time: 1 hour

Paper Reference
5PH2F/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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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

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

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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 ☒.

Radioactivity in action

1 (a) Here are four uses of radioactivity.
Draw a line from each one of them to the type of radiation it uses.

Each type of radiation may be chosen once, more than once or not at all.

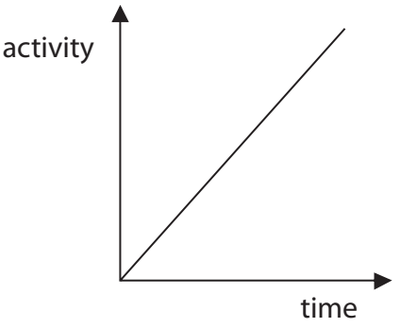
(4)

Use of radioactivity	Type of radiation it uses
sterilisation of medical equipment	alpha
household fire (smoke) alarm	beta
gauging thickness of cardboard	gamma
irradiating food	

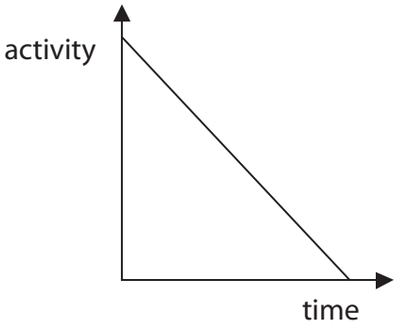
(b) Which graph best shows how the activity of a radioactive isotope changes with time?

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

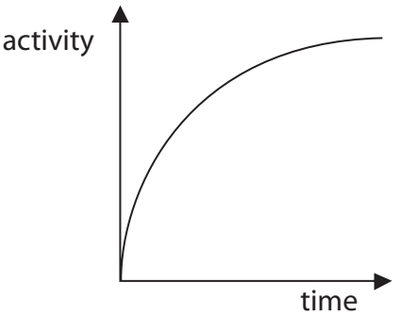
(1)



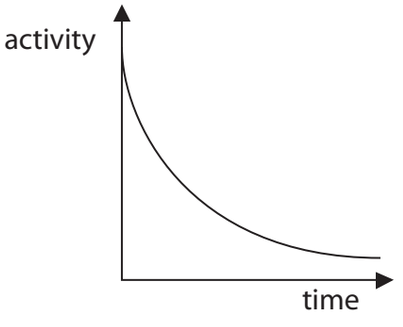
☒ **A**



☒ **B**



☒ **C**



☒ **D**

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

The unit of activity of a radioactive isotope is the

(1)

☒ **A** americium

☒ **B** becquerel

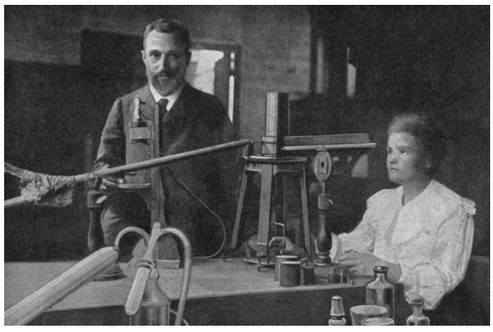
☒ **C** einstein

☒ **D** radium

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(d)

Marie Curie investigated radioactivity over 100 years ago.



She often carried radioactive materials in her pocket.
She stored them in her desk drawer.
She liked the coloured light they gave off.
Marie probably died from exposure to their radiation.

Describe **two** precautions that scientists now take when they use radioactive materials.

(2)

.....

.....

.....

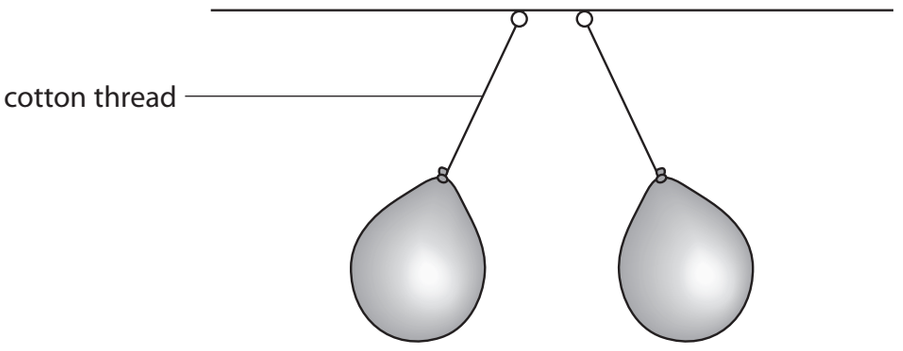
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(Total for Question 1 = 8 marks)

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Investigating static electricity

2 (a) A student charges two balloons and hangs them side by side.



Explain why the cotton threads are not vertical.

(2)

.....

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(b) The student rubs another balloon with a cloth.
This balloon becomes negatively charged.

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

Compared to the charge gained by the balloon, the cloth gains

(1)

☒ **A** a larger negative charge

☒ **B** a larger positive charge

☒ **C** an equal negative charge

☒ **D** an equal positive charge

(ii) Explain why the balloon became negatively charged when it was rubbed with the cloth.

(2)

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(iii) The student then puts this charged balloon against a metal cabinet.

Describe what happens to the charge on the balloon where it touches the metal cabinet.

(2)

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(iv) The student charges another balloon and holds it against a wall. The charged balloon sticks to the wall when he lets go.

Suggest why the balloon is attracted to the wall.

(1)

.....

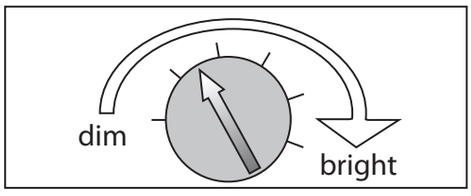
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(Total for Question 2 = 8 marks)

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Controlling electric current

3 An inventor is designing a battery-powered torch.
She wants the torch to have a brightness control.



brightness control

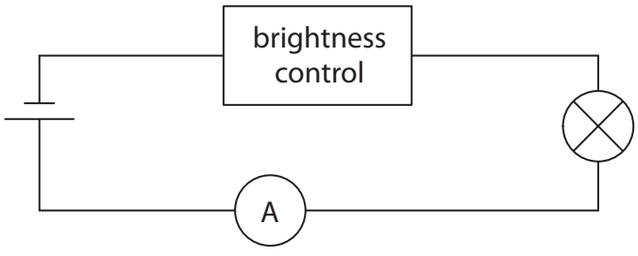
(a) Which of these could she use in this control?

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

(1)

- ☒ **A** a diode
- ☒ **B** a light-dependent resistor
- ☒ **C** a thermistor
- ☒ **D** a variable resistor

(b) She builds this circuit to test the lamp in the torch.



(i) Add a voltmeter to the circuit which will measure the potential difference (voltage) across the lamp.

(1)

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(ii) $R = \frac{V}{I}$

She sets the control at the "bright" position.
The current is 0.26 A and the potential difference (voltage) across the lamp is 6.0 V.

Calculate the resistance of the lamp.

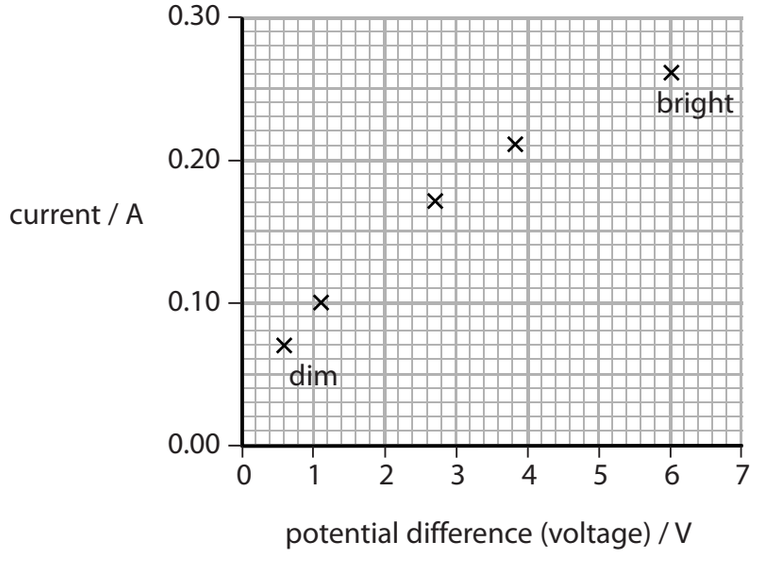
(2)

resistance of the lamp = ... Ω

(c) The inventor takes readings of the potential difference (voltage) across the lamp and the current at different positions of the control from "dim" to "bright".

	dim →					bright
voltage / V	0.6	1.1	2.0	2.7	3.9	6.0
current / A	0.07	0.10	0.14	0.17	0.21	0.26

She plots a graph of the readings.



(i) Complete this graph by plotting the missing point and drawing the curve of best fit.

(2)

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(ii) Describe what this graph shows about how the current changes as the voltage changes.

(2)

(iii) The lamp gives no light when the brightness control is at its lowest setting.

Suggest why the torch would still need an on/off switch as well as the brightness control.

(2)

(Total for Question 3 = 10 marks)

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Double alpha emission

4 Beryllium-9 is a stable isotope of beryllium.

(a) (i) State the meaning of the term **stable**.

(1)

.....

.....

(ii) Beryllium-9 has an atomic number of 4 and a mass number of 9.
A nucleus of this isotope can be described using this symbol.

$$^{9}_{4}\mathrm{Be}$$

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

The number of neutrons in this nucleus is

(1)

☒ **A** 4

☒ **B** 5

☒ **C** 9

☒ **D** 13

(iii) Which one of these symbols describes the nucleus of a different isotope of beryllium?

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

(1)

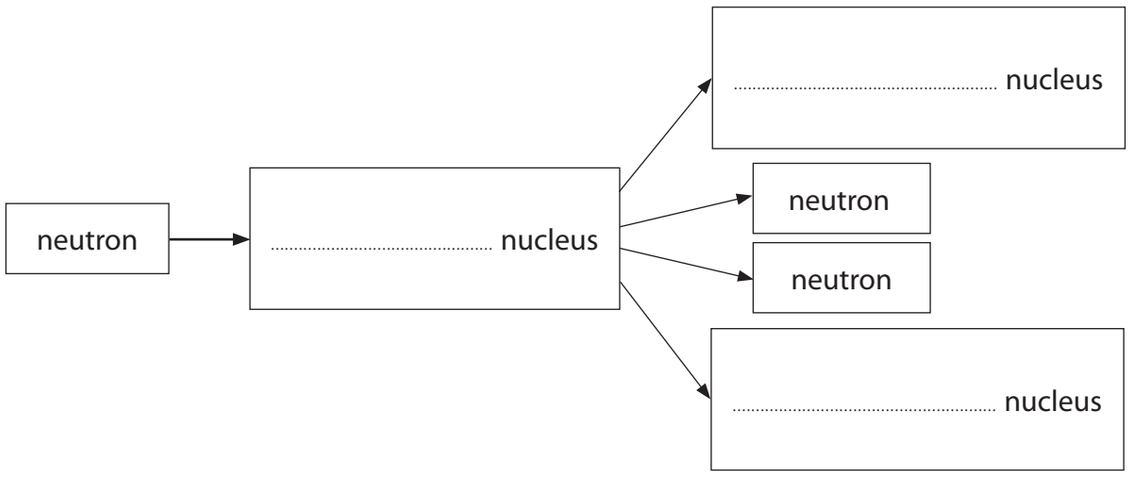
$^{8}_{4}\mathrm{Be}$	$^{8}_{5}\mathrm{Be}$	$^{9}_{4}\mathrm{B}$	$^{9}_{5}\mathrm{Be}$
☒ **A**	☒ **B**	☒ **C**	☒ **D**

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(b) A beryllium-9 nucleus absorbs a neutron.
After a short time the new nucleus splits into two neutrons and two alpha particles.

(i) Complete the flow chart for this reaction.

(2)



(ii) Compare this nuclear reaction with the fission of a uranium nucleus.

(3)

.....

.....

.....

.....

(iii) A fission reaction can be the start of a chain reaction.

Describe what needs to happen next to produce a chain reaction.

(2)

.....

.....

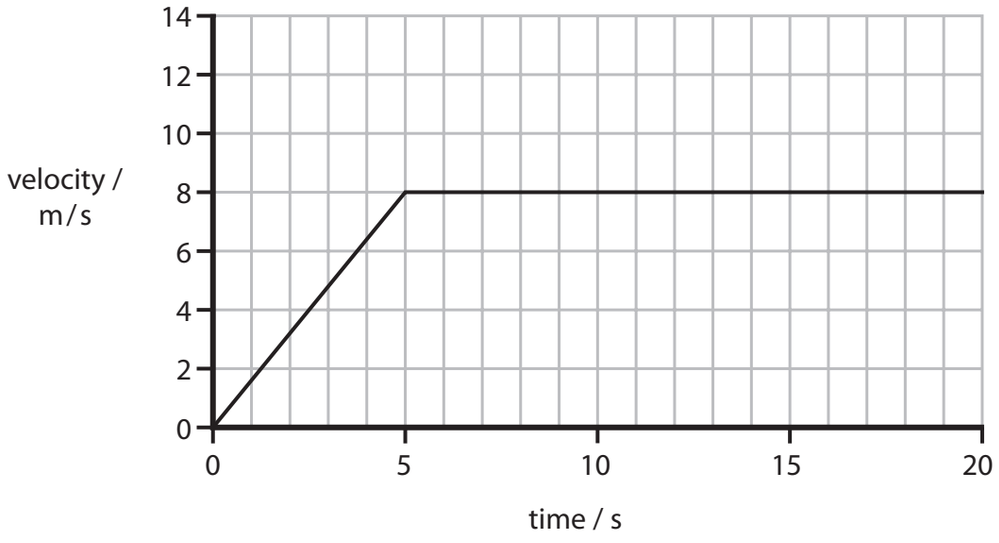
.....

.....

(Total for Question 4 = 10 marks)

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5 (a) Here is the velocity-time graph for a car for the first 20 s of a journey.



(i) Calculate the change in velocity of the car during the first 5 s.

(1)

change in velocity = ... m/s

(ii) Calculate the acceleration of the car during the first 5 s.

(2)

acceleration = ... m/s^2

(iii) State the size of the resultant force between 10 s and 15 s

(1)

resultant force = ... N

P 4 1 9 4 4 A 0 1 4 2 0

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(b) The mass of a car is 1200 kg.

Calculate the resultant force on the car required to produce an acceleration of 0.8 m/s^2.

(2)

resultant force = ... N

*(c) A car, travelling at 20 m/s, with just the driver inside takes 70 m to stop in an emergency.
The same car is then fully loaded with luggage and passengers as well as the driver.

Explain why it will take a different distance to stop in an emergency from the same speed.

(6)

(Total for Question 5 = 12 marks)

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Dropping eggs

6 The photograph shows a man dropping an egg inside a padded box from a height.



He is investigating to see if the padding stops the egg from breaking.

(a) State the type of energy which the egg gains as it falls.

(1)

.....

(b) The weight of the egg is 0.6 N.

Calculate the work done on the egg to lift it up by 20 m. State the unit.

(3)

work done on egg = ... unit .....

(c) The velocity of the container was 18 m/s as it hit the floor.
The mass of the container was 0.5 kg.

Calculate the momentum of the container.

(2)

momentum = ... kg m/s

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*(d) A student stands on the ground with an egg in his hand.
He throws the egg vertically upwards.
The egg rises to a height of 10 m.
Then the egg falls and lands on the ground.

Describe the energy changes of the egg during this sequence of events.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2013

GCSE Physics (5PH2F)
Paper 01

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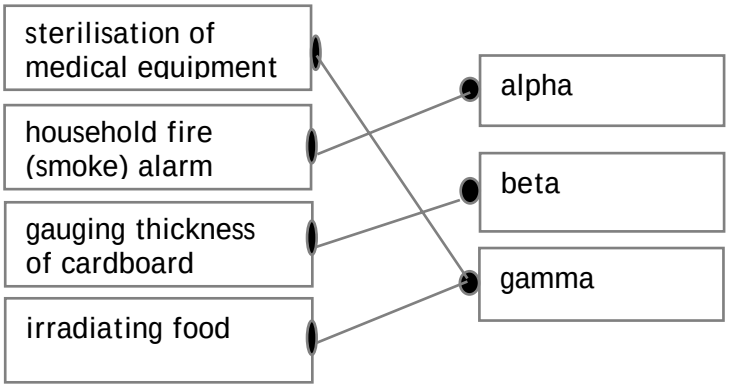
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)		one mark for each correct line	**(4)**

Question Number	Answer	Acceptable answers	Mark
1(b)	☒ **D**		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	☒ **B** becquerel		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	A description including any **two** from: • secure storage (1) • avoid direct contact (1) • wear protective clothing (1) • minimise exposure (1) • shielding (1) • minimise dose (1) • monitor exposure (1) • protect other people (1)	either the purpose, such as to prevent radiation getting out or a description such as lead-lined box/locked away when not in use. do not touch / use tongs /wash after handling lead lined suits/aprons/masks/gloves ignore goggles long distance away / not pointing towards body/ keep sources shielded /stand behind shields short time wear film badge/use Geiger counter (to monitor radiation levels) warning signs / barriers / restricted areas /controlled areas	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (a)	an explanation linking: balloons repel (1) (because) they have like charges (1)	balloons repulse / push away (from each other/to the side) same charge / both positive / both negative accept like charges repel for 2 marks	**(2)**

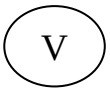
Question Number	Answer	Acceptable answers	Mark
2 (b)(i)	☒ **D** an equal positive charge		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	an explanation linking any two of friction (between cloth and balloon) (1) transfer of electrons (1) (electrons/negative charges move) from cloth to balloon (1)	 charge/electrons move accept balloon gains electrons from the cloth for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	a description including **two** from the following: • balloon becomes discharged (1) • metal /cabinet is a conductor (1) • electrons {move through / on to} metal / cabinet (1)	 earthed / neutral (negative) charge for electrons accept electrons move to earth for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iv)	(surface of) wall (becomes) positively charged /charged by induction (1)	charges on the wall separate charge closest to the surface of the wall is opposite to the charge on the balloon	**(1)**

Question Number	Answer	Acceptable answers	Mark
3 (a)	☒ D a variable resistor		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	 connected in parallel with lamp (1)	recognisable symbol such as a box with letter V inside or box with the word voltmeter inside it accept voltmeter across both lamp and ammeter	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b(ii)	Substitution R = 6.0 / 0.26 (1) Evaluation = 23 (1)	 An answer which rounds to 23 Give full marks for correct answer no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	point correctly plotted at 2.0, 0.14 to within half a small square (1) smooth curve of best fit connecting all given points within half a small square (1)	Judge curve by eye. If more than one line present then ignore any that appear to be erased or deleted. Ignore any part of line which goes beyond given points. If plotted point is incorrect then allow ecf for line	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	a description including **two** of the following: • current increases as voltage increases (1) • current is not proportional to the pd (1) • gradient gets less (1)	Allow reverse argument positive correlation (between them) graph is not a straight line not in equal steps current does not increase as much (as it gets higher) accept resistance has increased with increase in current for two marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(iii)	a suggestion to include: there is still a current (when control is at min position) (1) make the battery last longer (1)	to break the circuit to switch **the current** off accept flow of electricity/charge/electrons for current {battery / energy} would be {drained /used up/ wasted} otherwise accept reverse arguments ignore reference to power / volts	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	does not emit (ionising) radiation / no (radioactive) decay	it is not radioactive	**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a)(ii)	☒ **B** 5		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a)(iii)	$^{8}_{4}Be$ ☒ A		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	helium beryllium (1) (1) helium	daughter in right hand boxes daughter	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	a comparison which describes any **three** of the following: similarities: • produce (more) neutrons (1) • produce 'daughter' (nuclei) (1) • release energy (1) • split a (bigger) nucleus (1) • (triggered by) a neutron coming in (1) • nucleus becomes unstable (before splitting) (1) differences: • uranium daughters are different from each other/ beryllium daughters are the same (1) • uranium daughters are heavier than beryllium daughters (1)	different elements / smaller nuclei for daughters do not accept split an atom neutron is absorbed	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	a description including: neutron(s) (from first fission) (1) (go on to) cause another fission (1)	collide with another nucleus /atom	**(2)**

Question Number	Answer	Acceptable answers	Mark
5 (a) (i)	8 – 0 (m/s)	8	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	substitution 8 / 5 (1) evaluation (1) 1.6 (m/s^2)	ecf from (i) full marks for correct answer (or ecf) with no working shown.	 **(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	0	Nil / nothing / zero / none (no mark for no response)	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	substitution F = 1200 x 0.8 (1) evaluation (1) 960 (N)	 full marks for correct answer with no working shown.	 **(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	an explanation linking some of the following points: compared to a car with just the driver, a fully loaded car will • have a greater mass / be heavier • greater kinetic energy / momentum • experience the same braking force (when brakes are applied) • require a greater braking force (than available) to stop (in the same distance) • have a smaller acceleration / deceleration • take a longer time to come to rest (from given speed) • travel greater distance in this time • needs to do more work with same amount of force • use of relevant equations such as F = ma, work done = F x d • consequence of driver distractions	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation using one idea from the indicative content eg fully loaded car is heavier. • in answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation which links ideas from the indicative content eg it is heavier and so it takes a longer distance to stop • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation which links several ideas from the indicative content e.g. It has more momentum and so it will take a longer time to stop. This means that it will travel a further distance. The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	kinetic (energy)	Movement (energy) KE	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	substitution: 0.6 x 20 (1) evaluation 12 (1) J (1)	give 2 marks for correct answer no working unit is an independent mark joules, Nm, kgm^2/s^2 , Ws	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(c)	substitution: 0.5 x 18 (1) evaluation 9.0 (1)	9 give full marks for correct answer no working	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	a description including some of the following points: • chemical to kinetic while in his hand • kinetic (gradually) to potential while rising / from 0-10 m • eventually all potential at 10 m with a little thermal (heat) energy • some mention of conservation of energy • potential (gradually) to kinetic as falls / 10 m-0 • with a little more thermal (heat) energy • at 0 m sound energy • at 0 m thermal (heat) energy	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description which identifies a change in one relevant type energy or a transfer of energy from one form to another e.g. kinetic energy increases OR kinetic energy changes to sound. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description giving detail of a relevant energy change/transfer e.g. kinetic energy changes into potential energy as it moves upwards OR kinetic energy increases as it falls. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of a sequence of relevant energy changes /transfers e.g. kinetic energy is transferred into potential energy as it rises. This then changes back into kinetic energy as it falls back down. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Physics/Additional Science

Unit 2: Physics for Your Future

Foundation Tier

Thursday 7 March 2013 – Morning
Time: 1 hour

Paper Reference
5PH2F/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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1/1/1/1/

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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 $P = m \times v$

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 $\text{KE} = ½ \times m \times v^2$

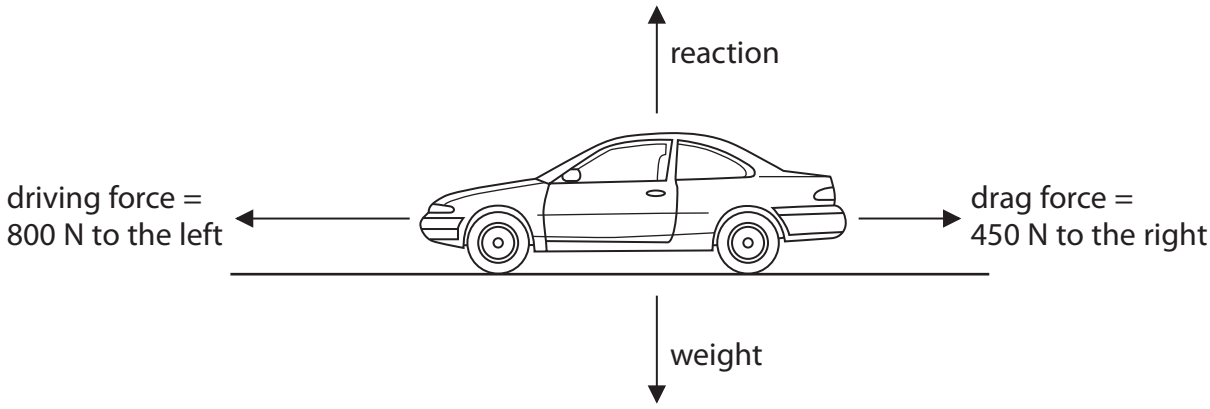
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Answer ALL questions.

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 ☒.

Motion and forces

1 The diagram shows the forces acting on a car which is travelling along a flat straight road.



(a) (i) The size of the resultant force on the car is 350 N.

In which direction is the resultant force acting?

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

(1)

- ☐ **A** down ↓
- ☐ **B** to the left ←
- ☐ **C** to the right →
- ☐ **D** up ↑

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

The car is

(1)

- ☐ **A** accelerating
- ☐ **B** decelerating
- ☐ **C** moving at a constant speed
- ☐ **D** not moving

(iii) The mass of the car is 625 kg.

Calculate the weight of the car.

gravitational field strength = 10N/kg

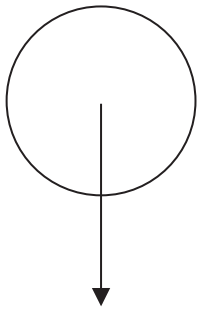
(2)

weight of car = ... N

(b) Forces also act on objects when they fall through the air.

There are two forces acting on this ball as it falls through the air.

The weight is shown on the diagram.



(i) Draw and label an arrow on the diagram to show the other force acting on the ball.

(2)

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(ii) Use words from the box to complete the sentences.

(2)

balanced	changing	greater	smaller	zero

After a short time the ball falls at a steady speed.

The forces acting on the ball are now ..... .

The acceleration of the ball is now ..... .

(Total for Question 1 = 8 marks)

Power from the nucleus

2 The fuel in a nuclear power station is an isotope of uranium.

(a) The symbol for a nucleus of this uranium isotope is $^{235}_{92}U$.

(i) How many protons are there in a nucleus of this isotope?

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

(1)

- ☒ **A** 92
- ☒ **B** 143
- ☒ **C** 235
- ☒ **D** 327

(ii) Name another particle in a nucleus of this isotope.

(1)

.....

(b) Nuclear fission is the reaction that happens in a nuclear power station.

Explain what happens when nuclear fission occurs.

(2)

.....

.....

.....

.....

(c) Control rods are used in the nuclear reactor.

Explain how these rods stop the nuclear reaction from getting out of control.

(2)

.....

.....

.....

.....

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(d) Describe how the thermal energy produced by the nuclear reaction is used to produce electricity.

You may draw a diagram to help with your answer.

(2)

.....

.....

.....

.....

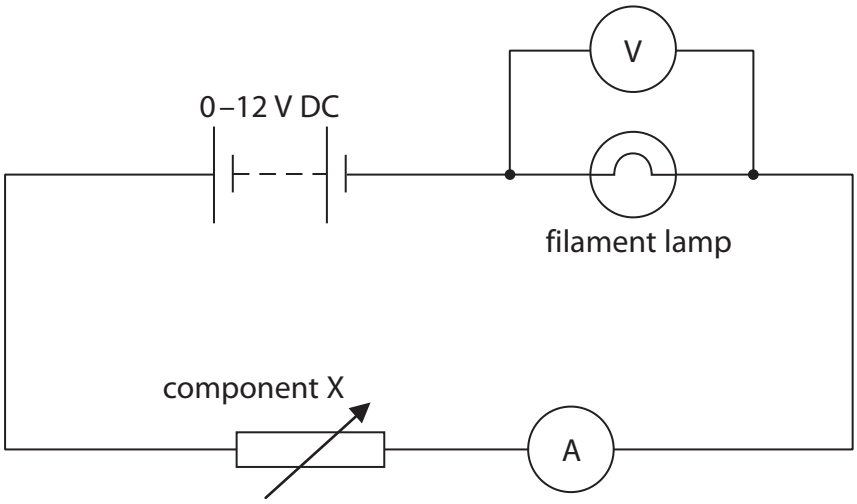
(Total for Question 2 = 8 marks)

Filament lamps

3 A student sets up an experiment to measure the potential difference (voltage) across a filament lamp.

She changes the current through the lamp.

The diagram shows the circuit she used.



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

(i) The component X in the circuit diagram is a

(1)

☒ **A** diode

☒ **B** fixed resistor

☒ **C** thermistor

☒ **D** variable resistor

(ii) The meter that measures potential difference is

(1)

☒ **A** in parallel with the power supply

☒ **B** in parallel with the lamp

☒ **C** in series with the lamp

☒ **D** in series with the component X

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(iii) Describe how the student should increase the current in the lamp.

(2)

.....

.....

.....

.....

(b) The student recorded these readings.

current / A	potential difference / V
0.00	0.0
0.20	2.0
0.31	4.0
0.37	6.0
0.42	8.0
0.44	10.0

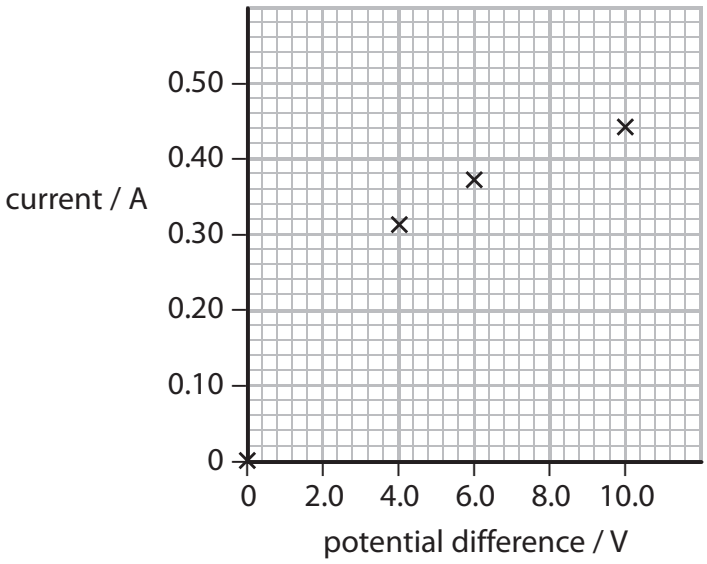
Four points are plotted on the graph.

(i) Plot the points for 2.0 V and 8.0 V.

(1)

(ii) Draw the line of best fit.

(1)



(c) Calculate the resistance of the lamp when the current is 0.44 A and the potential difference is 10.0 V.

(2)

$$R = \frac{V}{I}$$

resistance = ... Ω

(d) Describe the energy transfer that takes place in the lamp.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

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Down to Earth

4 A pilot begins to land an aircraft.

(a) The height of the aircraft decreases from 200 m above the ground to 100 m.

(i) What happens to the gravitational potential energy of the aircraft?

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

(1)

☒ **A** it becomes zero

☒ **B** it decreases

☒ **C** it does not change

☒ **D** it increases

(ii) The velocity of the aircraft remains constant.

What happens to the kinetic energy of the aircraft?

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

(1)

☒ **A** it becomes zero

☒ **B** it decreases

☒ **C** it does not change

☒ **D** it increases

(b) The aircraft lands with its wheels on the runway as shown.



The aircraft is moving forwards.

(i) Draw an arrow on the diagram to show the direction of the momentum of the aircraft.

(1)

(ii) The velocity of the aircraft when it lands is 75 m/s.

The mass of the aircraft is 130 000 kg.

Calculate the momentum of the aircraft.

(2)

momentum = ... kg m/s

(iii) The aircraft comes to a stop.

State the momentum change of the aircraft from when it lands to when it stops.

(1)

change in momentum = ... kg m/s

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(c) When the aircraft lands, the momentum of each passenger also changes.

(i) Explain why it is more comfortable for a passenger if the aircraft takes a longer time to slow down.

(2)

.....

.....

.....

.....

(ii) Suggest why some aircraft need a very long runway to land safely.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

Living with radioactivity

5 Everyone is exposed to background radiation. Some of this radiation comes from natural sources.

(a) (i) One example of a source of background radiation that does not occur naturally is radiotherapy.

State **one** other source of background radiation that does not occur naturally.

(1)

.....

.....

(ii) Radon gas is a natural source of background radiation.

In some parts of the country, a lot of the background radiation comes from radon gas.

Explain why there is no radon gas in some other parts of the country.

(2)

.....

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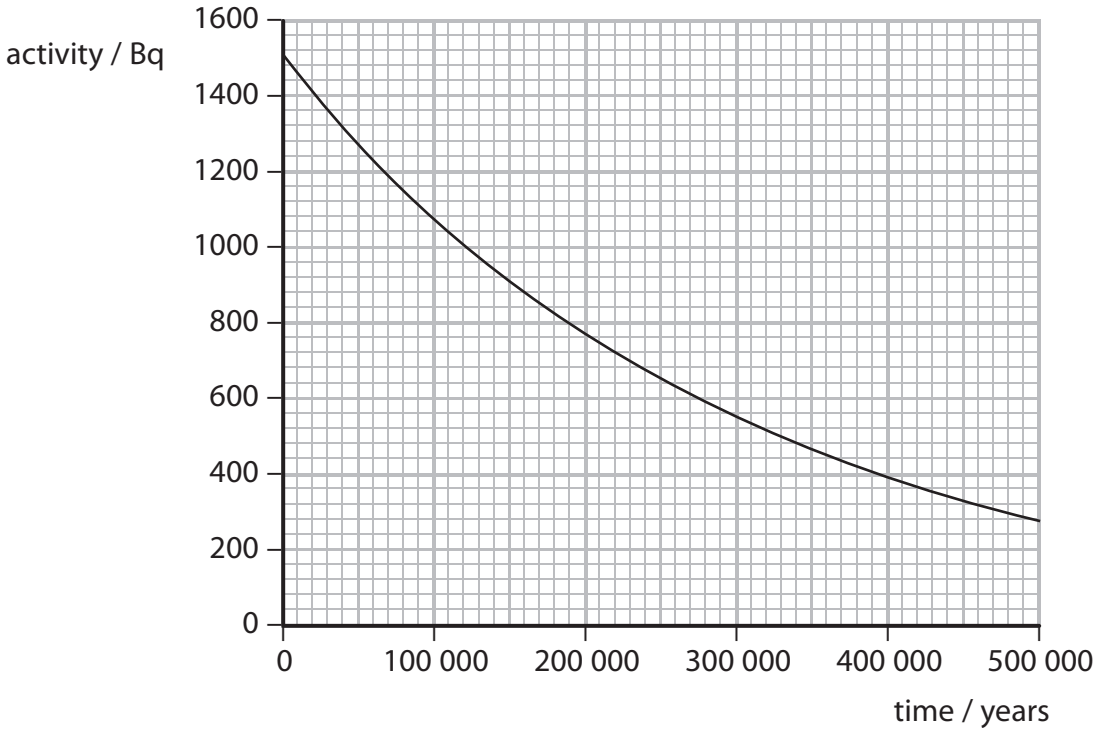
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(b) Technetium-99 is one of the radioactive isotopes in nuclear waste.

The graph shows the decay curve for technetium-99.



(i) Use the graph to show that the half-life of technetium-99 is about 200 000 years.

(2)

(ii) Technetium-99 emits beta particles.

Give **one** reason that beta particles can cause harm to people.

(1)

.....

.....

*(c) There are many radioactive isotopes in nuclear waste.

Technetium-99 is just one of these isotopes.

People are worried about how we should deal with nuclear waste.

Explain why it is difficult to deal with nuclear waste safely.

(6)

(Total for Question 5 = 12 marks)

Static electricity

6 An atom contains electrons, neutrons and protons.

(a) Use words from the box to complete the sentences.

neutral	negative
much larger than a neutron	much smaller than a neutron
positive	the same size as a neutron

(i) The charge on an electron is .....

(1)

(ii) An electron has a mass that is .....

(1)

(b) At a petrol station, a pipe is used to transfer petrol to the storage tanks.

The pipe is earthed.

There is friction between the petrol and the end of the pipe.

(i) Explain why it is dangerous **not** to earth the pipe.

(2)

.....

.....

.....

.....

(ii) Explain how earthing the pipe makes this process much safer.

(2)

.....

.....

.....

.....

*(c) The photographs show some electrostatic effects.



positively charged balloon near hair



positively charged rod near some paper



positively charged balloon near a thin stream of water

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Explain in terms of electric charges how **one** of these effects is caused.

You may include diagrams to help with your answers.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

March 2013

GCSE Physics
5PH2F/01

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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	B to the left ←		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	A accelerating		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	substitution 625x 10 (1) Evaluation 6250 (N) (1)	625 x 9.8 6125 (N) give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	 (1) air resistance (1)	upward arrow on any part of line vertical line from any point on the diagram air friction, upthrust, drag Ignore any downward arrow labelled weight or gravity	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	Balanced (1) Zero (1)		**(2)**

Total for marks for question 1 = 8

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	A 92		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	neutron(s) (1)	allow phonetic spelling nutron, newtron, nuetron	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation linking any two of the following points • a neutron(s)(1) • hits nucleus/nuclei (1) • uranium/nucleus splits (1) • (producing) neutrons /daughter nuclei/ energy / Kr and Ba (1)	 collides/is absorbed breaks/divides accept chain reaction for 1 mark if no other mark awarded accept a correctly labelled diagram	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking two of the following points • absorb (1) • neutrons (1) • (influences) chain reaction / rate of reaction (1)	Accept reverse arguments collects/removes/takes away slows down/changes	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	An explanation linking any two of the following points • heats/boils water (1) • to produce steam (1) • to run/turn/spin turbines (1) • to turn/power generators (1)	 labelled diagram that indicates process (not just parts). heats boiler turns a coil in a magnet	**(2)**

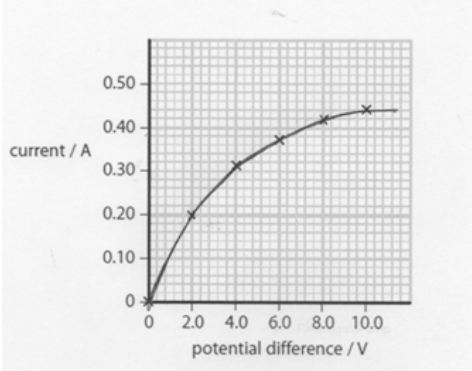
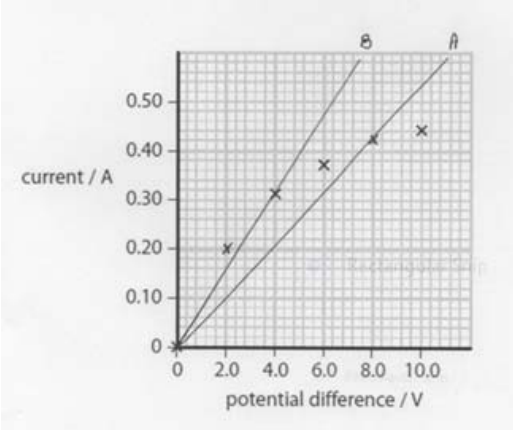
Total marks for question 2 = 8

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D variable resistor		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	B in parallel with the lamp		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	A description including • resistance changed (1) • reduced/decreased/lowered (1) **OR** • voltage/p.d /EMF (of supply) changed (1) • increased /turned up/higher(1)	remove (variable) resistor /component X (2) number of batteries/number of cells <u>add</u> another cell/battery/battery pack/power pack/power supply (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	both points correct (1)	allow + / - half square	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	curve of best fit judged by eye (1)  	Must pass through zero and two other points. 5th point can be either (8.0,0.42) or (8.0, 0.44) straight line of best fit through origin tolerance between lines A and B shown on the diagram  5th point can be either (8.0,0.42) or (8.0, 0.44)	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	substitution (1) 10/0.44 or 250/11 evaluation (1) 23 (ohms)	give full marks for correct answer, no working 22.7(ohms),22.73 (ohms), 22.72(ohms) Ignore excessive decimal places.	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	an explanation linking two of the following points • electric(al)(energy) (1) • (is converted) to heat / thermal (energy) (1) • (is converted) to light (1)	electricity	**(2)**

Total marks forquestion3 =10

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	B it decreases		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	C it does not change		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(i)	horizontal arrow (judge by eye), pointing to the right **anywhere** on the diagram 		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	substitution: (1) 130 000 × 75 evaluation: (1) 9 750 000 (kgm/s) (Ns)	give full marks for correct answer, no working Ignore minus sign 9.75×10^6 (kgm/s) (Ns)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (b)(iii)	9 750 000 kgm/s	same value as answer to (b)(ii) Ignore minus sign	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation linking two of the following: • force is smaller/less (1) • momentum changes more slowly (1) • lower deceleration (1) • use of the formula (1)	 pressure is smaller/less slower deceleration force is proportional to rate of change of momentum/F= (mv – mu)/t	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	Any two from: (for loaded aircraft) • has more mass (1) • has more momentum (1) • has more k.e. (1) • higher velocity • brakes need to do more work (1)	accept reverse argument for empty aircraft heavier/more passengers/more cargo higher speed/moving faster	**(2) expert**

Total marks for question 4 = 10 marks

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	any one of X-ray (machines) / smoke alarms/ nuclear/ radioactive waste (1)	nuclear weapons (tests) nuclear power plants (medical) tracers/technetium	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	an explanation linking: comes from granite / rocks (1) none/ less of these (rocks) in some areas (1)	in some areas/Cornwall/Aberdeen the second mark is dependent on the first.	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	suitable lines on graph to show halving after about 200 000 years (2) • horizontal line at 750 +or –50 Bq on y-axis to curve (1) •meeting (by eye) vertical line from x-axis between 190,000 years and 230,000 years (1)	use of data from graph to show halving after about 200 000 years 1500/2 =750(Bq) or 1600/2=800(Bq) gives a half-life of 210,000 +or- 20 000 (years)	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	any one of • penetrates/passes through the skin (1) • ionises (1) • damages tissue/ cells/DNA (1) • mutates cells/DNA(1) • causes cancer(1)		**(1)**

Total marks for question 5 = 12

Question Number		Indicative Content	Mark
QWC	***5(c)**	an explanation which may include some of the following points: <u>properties of nuclear waste</u> radioactivity is dangerous some isotopes in nuclear waste have long half-lives/radioactive for thousands of years products of fission are warm identified radiation from nuclear waste e.g alpha, beta, gamma <u>problems caused by nuclear waste</u> leakage of radioactivity contamination of ground/sea water/lakes /rivers contamination of crops/fish/animals/drinking water harm to humans/cancer/radiation poisoning/ damage to cells/mutation of cells or DNA difficulty in transporting safely/ stolen by terrorists fears of local people <u>solutions for dealing with nuclear waste safely</u> long term storage, underground /under the sea radiation shielding, lead/steel/concrete/ containers, sealed in glass. human safety, radiation suits, using tongs/lead jackets safe location, away from people/remote areas/sea cooling, ponds information to persuade local people of safety	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation mentioning at least one point, but without linking, e.g. radioactivity is dangerous ; nuclear waste should be stored underground ; terrorists might steal nuclear waste; • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation mentioning two points with an appropriate linkage e.g. nuclear waste is dangerous and it must be stored underground ; the isotopes in nuclear waste have long half-lives so they must be stored for a long time; • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation mentioning a range of points with appropriate linkages e.g. gamma rays from nuclear waste causes damage to cells so it must be stored away from where people live ; the isotopes in nuclear waste have long half-lives so they must be stored underground or in remote areas; • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	negative (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	(much) smaller than a neutron (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	An explanation linking • (friction/it) produces charges (at the end of the pipe) (1) • charge jumps to fuel tank (1) • (charge/friction) causes a spark (1) • can cause a fire /explosion (1)	static (electricity) builds up	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	An explanation linking • (excess) charge / electrons (1) • Removed/ conducts away (1)	static charge discharged/ neutralised discharge current scores both marks	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation etc. including some of the following points • static electricity • opposites charges attract • charges are different • induced charges • charges separate • charges move • electrons move • electrons move towards a positive charge / balloon / rod Allow credit for a correct explanation for an effect which is not given in the question. Allow credit for separation of charge being shown on a diagram.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation. Explains the effect is caused by charges. e.g. the charge on the balloon pulls the water; the charge on the rod attracts the bits of paper; the balloon is rubbed to give it charge; opposites attract; positive and negative attract; • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation. Explains an effect is caused by opposite charges attracting or like charges repelling. e.g. the charge on the balloon is opposite to the charge on the water so they attract; the positive charges on the balloon attract negative charges on the girl's hair; • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation. Explains the effect is caused by induction, charge separation or moving electrons which leads to attraction between opposite charges. e.g. the electrons have been moved off the balloon so it has a positive charge and attracts the negative charge on the hair; the balloon has a positive charge and induces a negative charge on the stream of water which attracts it; • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total marks for question 6=12

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Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Thursday 8 November 2012 – Morning
Time: 1 hour

Paper Reference
5PH2F/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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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

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.

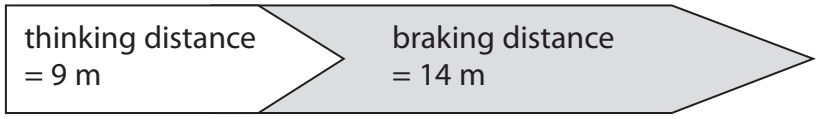
Answer ALL questions.

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 ☒.

Speed and safety

1 The Highway Code gives this information about the stopping distance of a car.

speed = 30 miles per hour



(a) (i) What is the stopping distance?

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

(1)

☐ **A** 5 m

☐ **B** 9 m

☐ **C** 14 m

☐ **D** 23 m

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

The driver's **thinking** distance is most likely to increase when

(1)

☐ **A** the driver is tired

☐ **B** there is ice on the road

☐ **C** the car is heavier

☐ **D** the car moves at a slower speed

(b) A car has a mass of 800 kg.
It has a velocity of 3.0 m/s.

Calculate the momentum of the car.

(2)

momentum of car = ... kg m/s

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(c) (i) The braking force on another car is 600 N.
The force acts for a distance of 15 m.

Calculate the work done by the braking force.

(2)

work done by braking force = ... J

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

The work done by the brakes during braking is equal to

(1)

☒ **A** the energy transferred

☒ **B** the stopping distance

☒ **C** the acceleration

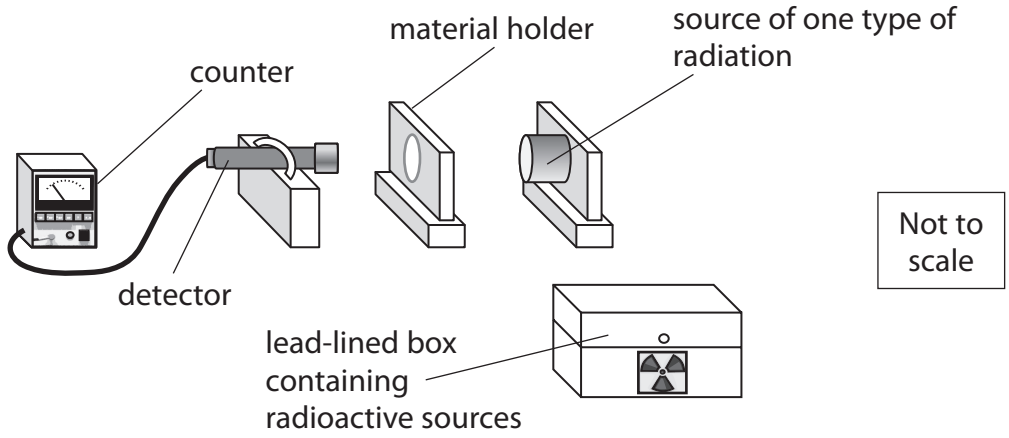
☒ **D** the thinking distance plus braking distance

(Total for Question 1 = 7 marks)

Radioactive materials

2 (a) A student watches a radioactivity demonstration.

The demonstration uses this arrangement.



The teacher puts different materials in the holder.
Then she measures the radiation entering the detector.
Here are the results.

material in the holder	radiation entering detector (counts per minute)
nothing (only air)	121
paper	17
aluminium	17
thick lead	17

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

The radiation from the source is

(1)

☒ **A** alpha particles

☒ **B** beta particles

☒ **C** gamma rays

☒ **D** X-rays

(ii) The teacher returns the radioactive source to the box.

Suggest why the box is lined with lead.

(1)

.....

.....

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(iii) The counter still gives a reading.
The teacher says this is caused by background radiation.

State **one** source of background radiation.

(1)

.....

(iv) The teacher takes precautions to protect her students from the radiation emitted by the radioactive sources.

State **two** suitable precautions that protect the students.

(2)

1 .....

2 .....

(b) Radon is a radioactive gas which emits alpha particles.

(i) A sample of air contains 6 mg of radon.
Radon has a half-life of 4 days.

Calculate the mass of the radon remaining after 8 days.
Show your working.

(2)

mass remaining after 8 days = ... mg

(ii) Some places have rocks which release radon gas.
Explain why people living in these places may have an increased risk of long-term health problems.

(2)

.....

.....

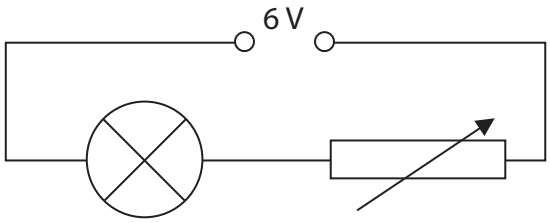
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(Total for Question 2 = 9 marks)

Electric circuits

3 (a) Some students investigate electric circuits.
They set up this circuit.



What can the students do to increase the brightness of the lamp?

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

(1)

☒ **A** add another lamp in series

☒ **B** add another lamp in parallel

☒ **C** increase the resistance of the variable resistor

☒ **D** decrease the resistance of the variable resistor

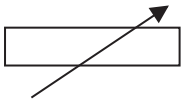
(b) The students want to measure both the current in the lamp and the potential difference (voltage) across the lamp.

(i) Complete the circuit below with an ammeter and a voltmeter correctly connected.
The power supply, variable resistor and lamp symbols are already drawn for you.

(3)







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(ii) The current in a lamp is 0.5 A.
Its resistance is 8 Ω.

Calculate the potential difference (voltage) across the lamp.

(2)

potential difference = ... V

(c) Some electrical energy is transferred to light energy in the lamp.

Explain why only some of the electrical energy is transferred to light energy in the lamp.

(2)

.....

.....

.....

.....

(d) The students use a different lamp in the circuit.
The current in this lamp is 0.4 A.
The potential difference (voltage) across the lamp is 5 V.

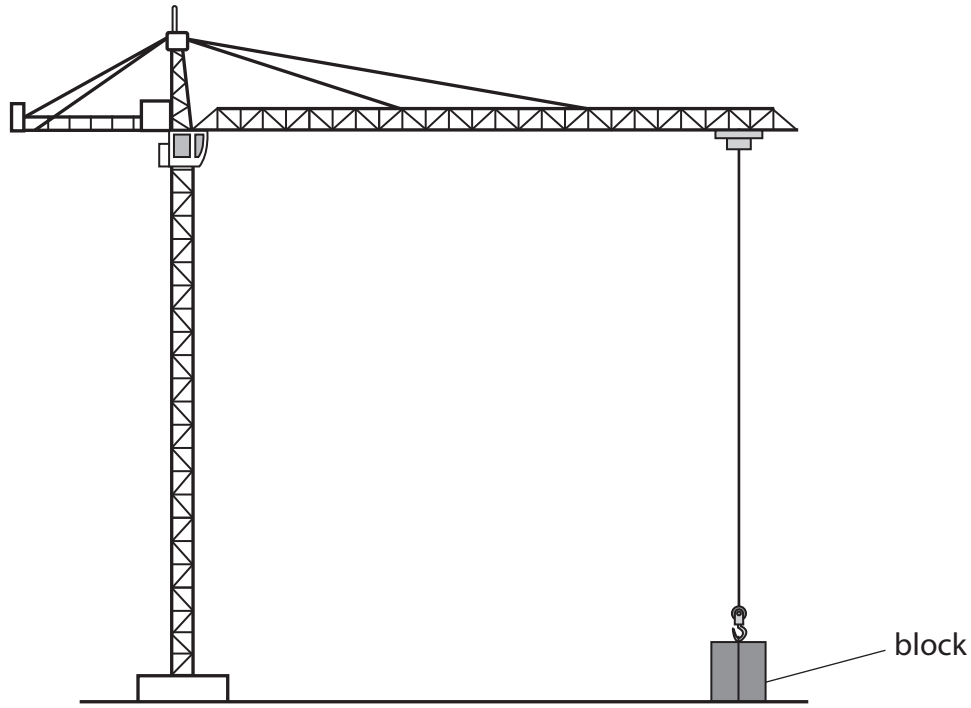
Calculate the power being supplied to the lamp.

(2)

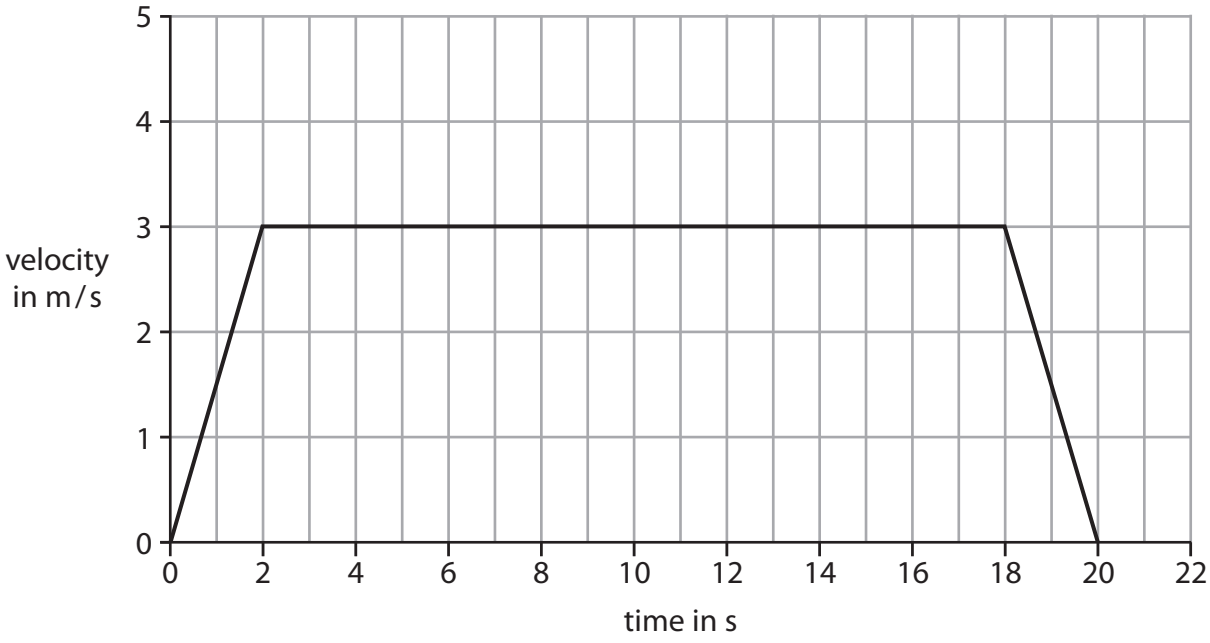
power supplied to the lamp = ... W

(Total for Question 3 = 10 marks)

4 (a) A crane is lifting a heavy block from the ground to the top of a building.



This is the velocity/time graph for the block as it travels upwards.



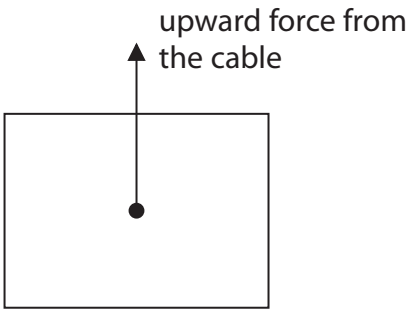
(i) For how many seconds is the block moving at a constant velocity?

(1)

number of seconds = ...

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This diagram shows one of the forces acting on the block.



(ii) Draw an arrow on the diagram to represent the weight of the block.

(1)

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

When the block is moving upwards at a constant velocity, the resultant force on the block is

(1)

☒ **A** upwards and equal to its weight

☒ **B** downwards and equal to its weight

☒ **C** upwards and more than its weight

☒ **D** zero

(iv) Use the velocity/time graph to calculate the acceleration of the block during the first 2 s.
State the unit.

(3)

acceleration = ... unit .....

(v) Explain why the upward force from the cable during the first 2 s is greater than the upward force for the next 4 s.

(2)

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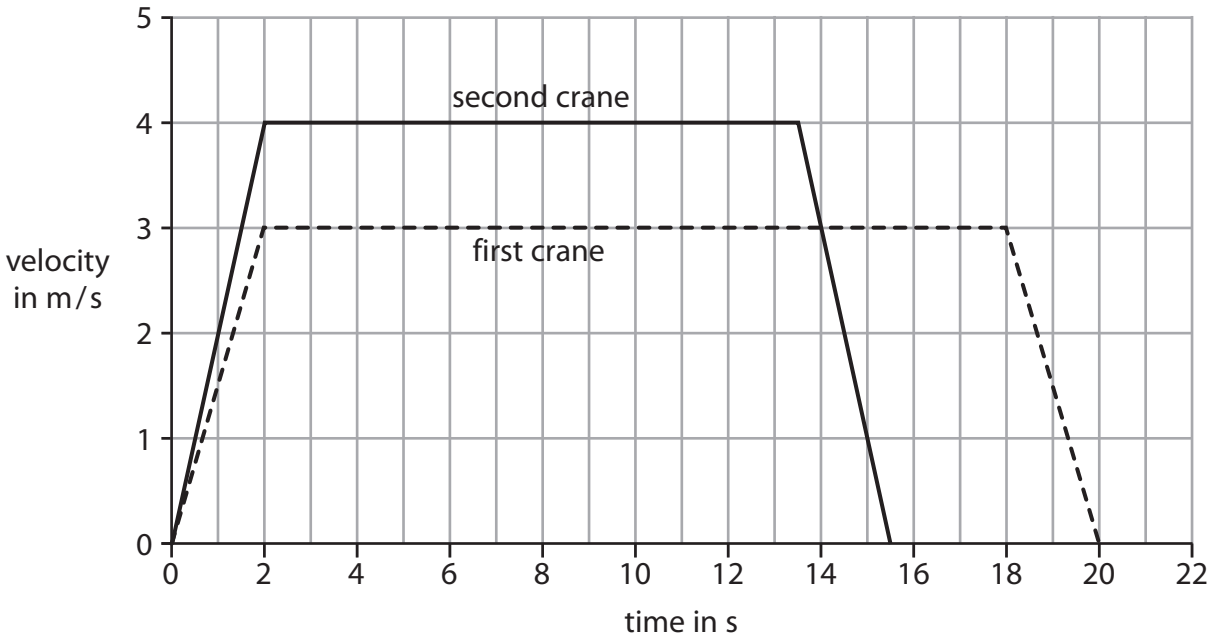
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(b) A second crane lifts an identical block to the same height.

This is the velocity/time graph for the second crane.

The graph for the first crane is shown as a dotted line.



The second crane has a larger power than the first crane.

Explain how the graph shows that the second crane has the larger power.

(2)

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(Total for Question 4 = 10 marks)

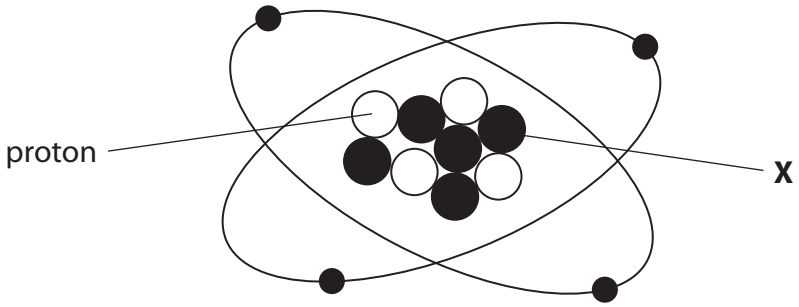
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Turn over for Question 5.

Nuclear particles and reactions

5 (a) The diagram represents an atom of beryllium (Be).



Not to scale

(i) State the name of the particle labelled **X**.

(1)

.....

(ii) Which of these is the correct symbol for this nucleus of beryllium?
Put a cross (☒) in the box next to your answer.

(1)

${}^{5}_{4}\mathrm{Be}$	${}^{5}_{9}\mathrm{Be}$	${}^{9}_{5}\mathrm{Be}$	${}^{9}_{4}\mathrm{Be}$
☒ **A**	☒ **B**	☒ **C**	☒ **D**

(iii) Explain how a beryllium atom can become a positive ion.

(2)

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(b) Nuclear fusion is one type of nuclear reaction.
Nuclear fusion reactions release energy in the Sun.

Describe what happens during nuclear fusion.

(2)

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*(c) Nuclear fission is another type of nuclear reaction.
In some nuclear reactors, the controlled fission of uranium-235 (U-235) is used to release thermal energy.

Describe the process of fission and its control in a nuclear reactor.

You may draw a labelled diagram to help with your answer.

(6)

(Total for Question 5 = 12 marks)

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Using static electricity

6 (a) Vicky combs her hair with a plastic hair comb.
The comb now has a negative charge.

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

The comb has a negative charge because it has

(1)

☒ **A** gained electrons

☒ **B** lost electrons

☒ **C** gained protons

☒ **D** lost protons

(ii) Vicky's hair has also become charged.

Explain how Vicky's hair has become charged.

(2)

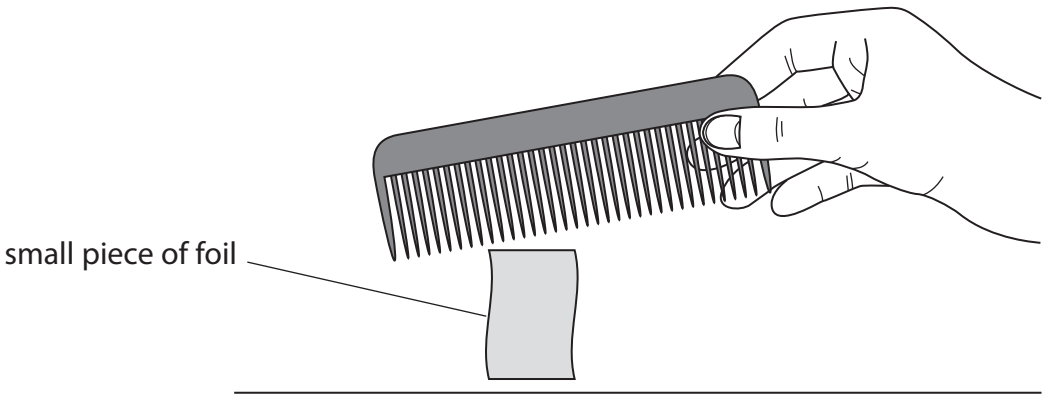
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(iii) Vicky holds the comb over a small piece of metal foil.
The foil jumps up and sticks to the comb.



Show on the diagram where the foil is negatively charged.

(1)

(b) Vicky combs her hair with a metal comb.
Then she tries to pick up some small pieces of metal foil with the comb.
The metal comb does not pick up any pieces of metal foil.

Explain why the metal foil is not picked up by the comb.

(2)

.....

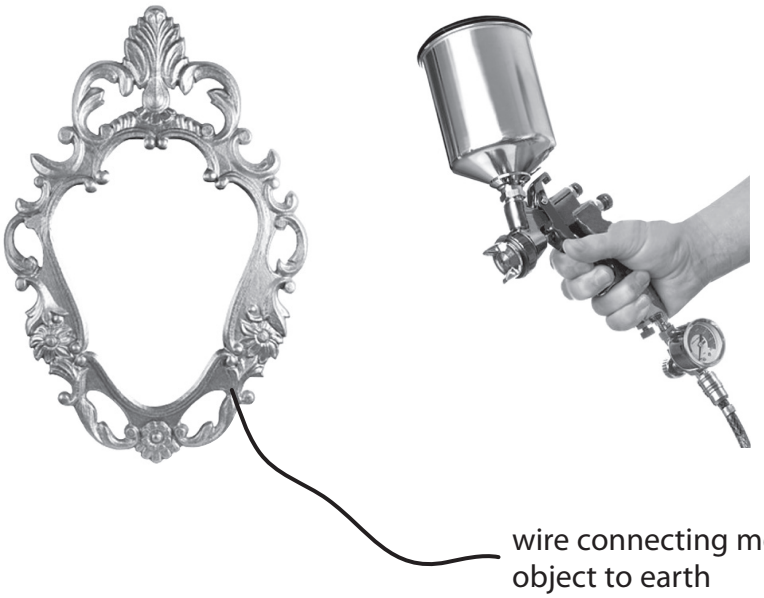
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(c) The picture shows an electrostatic paint sprayer about to be used to paint a metal object.



When the paint particles leave the sprayer, they are negatively charged.

Explain the benefits of using this sprayer compared with one that does not charge the paint.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

November 2012

GCSE Physics
5PH2F/01

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GCSE Physics 5PH2F/01 Mark Scheme – November 2012

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	D 23 m		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	A the driver is tired		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 800 x 3 evaluation (1) 2400 (kg m/s)	Give full marks for correct numerical answer, even if no working bald 2.4 x 10^n gains 1 mark (BOD for correct substitution) eg bald 240 = 1 mark In all calculations if the candidate gives two different methods and writes the wrong answer in the answer space award no marks If the candidate writes correct answer they will gain full marks.	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	substitution (1) 600 x 15 evaluation (1) 9000 (J)	bald 9.0 x 10^n gains 1 mark eg bald 900 = 1 mark (BOD for correct substitution) give full marks for correct numerical answer, 9000 (J) even if no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	A the energy transferred		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (a) (i)	A alpha particles		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (a) (ii)	A suggestion to include Absorbs (ionising) radiation (from the sources)	Stops/reduces radiation/ radioactivity (reaching people); Stops/reduces (alpha) particles or any named ionising radiation (reaching people); Protects people/keeps it safe; Ignore – "so the source cannot pass through"	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (a) (iii)	One from Buildings/building materials, food, plants, water, outer space, rocks, air, Sun	Cosmic rays/waves; radon (gas); radioactive waste; nuclear accidents/Chernobyl/nuclear explosions; nuclear power stations; do NOT accept everywhere ignore alpha, beta, gamma, microwaves and X-rays, carbon dioxide, nitrogen, (mobile) phones	**(1)**

Question Number	Answer	Acceptable answers	**Mark**
2 (a) (iv)	Any two relevant precautions	Distance (between students and source); no touching; no eating; short exposure time;(use of) film badge/ detector ; Protective clothing; Use of lead (lined) box /keep box shut/ sources in box (when not in use); (stand behind/use of) a screen; Do not point (source) at students; Show video/dvd of demo; Ignore goggles, gloves, lab coats,; Answers referring to the safety of teacher can score a maximum of one of the 2 marks eg use of tongs	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (b) (i)	Calculation of number of half-lives 8 ÷ 4 = 2 (half lives) (1) evaluation of mass 6 ÷ 2 = 3 ÷ 2 = 1.5 (mg) (1)	Award 1 mark for clearly calculating mass halves after 4 days eg 6/2 = 3 (mg) 6/4 = 1.5 scores 2 marks Allow rounded 2 mg if clear they calculated 1.5 mg give full marks for correct numerical answer, 1.5 (mg) even if no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (b) (ii)	An explanation linking any two of the following points • people inhale radon (gas) (1) • radon is quite likely to/may decay in the lungs (before being exhaled) (1) • causes ionisation of cells (in lungs) (1) • increases risk of (lung) cancer (1)	Breathe in radon (gas)/ breathe it in/ radon (gas) gets into the body; Gives out radiation in the body / alpha (particles) very ionising; causes damage to (DNA of) cells (in lung)/cell mutations/kills cells; (Damages the body is insufficient) (causes lung) cancer	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	D decrease the resistance of the variable resistor		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	correct symbol for ammeter or voltmeter (seen anywhere) (1) one meter connected in parallel with lamp/variable resistor/supply and one meter in series with lamp(1) both meters correctly connected (ammeter in series and voltmeter in parallel with lamp) (1)	Ignore gaps, lines through symbols and wire connected to side of variable resistor Symbols do not have to be correct for this mark voltmeter connected across both components is same as voltmeter connected across supply Symbols do not have to be correct for this mark any shape, labelled ammeter, in series with lamp AND any shape, labelled voltmeter, in parallel with lamp gains marking points 2 and 3	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	substitution (1) 0.5 x 8 evaluation (1) 4 (V)	bald 4.0 x 10^{n} gains 1 mark eg bald 40 or 0.4 = 1 mark (BOD for correct substitution) give full marks for correct numerical answer, 4 (V) even if no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking the following points Heat/thermal energy is produced (1) In the lamp/bulb / variable resistor / connecting wires (1)	 Ignore sound (energy) and 'it is inefficient' Accept 'it' as meaning the lamp Eg 'it also produces heat' gains both marks Idea that (some) energy is wasted/lost in the lamp/variable resistor/wires gains maximum of 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution (1) 0.4 x 5 evaluation (1) 2 (W)	 bald 2.0×10^{n} gains 1 mark eg bald 20 or 0.2 = 1 mark (BOD for correct substitution) give full marks for correct numerical answer, 2 (W) no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (i)	16 (s) (1)	Sixteen/ sixteen seconds/ 16 s/ 16 seconds	**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (ii)	Downward arrow starting at centre of the block (1)	Mark by eye ie ruler not required. Accept freehand lines and gaps between dot and line less than half the distance between dot and bottom of block by eye. Accept lines that are not quite vertical	**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (iii)	D zero		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (iv)	Substitution 3 / 2 (1) Evaluation 1.5 (1) Unit m/s^2 (1)	 ms^{-2} or m/s/s bald 1.5 x 10^n m/s^2 gains 2 marks eg bald 150 = 1 mark (BOD for correct substitution) 150 m/s^2 gains 2 marks give full marks for correct numerical answer, 1.5 $\underline{m/s^2}$ even if no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4 (a) (v)	An explanation to include two of the following points • (At first/in first 2 seconds Block is) accelerating (1) • Which requires a (resultant) force (1) • In addition to the force needed to balance the weight of the block (1) • (In next 4 seconds) forces are balanced (1) • (Because) velocity is constant (1)	(block is) speeding up/increasing velocity there is an unbalanced force/ forces are not balanced (Because) speed is steady	**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (b)	An explanation to include Information taken from the graph (1) A valid conclusion (1)	Ignore air resistance (Overall) time is less OR velocity/speed is greater OR acceleration is greater OR bigger/faster change in velocity/speed So (same amount of) work is done more quickly/energy is transferred faster	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	Neutron(s)	Accept phonetic spellings eg newtron(s) or neutron(s) Reject newtons	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	D $^{9}_{4}Be$		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	A explanation linking the following points • Charge/electron transfer (1) • Correct transfer detail (1)	Gains/loses charge Gains an electron = 1mark Loses (an) electron(s) gains both marks Award 1 mark for gaining a proton as idea of gains charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)	A description including any two of the following points • Two (light) / (small) <u>nuclei</u> (1) • Fuse together (1) • To produce a large(r)/heavier nucleus/atom /particle (1)	Ignore references to releasing energy as this is in the Q. two hydrogen (and or helium) <u>nuclei</u> / two protons join /combine/merge/come / forced together helium/lithium (nucleus/atom/particle)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points • Nucleus absorbs a neutron • Nucleus becomes unstable • nucleus fissions/ splits • (2 or) more neutrons released • daughter products • chain reaction • use of moderator • to control kinetic energy of neutrons/slow down neutrons • increases chance of further/more (fission) reactions • use of control rods • control rods absorb neutrons • reducing number of neutrons available for fission/to control (fission) reaction • containment of radioactive materials • little/no radiation enters environment Ignore references to the release of energy as this is given in Q Marks can be scored by a suitably labelled diagram	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description that contains one or two points and possibly has a number of inaccuracies e.g. Uranium atom splits .....control rods are used (to moderate the reaction) OR Uranium atom absorbs a neutron ....there is a chain reaction OR (In the nuclear reactor) .....chain reaction starts • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description that links two points e.g. A uranium nucleus absorbs a neutron and splits. OR A uranium atom splits and releases more neutrons. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	

3	**5 - 6**	• a detailed description that gives a linked statement about fission plus some detail about control or containment OR A detailed description that gives two pairs of linked statements about fission e.g Uranium nucleus absorbs a neutron and splits/fissions AND 2 or more neutrons are released and are slowed by a moderator/ produce a chain reaction. OR Control rods absorb (some) neutrons to control the reaction. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6 (a) (i)	A gained electrons		**(1)**

Question Number	Answer	Acceptable answers	Mark
6 (a) (ii)	An explanation linking any two of the following Friction (1) (Causes) hair to lose electrons(to the comb) (1) Hair has an (overall) positive charge (1)	Reject positive electrons and movement of positive charge Rubbing (hair with comb) Electrons transfer/move (Ignore atoms) Eg electrons transfer to hair as comb rubs hair gains 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
6 (a) (iii)	An indication that negative charges have been repelled (by the comb) (1)	An arrow/label clearly indicating to the bottom of the foil Correct separation of positive and negative charges minus signs shown less than half-way up the foil	**(1)**

Question Number	Answer	Acceptable answers	Mark
6 (b)	An explanation linking the following points excess charge is removed /comb does not become charged /gain charge/static electricity (1) it/charge moves through the metal/comb(1)	No credit for both have the same charge so repel Accept electrons for charge Charge is earthed/flows (in)to ground/off comb/into Vicky Metal is a conductor credit they are both neutral/have no charge with 1 mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description / comparison/ explanation / etc including some of the following points • paint particles have the same charge • like charges repel • Particles repel each other • So spread out (more)/form a (fine) mist • Even layers • Improved finish • Opposite charge(is induced) on object • Paint particles are attracted to metal object • To parts not in direct line of spray/back of object • Need not move the sprayer to reach back • Takes less time • Uses less paint/ less paint wasted. • Uncharged paint forms large droplets/runs (off object) Allow reverse arguments for uncharged paint Accept an explanation that includes the idea that there is attraction between charged and uncharged/neutral/earthed objects	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description that contains one or two points and possibly has a number of inaccuracies e.g. even layer....paint is attracted to object OR uses less paint • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description that links two points • e.g. particles repel each other which makes them spread out OR They are attracted to the metal object because it has the opposite charge. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	

3	**5 - 6**	• a detailed description that links two points about repulsion and links two points about attraction of charges OR a statement that links two points about charged paint together with a comment about uncharged paint. e.g. particles have the same charge and repel each other (which makes them spread out to form even layers) AND they are attracted to the metal object OR particles have the same charge and repel each other but uncharged paint would form big drops. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

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Edexcel GCSE

Physics/Additional Science

Unit 2: Physics for Your Future

Foundation Tier

Thursday 24 May 2012 – Morning
Time: 1 hour

Paper Reference
5PH2F/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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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 $P = m \times v$

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 $\text{KE} = ½ \times m \times v^2$

Answer ALL questions

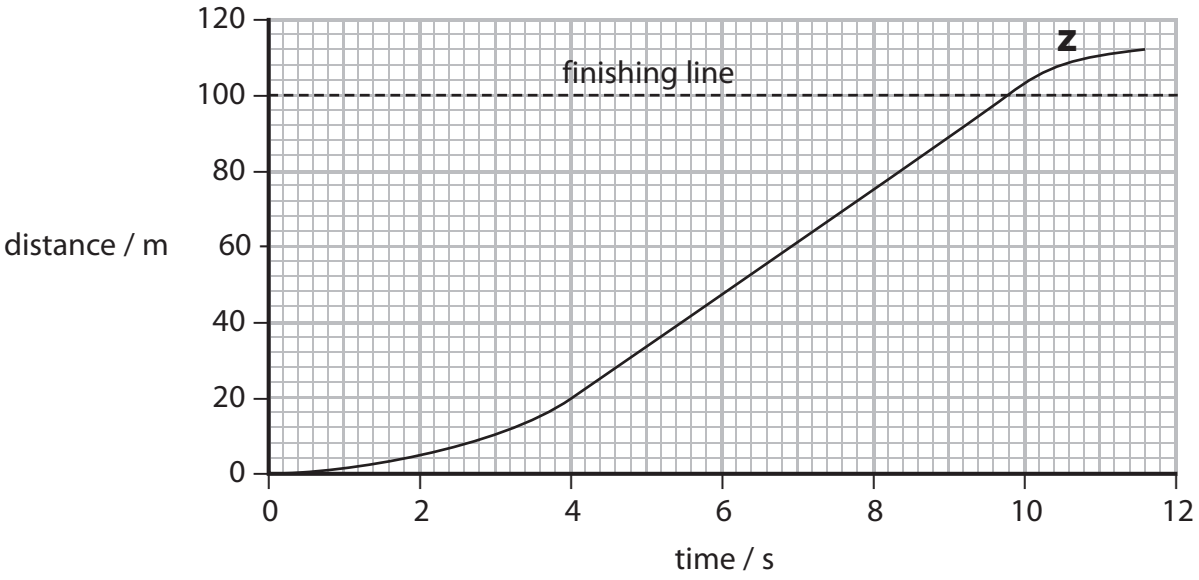
Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

100 m race

1 The photograph shows the beginning of a 100 m race.



David wins the race.
The graph shows David's distance-time graph.



(a) Use the graph to find the distance David ran in the first 4 s.

(1)

distance in the first 4 s = ... m

(b) David runs 100 m in a time of 9.80 s.

Calculate his average speed.
State the unit.

(3)

average speed = ... unit .....

(c) Explain why David's average speed is less than his top speed.

(2)

.....

.....

.....

.....

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

(i) In the section of the graph marked **Z**, David is

(1)

☒ **A** running at constant speed

☒ **B** slowing down

☒ **C** speeding up

☒ **D** stopped

(ii) Velocity is

(1)

☒ **A** speed in a circle

☒ **B** the same as speed

☒ **C** constant speed

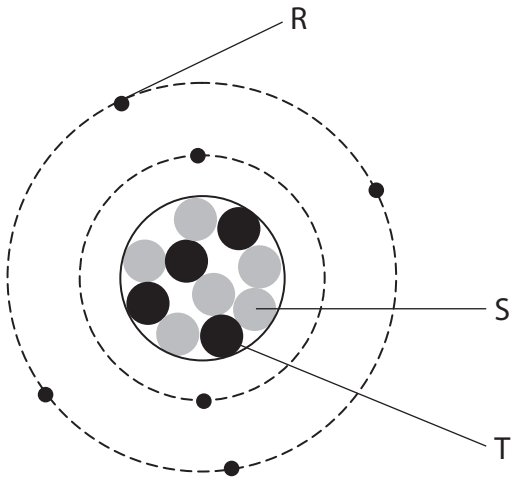
☒ **D** speed in a stated direction

(Total for Question 1 = 8 marks)

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Static electricity

2 (a) The diagram represents an atom.
The atom is neutral.



Draw **one** straight line from each letter in the boxes to the particle.

(2)

letter	particle
R	proton
S	neutron
T	electron

(b) A boy combs his hair using a plastic comb.
His hair becomes positively charged.



(i) Explain what happens to the boy's hair when it becomes positively charged.

(2)

.....

.....

.....

.....

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

His plastic comb also becomes charged.
If a copper comb was used, it would not become charged.

This is because the copper is

(1)

☒ **A** an insulator

☒ **B** a conductor

☒ **C** magnetic

☒ **D** non-magnetic

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(iii) The boy puts his charged comb near some small pieces of paper.

Explain what happens.

(3)

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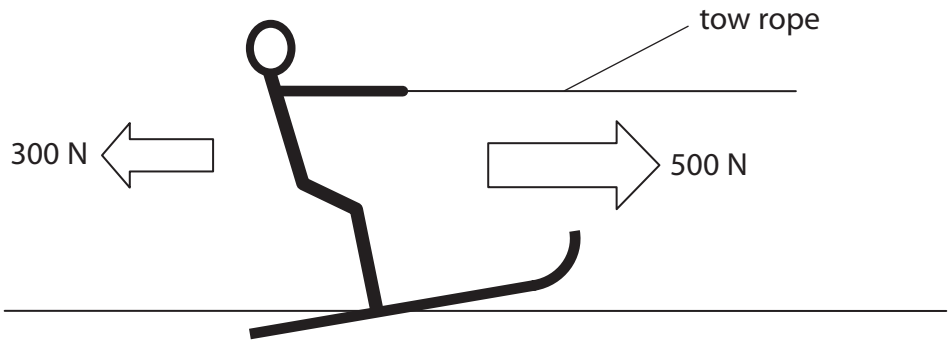
(Total for Question 2 = 8 marks)

Water skiing

3 The photograph shows a water skier being pulled along by a boat.



(a) The diagram shows the horizontal forces acting on the water skier.



(i) The 500 N force is the force that the boat tow rope is exerting on the water skier.

Suggest what causes the 300 N force.

(1)

.....

(ii) Calculate the resultant of these two forces.

(2)

resultant force = ... N

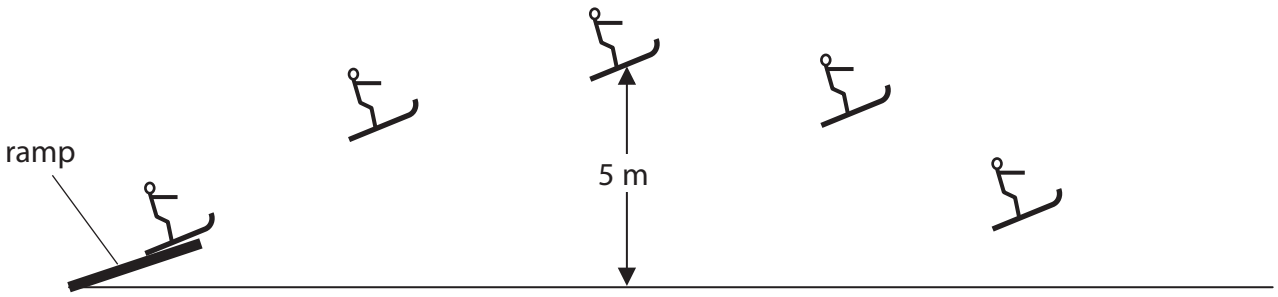
(iii) State the direction of the resultant of these two forces.

(1)

.....

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(b) The diagram shows the water skier using a ramp to perform a jump.
During the jump, she gains gravitational potential energy.



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

The unit of gravitational potential energy is

(1)

☒ **A** A

☒ **B** J

☒ **C** N

☒ **D** W

(ii) The mass of the water skier is 54 kg.
At the top of the jump, she is 5 m above the water level.

Calculate the amount of gravitational potential energy she gains in rising 5 m.
Gravitational field strength = 10 N/kg

(2)

gain in gravitational potential energy = ...

(iii) When the water skier reaches the top of the ramp, she lets go of the rope.

Describe the energy changes that happen between the skier leaving the ramp and reaching the top of the jump.

(2)

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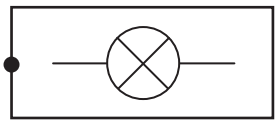
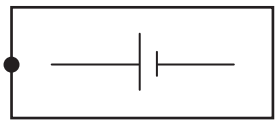
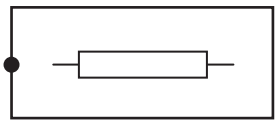
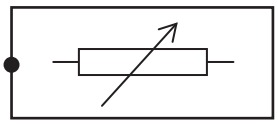
(Total for Question 3 = 9 marks)

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Circuits

4 (a) (i) Draw **one** straight line from each name to its circuit symbol.

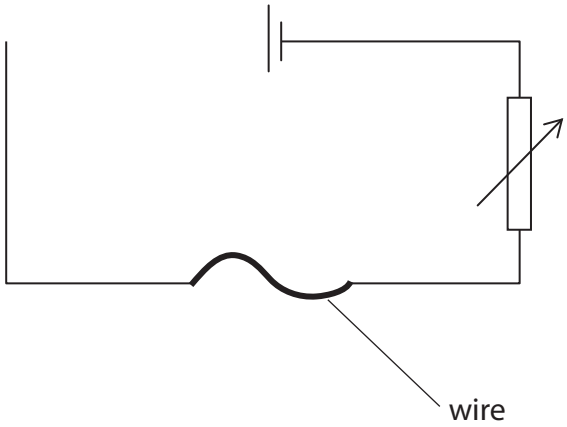
(2)

name	circuit symbol
lamp	
fixed resistor	
	
	

(ii) The diagram shows an incomplete circuit for measuring the resistance of a length of wire.

Complete the diagram to show how an ammeter, —(A)—, and a voltmeter, —(V)—, should be connected in the circuit.

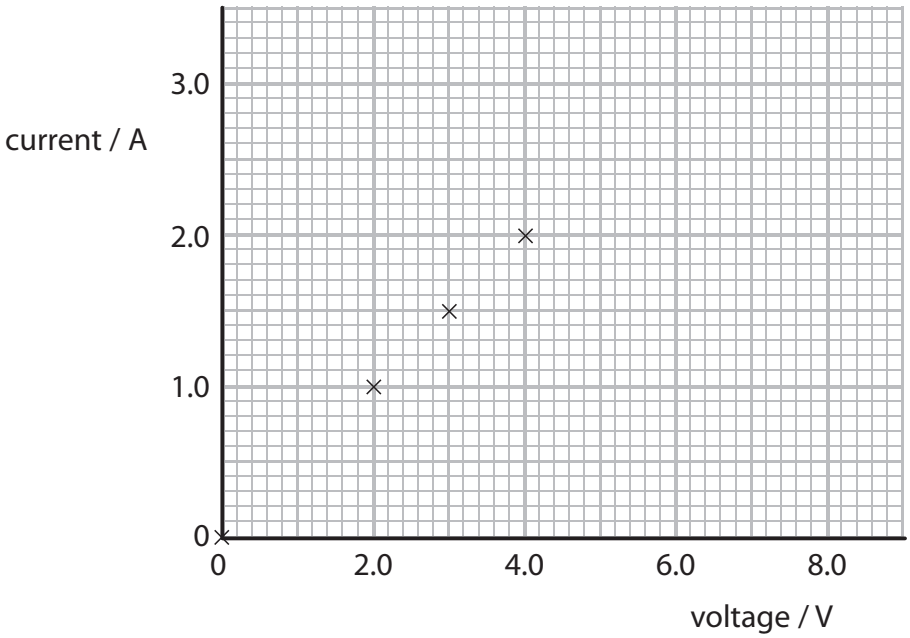
(2)



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(b) A student sets up a circuit to find the resistance of a piece of wire.
She measured current and voltage at different voltage settings.

She plotted a graph of her results.



(i) Draw the line of best fit for these four points.

(1)

(ii) She then took an extra reading and found that a voltage of 7.0 V gave a current of 3.0 A.

Plot this point on the graph.

(1)

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(iii) She decides to take an additional reading.
This is to help her reach a conclusion about the way current changes with voltage.

Explain which additional reading she could take.

(2)

.....

.....

.....

.....

(iv) $R = \frac{V}{I}$

Calculate the resistance of the piece of wire when the current is 1.5 A.

(3)

resistance = ... Ω

(Total for Question 4 = 11 marks)

Nuclear reactions

5 (a) The nucleus of an atom of cobalt-60 can be represented by the symbol

$$^{60}_{27}Co$$

(i) Use numbers from the box to complete the following sentences.

(2)

27	33	60	87

The number of protons in an atom of cobalt-60 is .....

The number of neutrons in an atom of cobalt-60 is .....

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

Atoms are neutral. An atom can become an ion by losing

(1)

☒ **A** an electron

☒ **B** a neutron

☒ **C** a gamma ray

☒ **D** an X-ray

(iii) Cobalt-60 is radioactive.
It emits beta radiation and gamma radiation.

Describe the differences between beta radiation and gamma radiation.

(3)

.....

.....

.....

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.....

.....

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*(b) Fission and fusion are two different types of nuclear reaction.

Describe the similarities and differences between nuclear fission reactions and nuclear fusion reactions.

(6)

(Total for Question 5 = 12 marks)

Radioactivity – natural and useful

6 (a) (i) One source of background radiation is radon gas.

State another source of background radiation.

(1)

.....

(ii) Which of these two statements about background radiation are correct?

1 Radon gas from nuclear power stations is the main cause of background radiation.

2 Background radiation can be detected during radioactive experiments.

(1)

☒ **A** statement 1 only

☒ **B** statement 2 only

☒ **C** both statement 1 and statement 2

☒ **D** neither statement 1 nor statement 2

(iii) Background radiation from radon gas is different from place to place in the UK.

Explain these differences in background radiation.

(2)

.....

.....

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.....

(b) Scientists have changed their ideas about the hazards from radioactive sources.

Describe how their ideas have changed since radioactivity was first discovered.

(2)

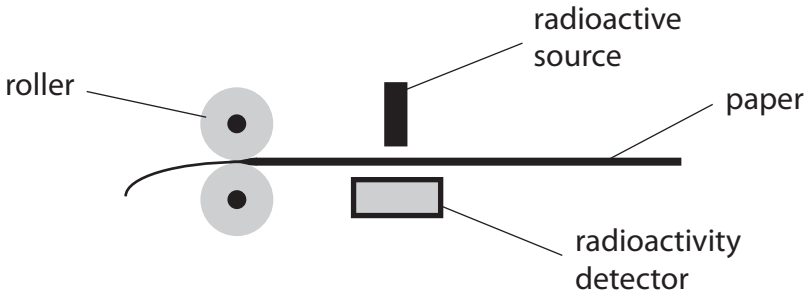
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*(c) The diagram shows how rollers can change the thickness of paper in a factory.
A thickness gauge controls the rollers.
The thickness gauge contains a radioactive source and a detector.
If the paper is too thick, the reading on the detector goes down.
This causes the rollers to be pushed closer together.



The radioactive source used must be chosen carefully to be effective and used in a way that is not a hazard to workers.

Discuss the factors to consider when choosing and using this radioactive source.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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GCSE Physics
5PH2F/01

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GCSE Physics 5PH2F/01 Mark Scheme – Summer 2012

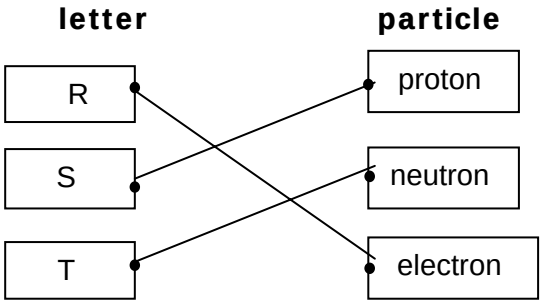
Question Number	Answer	Acceptable answers	Mark
1(a)	20(m)	value between 18 and 22	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 100/9.8 evaluation (1) 10 unit (1) m/s	 **Accept** 10.2 give 2 marks for correct answer, no working accept for 1 mark 9.65 or 9.7 mps	 **(3)**

Question Number	Answer	Acceptable answers	Mark
1(c)	An explanation linking the following points • speed changes (1) • (because) slower to begin with / faster at the end (1)	 not the same speed throughout slows down after 100 m he speeds up=2	 **(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)(i)	**B** slowing down		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)(ii)	**D** speed in a stated direction		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)	 Three lines correct 2 marks One / two correct 1 mark	if two lines from a box reject mark for that box	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	An explanation linking **one** of the following pairs **Either** • loss of a negative (1) • electron (1) **Or** • hair's repel (1) • (because) like charges repel (1)	Allow explanation linking any two electron rubbed off (hair) = 2 (hair) stands on end opposite charges on hair and comb attract = 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	**B** a conductor		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	An explanation linking **three** of the following points • paper is picked up (1) • charged objects attract uncharged (1) • charges separate on paper (1) • opposite charges attract (1) • weight is less than electrostatic force (1)	paper becomes positively charged paper is light	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	(force of) water (on ski)	air resistance/drag ignore wind/unqualified friction	**(1)**

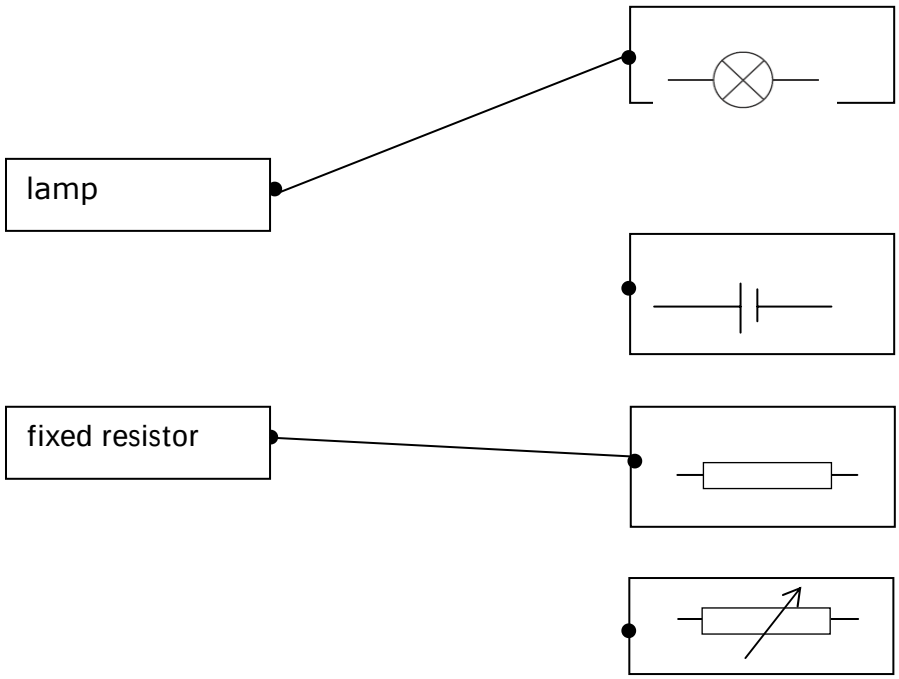
Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	substitution (1) 500 – 300 evaluation (1) 200 (N)	 give full marks for correct answer, no working	**(2)**

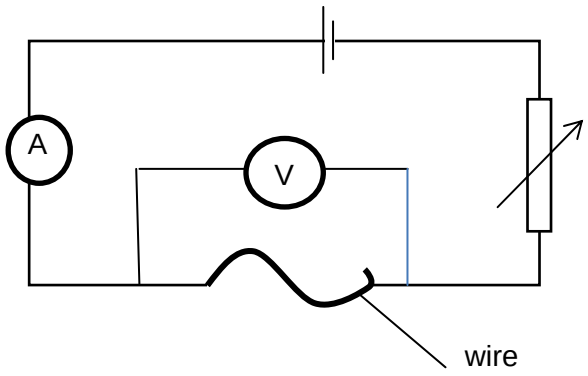
Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	to the right	forward/direction skier is travelling/towards the boat	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	**B** J		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	substitution (1) 54 × 10 × 5 evaluation (1) 2700	 **Ignore** unit (J) even incorrect give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	A description including **two** of the following points • (some) KE at the ramp (1) • is transferred to GPE at top (1) • still has some KE at top (1) • some energy lost due to air resistance (1)	 KE to GPE for 1 mark air friction	**(2)**

Question Number	Answer	Mark
4(a)(i)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	 ammeter in series (1) voltmeter in parallel (1)	'A' clearly in series with wire and cell anywhere on a complete circuit diagram 'V' in parallel with wire only / wire and 'A'	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	straight line drawn through origin and most points	line no thicker than half a cross – no tramlining ignore line after given four points	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	point plotted within ½ a small square		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	An explanation linking **one** of the following pairs **Either** • taking reading between 0 and 4 V (1) • to check the straight line (1) **Or** • taking reading between 4 and 7 V (1) • to check straight line / confirm curve/find out what happens between 4 and 7 (1) **Or** • taking reading greater than 7 V (1) • to extend range (1) **Or** • repeating reading for 7 V / anomalous result (1) • to check that no mistake was made (1)	read secondary source / compare with other people (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iv)	voltage value from graph (1) 3.0 substitution (1) 3.0 /1.5 evaluation (1) 2.0 (Ω)	3 3/1.5 2 give full marks for correct answer, no working accept 1.6 for 2 marks (ecf if 2.5 from graph)	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	27 (1) 33 (1)	accept 33 27 for 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	**A** an electron		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	A description including **three** of the following points • beta (radiation) is electron(s) (1) • beta has mass (1) • beta has (negative) charge (1) • beta is a better ioniser (1) • beta is less penetrating (1) • gamma radiation is electromagnetic (1) • wave (1) • gamma travels at a speed of light (1) • gamma is just energy (1)	**Allow** ORA where applicable allow em for electromagnetic ignore uses	**(3)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	A description including some of the following points **Similarities (S):** • involve nuclei • involve particles colliding • energy released • can cause explosions/rapid release of energy **Differences (D):** **Fission** • splitting • of heavy nucleus • by neutron • chain reaction • products radioactive • used in power stations at present • rate can be controlled **Fusion** • joining smaller nuclei • to form larger nucleus • occurs in stars • needs very high temperature and/or pressure and/or particle density • because of like charge repulsion	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description including a similarity OR a difference e.g. (S) both release energy OR (D) one is splitting, one is joining. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description including **EITHER** one similarity AND one difference **OR** some differences / similarities e.g.(S) both give out energy but (D) fission uses uranium, fusion uses hydrogen. **OR** (D)fusion occurs in stars when hydrogen particles join **OR** (S) both involve nuclei and release energy • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description including EITHER two similarities (or one detailed) AND one difference OR one similarity and two differences (or one detailed) e.g. (S) uranium gives out energy (D) when it is hit by neutrons and energy is released (D) in fusion when (small) nuclei join. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	Any **one** from the following • living things (1) • space (1) • nuclear power stations/accidents (1) • hospitals (1) • industrial processes (1)	Ignore radon gas from … another radioactive rock a named radioactive substance eg uranium, radium, plutonium	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	**B** statement 2 only		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	An explanation linking **two** of the following points • radon gas comes from rocks (1) • types of rocks vary in different parts of the UK (1) • where there is more (of this type of) rock, the reading is higher (1)	may be explained in terms of specific places eg Cornwall	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	A description of a change including the following points • used to be thought beneficial (1) • now known to be extremely {dangerous/hazardous} (1)	{was commonly used (without care)/dangers were not realised} now known to cause cancer now can be used safely {under controlled conditions/medical supervision}	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A discussion including some of the following points Appropriate type of radiation is chosen - some passes through - – β and γ not α - significant change with thickness - - β Half-life - reference to half-life - not too long - too much material needed for activity - not too short – expense of replacing regularly - disposal problems Safety issues - shielding • type of radiation • linked to appropriate material and thickness - security • storage of spares • in use - safety procedures / precautions in use	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited discussion of one factor with no reasons e.g.(F) penetration / half-life/ safety. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a discussion linking some of one factor (F) with some reasoning (R) **OR** two factors e.g. (F) use a source which has a long/short half life (R) with suitable reason **OR** (F) use radiation which is affected by different thicknesses of paper and (F) mention of half-life. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed discussion of at least two factors with some reasons e.g. (F) use a (beta) radiation which is affected by thickness (R) because others will not penetrate at all (alpha) or will not be {affected / stopped} by paper (gamma) and (F) some discussion of half-life or safety. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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