Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Additional Science

Unit P2: Physics for Your Future

Foundation Tier

Sample Assessment Material
Time: 1 hour

Paper Reference
5PH2F/01

You do not need any other materials.

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 $\text{KE} = ½ \times m \times v^2$

Answer ALL questions

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

Static electricity

1 Ellie slides down a plastic tube.

Her hair becomes charged.

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

(i) Ellie's hair is charged by the transfer of

(1)

☒ **A** atoms

☒ **B** electrons

☒ **C** neutrons

☒ **D** protons

(ii) Strands of Ellie's hair repel each other.

This is because they have

(1)

☒ **A** the same electric charge

☒ **B** a different electric charge

☒ **C** the same magnetic charge

☒ **D** a different magnetic charge

(b) The photograph shows an aircraft being refuelled.

Shutterstock

(i) The aircraft is refuelled using a plastic fuel pipe.
The plastic pipe can become charged with static electricity.

Give the reason for this.

(1)

.....

.....

(ii) Explain how static electricity could cause an explosion during refuelling.

(2)

.....

.....

.....

.....

(iii) A metal safety cable is used during refuelling.

Explain how this cable reduces the risk of an explosion.

(2)

.....

.....

.....

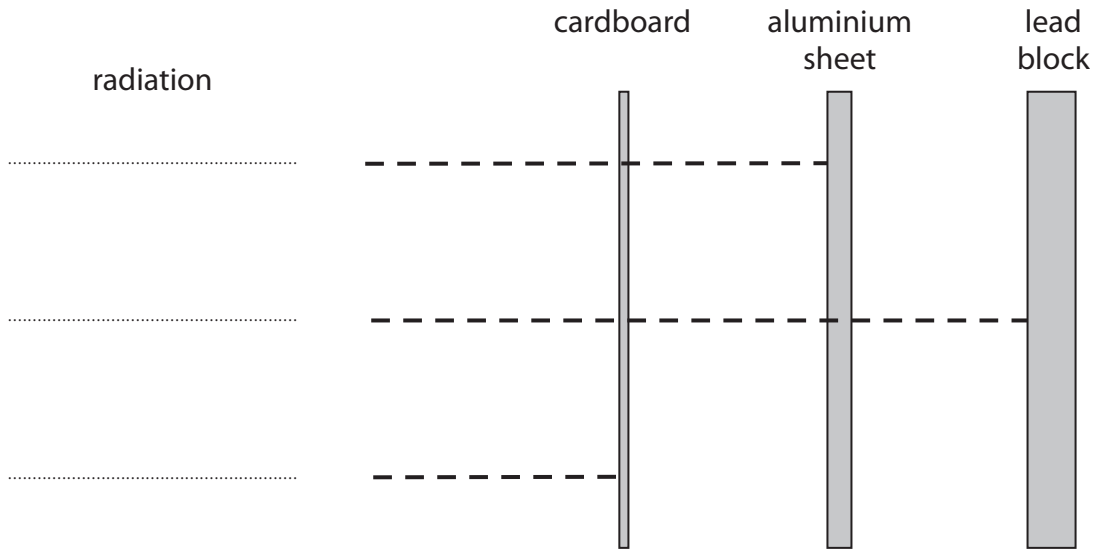
.....

(Total for Question 1 = 7 marks)

2 Alpha, beta and gamma are three types of radiation.

(a) Label the diagram to show the different penetrating powers of alpha, beta and gamma.

(2)



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

Radioactive substances can be used in many ways.

Alpha radiation is

(1)

☒ **A** used to study stars

☒ **B** used to monitor the thickness of paper

☒ **C** used in smoke detectors

☒ **D** used to irradiate fruit

(c) (i) Diagram **A** represents a neutral gas atom.
The gas atom is ionised when an alpha particle passes close to the atom.

Complete diagram **B** for the gas ion.

(1)

diagram **A**

neutral gas atom

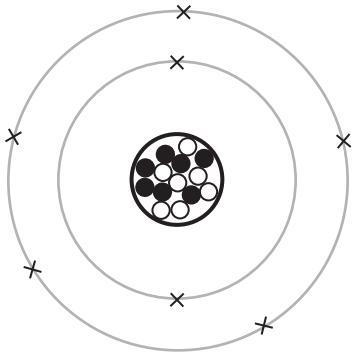
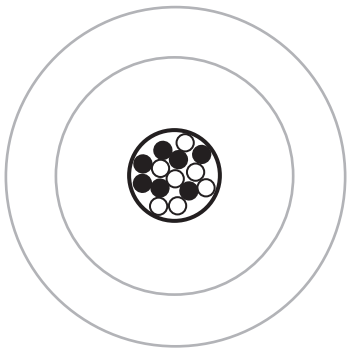


diagram **B**

gas ion



Key

- ● proton
- ○ neutron
- × electron

(ii) Explain how the alpha particle produces a gas ion from the neutral gas atom.

(2)

.....

.....

.....

.....

(d) An alpha-emitting radioactive isotope has a half-life of 1 hour.
A sample contains 4.0 g of the isotope.

Calculate the mass of this isotope that will remain after 2 hours.
Show your working.

(2)

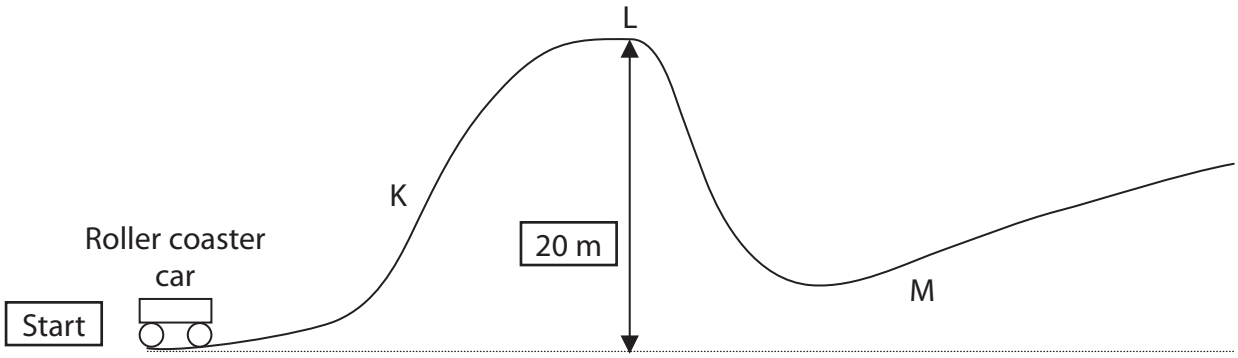
mass remaining = ... g

(Total for Question 2 = 8 marks)

3 The photograph shows people on a roller coaster ride.

Shutterstock

The diagram shows part of the roller coaster track.



An electric motor pulls the roller coaster car slowly up the slope.
The car passes point K and stops briefly at point L.
The motor is switched off at L and the car rolls down past point M.

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

The **most useful** energy transfer **in the motor** between K and L is electrical energy to

(1)

☒ **A** chemical energy

☒ **B** light energy

☒ **C** thermal (heat) energy

☒ **D** gravitational potential energy

(ii) Sound energy is also produced by the roller coaster motor.

State what happens to this energy.

(1)

.....

.....

(b) Describe what happens to the energy of the car as it moves from L to M.

(2)

.....

.....

.....

.....

(c) The weight of the car is 6000 N.

Calculate the work done on the car when it is raised from the start to L.

(2)

work done = ... J

(d) The motor does 300 000 J of work in a time of 100 s.

Calculate the power of the motor.

(2)

power = ... W

(e) At one part of the ride the car has a velocity of 10 m/s.
The mass of the car is 600 kg.

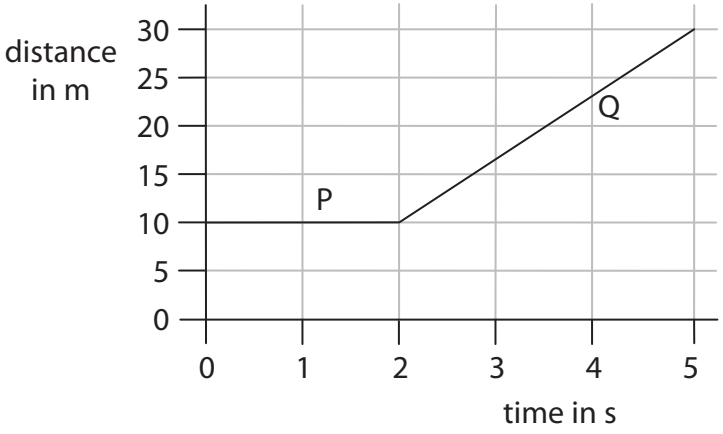
What is the kinetic energy of the car?

(2)

kinetic energy = ... J

(Total for Question 3 = 10 marks)

4 (a) The graph shows the motion of a car at the start of a race.



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

In section **P**, the car is

(1)

A ☒ moving with a steady acceleration

B ☒ moving at a steady speed

C ☒ moving backwards

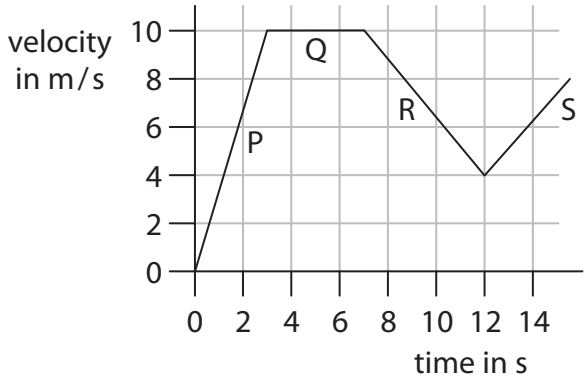
D ☒ not moving

(ii) Calculate the speed of the car in section **Q**.
Show all your working.
Give the unit.

(3)

speed = ... unit .....

(b) The graph below shows the motion of the car for a different part of the race.



In which section does the car have the biggest acceleration?

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

(1)

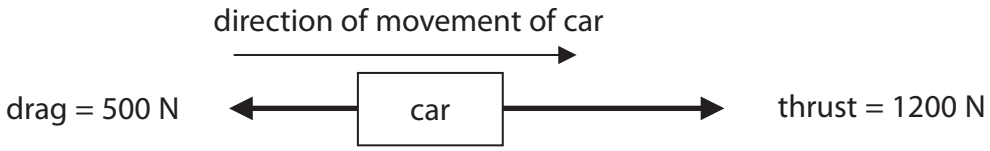
☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(c) The diagram shows the horizontal forces acting on the car at one point in the race.



Calculate the resultant horizontal force acting on the car.
State the direction of this resultant force.

(2)

resultant force = ... N

direction of the resultant force = ...

(d) The photograph shows a skydiver a few seconds after beginning his jump.

He is falling at a steady speed and has not yet opened his parachute.

Photo: Shappy/Shutterstock

(i) Gravity is one force acting on the skydiver in the photograph.

Give **one** other force acting on the skydiver.

(1)

.....

.....

(ii) Explain why the skydiver in the photograph is falling at a steady speed.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 11 marks)

Uses of radioactive isotopes

5 In 2008, there were 19 nuclear power stations in the UK.

These power stations provided around 12.5% of the UK's electricity.

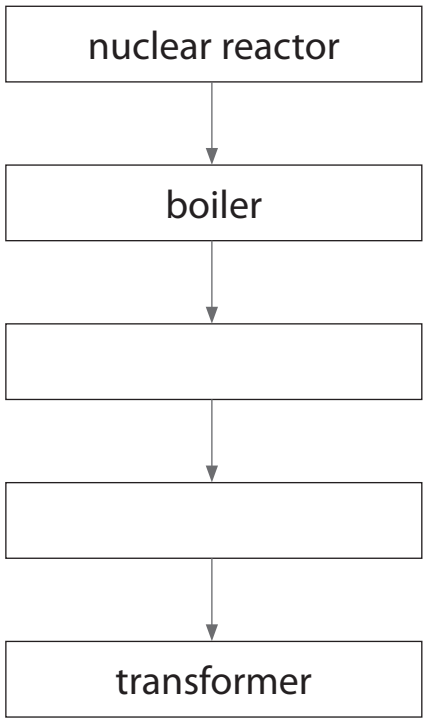
The percentage of the UK's energy needs which are provided by nuclear power stations has been falling over the past ten years.

(a) The flow chart shows some of the main stages in the production of electrical energy in a nuclear power station.

Use words from the box to complete the flow chart.

(2)

control rods	moderator	furnace	generator	motor	turbine



(b) The nuclear reactor in part (a) uses the nuclear **fission** of uranium.

Describe what happens in the nuclear **fission** of uranium.

(2)

.....

.....

.....

.....

*(c) The UK government plans to build ten new nuclear power stations to help meet the UK's future energy needs.

Discuss the benefits **and** drawbacks of nuclear power stations.

(6)

(d) Scientists are developing a different nuclear reactor.
This type of reactor uses nuclear **fusion** with hydrogen as the fuel.

Describe what happens in the nuclear **fusion** of hydrogen.

(2)

.....

.....

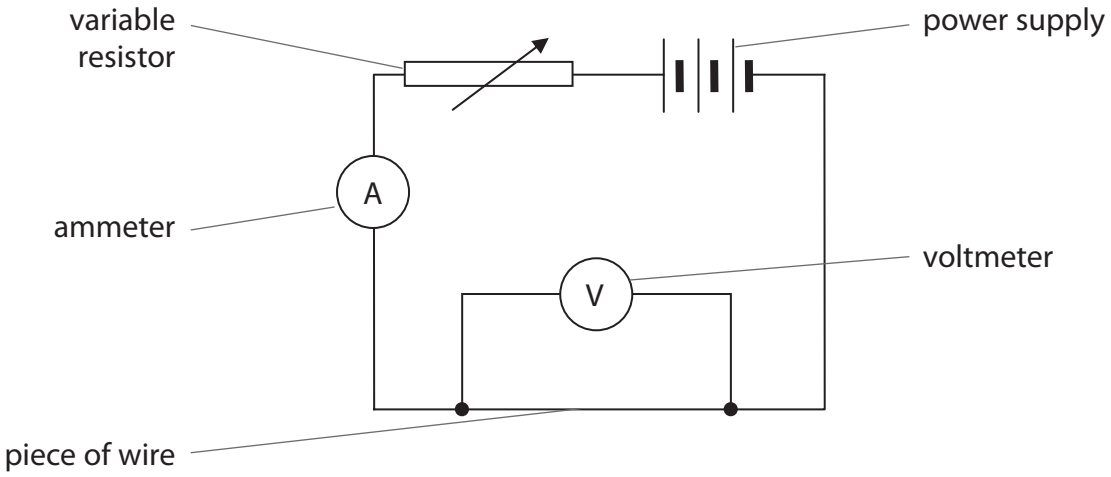
.....

.....

(Total for Question 5 = 12 marks)

Investigating current and voltage

6 The circuit below is used to investigate how the current in a piece of wire varies with potential difference (voltage) across it.

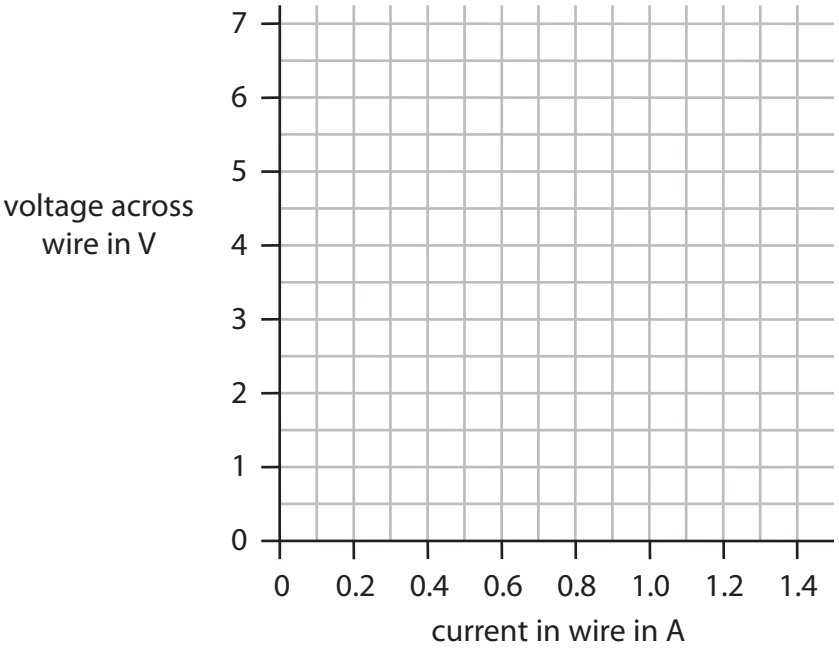


(a) Here are some results from the investigation.

current in wire (A)	voltage across wire (V)
0.0	0.0
0.2	1.0
0.6	3.0
0.8	4.0
1.2	6.0

(i) Plot the points on the axes below.

(2)



(ii) Draw a line of best fit through the plotted points.

(1)

(iii) What is the current in the wire when the voltage across it is 5.0 V?

(1)

current = ... A

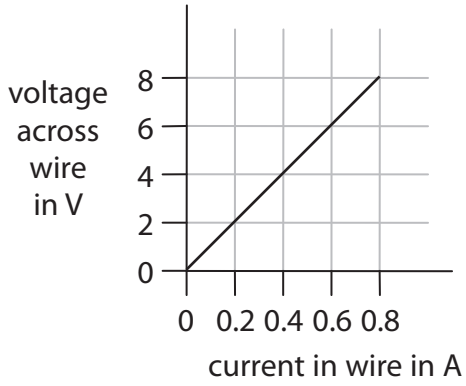
(iv) What is the power developed in the wire when the voltage across it is 4 V?

(2)

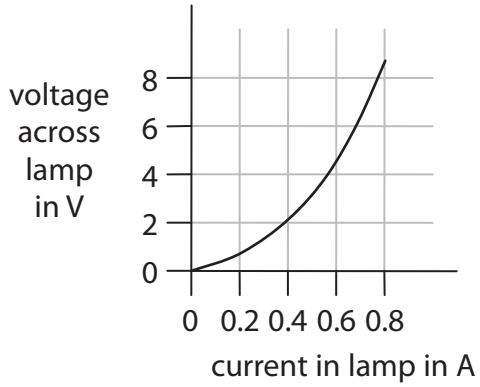
power = ... W

*(b) The voltage-current graphs for a different piece of wire and a filament lamp are shown below.

voltage-current graph for a wire



voltage-current graph for a filament lamp



The temperature of the wire is kept constant at 20 °C.

The temperature of the lamp filament is about 2500 °C at 8 V.

Using the information above, explain the differences in resistance between the wire and filament lamp.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Unit P2: Physics for Your Future (Foundation Tier)

Question Number	Answer	Mark
1(a)(i)	**B**	**(1)**

Question Number	Answer	Mark
1(a)(ii)	**A**	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	friction (as fuel moves through pipe)	accept idea of fuel swirling/rubbing against pipe accept electrons move/transferred by fuel	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	an explanation linking the following: (movement of fuel) causes build up of charge on aircraft (1) (so) spark produced (as charge discharges to Earth) (1)	 accept idea of p.d./voltage of aircraft increasing	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	an explanation linking the following: (metal cable/wire) connecting aircraft (and tanker) to the ground/Earth (1) (allows) excess charge to flow to Earth/ground (1)	 accept idea of p.d./voltage of aircraft/tanker same as ground	**(2)**

TOTAL: 7 MARKS

Question Number	Answer	Acceptable answers	Mark
2(a)	From the top down: beta/β gamma/γ alpha/α	Three correct = 2 marks One or two correct = 1 mark None correct = 0 marks	**(2)**

Question Number	Answer	Mark
2(b)	**C**	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	electron configuration showing one or two electrons missing	accept missing electrons from either shell	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	an explanation linking the following: alpha has positive charge and electron has negative charge (1) (so) electron pulled out of orbit (1)	accept alpha particle and electron have opposite charges not electron knocked out of orbit credit higher level responses, for example alpha particle has large charge/large mass/(relatively) slow speed (so it acts on a given electron for a longer time)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	(mass after 1 hour is) 2 (g) gains 1 mark but 1 (g) gains 2 marks	accept idea of mass halving every 1 hour for 1 mark do not accept idea that mass is zero after 2 hours	**(2)**

TOTAL: 8 MARKS

Question Number	Answer	Mark
3(a)(i)	**D**	**(1)**

Question Number	Answer	Mark
3(a)(ii)	it is wasted/dissipated	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	a description to include the following: potential energy decreases (1) as kinetic energy increases (1)	pe is gradually transferred to ke	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	substitution: 6000 X 20 (1) correct answer: 120 000 (J) (1)	accept 120 kJ/0.12 MJ give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution: 300 000/100 (1) correct answer: 3000 (W) (1)	accept 3 kW give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(e)	substitution: ½ × 600 × 10^2 (1) correct answer: 30 000 (J) (1)	allow 30 kJ give full marks for correct answer, no working	**(2)**

TOTAL: 10 MARKS

Question Number	Answer	Mark
4 (a)(i)	**D**	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	substitution: 20 ÷ 3 (1) answer: 6.7 (1) unit: m/s (1)	accept alternative correct values for distance and time give full marks for correct answer with correct unit, no working accept metres per second or m s^{-1} not mps	**(3)**

Question Number	Answer	Mark
4(b)	**A**	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	700 (N) (1) to the right/forwards (1)	credit 1200 – 500 if seen accept in the same direction as the 1200N force/direction car is moving	**(2)**

Question Number	Answer	Mark
4(d)(i)	air resistance/friction	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)(ii)	an explanation linking the following: air resistance/friction increases as speed increases(1) until opposing forces/gravity and air resistance/friction are balanced (1) (therefore) no resultant force/zero acceleration (1)	 ignore upthrust in the whole of this question accept downwards force = upward force/no resultant force	**(3)**

TOTAL: 11 MARKS

Question Number	Answer	Mark
5(a)	turbine in first box (1) generator in second box (1)	 **(2)**

Question Number	Answer	Mark
5(b)	a description including the following: uranium nucleus splits (into two daughter nuclei) (1) releasing (2 or 3) more neutrons (1)	 **(2)**

Question Number		Indicative content	Mark
***5(c) QWC**		A discussion including some of the following: Benefits: • no carbon dioxide emitted • no sulfur dioxide emitted • no contribution to global warming from power station • no contribution to acid rain from power station • very reliable • jobs in community when being built and running • conserving fossil fuels/reduces need for fossil fuels • security of national energy supplies Drawbacks: • named accidents e.g. 3 Mile Island, Chernobyl, Windscale fire. • idea of catastrophic damage/meltdown. • public perception • dangers of ionising radiation • storage/transport of radioactive waste. • energy used mining/transporting/reprocessing fuel, effect of above on global warming. Credit satisfactory explanations given through appropriate additions to the diagram or suitable labelled sketches (e.g. an energy chain).	**(6)**
Level	**0**	No rewardable material	
1	**1-2**	• simple statements are made probably only giving one side of the argument • the answer communicates ideas using simple language and uses little scientific terminology. Spelling, punctuation and grammar is used with limited accuracy	
2	**3-4**	• there is some description of a few of the benefits and drawbacks of nuclear power stations, not necessarily in a balanced manner • the answer communicates ideas showing some evidence of clarity and organisation and uses some scientific terminology appropriately. Spelling, punctuation and grammar is used with some accuracy	
3	**5-6**	• there is a clear description of a number of the main benefits and drawbacks of nuclear power stations, with some evidence of a balanced view. • the answer communicates ideas clearly and uses scientific terminology appropriately. Spelling, punctuation and grammar is used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(d)	a description including the following: (hydrogen) nuclei collide at high speed (1) (hydrogen) nuclei join/fuse to produce helium/larger nuclei (1)	credit higher level responses e.g. deuterium and tritium with release of energy and emission of neutron	**(2)**

TOTAL: 12 MARKS

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	points plotted correctly	accept one error 2 errors 1 mark 3 errors 0 marks	**(2)**

Question Number	Answer	Mark
6(a)(ii)	reasonable line of best fit drawn	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	1.0 (A)	accept 1 (A)	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iv)	substitution: 4×0.8 (1) correct answer: 3.2 (W) (1)	give full marks for correct answer, no working	**(2)**

Question Number		Indicative content	Mark
***6(b) QWC**		An explanation including some of the following: • comparison of shape of graphs • resistance of wire is constant • resistance of filament lamp changing (with voltage/current) • resistance of filament lamp increasing (with increasing voltage/current) • idea of gradient/slope of graph linked to resistance • idea that the steeper the graph the greater the resistance or reverse argument • use of R = V/I to calculate resistance • idea that electrical energy is transferred to thermal energy in a resistor • idea that temperature of filament lamp and wire are very different (at higher voltages/currents) • idea that resistance is dependent on temperature	**(6)**
Level	**0**	No rewardable material	
1	**1-2**	• one of resistances is explained/resistance in wire is constant/resistance in filament lamp is changing • attempt at calculating a resistance e.g. correct values subst. but no final answer • reference to different gradients of graphs/shape of lines but, little or no comparison made between the two resistances • the answer communicates ideas using simple language and uses little scientific terminology. Spelling, punctuation and grammar is used with limited accuracy	
2	**3-4**	• both resistances are explained/resistance in wire is constant and resistance in filament lamp is changing • comparisons are made between the two components, with some attempt to account for the differences in resistance in terms of the filament lamp being at a much higher temperatures at higher voltages • there is an attempt to link the gradient of the graphs to the resistance of the components eg the filament lamp V/I curve becomes much steeper/resistance is greater/at least one resistance is calculated correctly for each component • the answer communicates ideas showing some evidence of clarity and organisation and uses some scientific terminology appropriately. Spelling, punctuation and grammar is used with some accuracy	
3	**5-6**	• both resistances are explained in detail/resistance of wire is constant and resistance of filament lamp increases as voltage/current increases • comparisons are made between the two components, incorporating understanding that as current/voltage in filament lamp is increased there is a(n increased) heating effect resulting in a temperature increase • the increasing gradient for the filament lamp is linked to increasing resistance/the constant gradient of the wire is linked to a fixed resistance/there are correct calculations to show differences in resistance of wire and filament lamp at different voltages • the answer communicates ideas clearly and uses scientific terminology appropriately. Spelling, punctuation and grammar is used with few errors	

TOTAL: 12 MARKS

