WJEC GCSE PHYSICS

PHYSICS



EXAM QUESTION PACK

UNIT P2 FOUNDATION TIER 0241 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0241/01

ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

A.M. WEDNESDAY, 30 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**3**	
3.	**5**	
4.	**4**	
5.	**2**	
6.	**4**	
7.	**5**	
8.	**4**	
9.	**5**	
10.	**4**	
11.	**5**	
12.	**6**	
Total	**50**	

0241 010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

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EQUATIONS

Resistance	=	$\frac{\text{voltage}}{\text{current}}$
Current	=	$\frac{\text{power}}{\text{voltage}}$
Speed	=	$\frac{\text{distance}}{\text{time}}$
Acceleration (or deceleration)	=	$\frac{\text{resultant force}}{\text{mass}}$
Acceleration	=	$\frac{\text{change in speed}}{\text{time}}$
Work done	=	force × distance

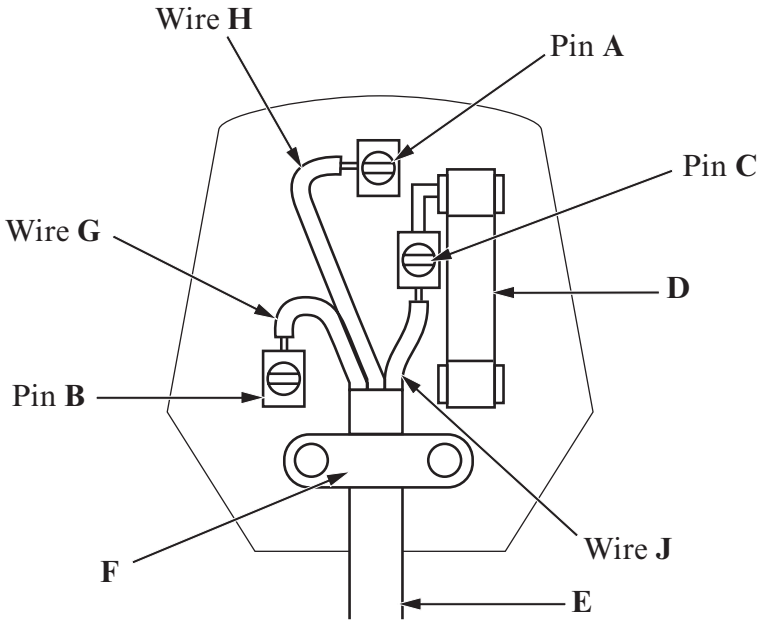
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Answer **all** *questions.*

1.



The diagram shows the inside of an electric plug.

(a) Complete the following sentences by inserting the correct letter from the diagram in the boxes provided.

(i) The earth wire ☐ is connected to the earth pin ☐. [1]

(ii) The blue wire ☐ is connected to the pin ☐. [1]

(b) Explain why 3-pin plugs are made of plastic or rubber. [1]

.....

.....

3

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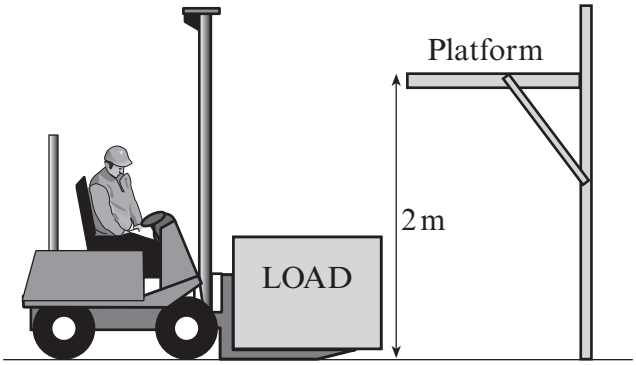
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2. A forklift truck lifts a load of 150 N and places it onto a 2 m high platform.



(a) Use the equation

work done = force × distance

to calculate the work done in lifting the load to the platform. [2]

Work done = ... J

(b) Give **one** reason why the forklift truck uses more energy than that required to lift the load. [1]

.....

.....

3

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3. *(a)* Background radiation is all around us

- Some rocks on Earth are radioactive.
- Radioactive rays shower down upon us from space.
- Nuclear power stations add a small amount to nature's radioactivity.

Explain, giving a clear reason for your answer, which **one** of the following statements below contains the most truth. [2]

(i) Background radiation is completely harmless.

(ii) Background radiation can cause harm but very few people are affected by it.

(iii) Background radiation will kill us.

.....

.....

.....

.....

(b) The table shows readings of background radiation, taken using a Geiger counter. The readings are all taken in the same place.

Counts in one minute	27	20	28	18	15

(i) Calculate the mean background count in one minute. [2]

Mean count = ... counts per minute

(ii) Why do you think the numbers are different?

Put a **tick** (✓) in the box next to the statement which best explains why the numbers are different. [1]

Experimental error. ☐

Different numbers of radioactive particles are being produced each minute. ☐

The readings were taken at different times of day. ☐

5

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4. The power ratings of parts of an electric cooker are given below.

Cooker part	Rating (W)
Oven	3000
Grill	2000
Rings	1400

(a) All parts of the cooker are being used at the same time.

Calculate the total power required in W. [1]

Power = ... W

(b) The cooker is connected to the 230 V mains.

Use the equation

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

to find the current in the cooker circuit when all parts of the cooker are being used. [2]

Current = ... A

(c) The cooker circuit is connected to its own circuit breaker.
Give a reason why a 20 A miniature circuit breaker (m.c.b.) would not be used to protect the whole circuit. [1]

.....

.....

4

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5. Explain why radioactive waste is expensive to dispose of safely. [2]

.....

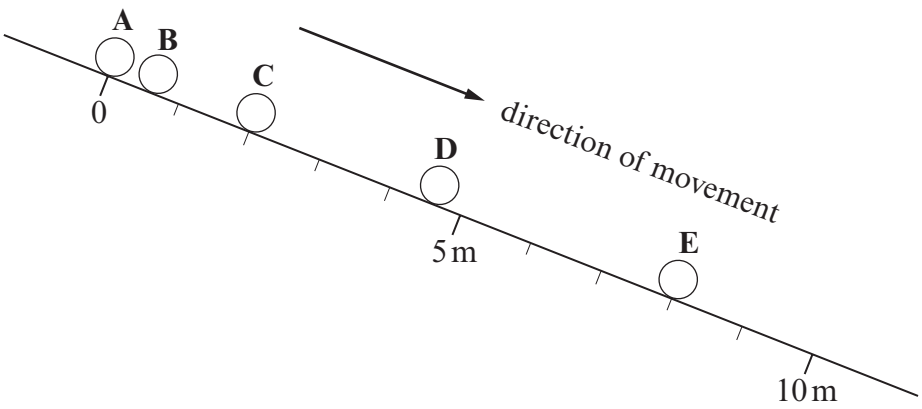
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.....

.....

2

6.



The diagram shows the position of a ball as it rolled down a track. The ball took 0.5 s to roll from one position to the next. For example, it rolled from **A** to **B** in 0.5 s and from **B** to **C** in 0.5 s and so on.

(a) (i) Write down the distance travelled by the ball from **A** to **E**. ..... m [1]

(ii) Write down the time taken by the ball to reach **E**. ..... s [1]

(b) Use the equation

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

to calculate the mean speed of the ball rolling from **A** to **E**. [2]

Mean speed = ... m/s

4

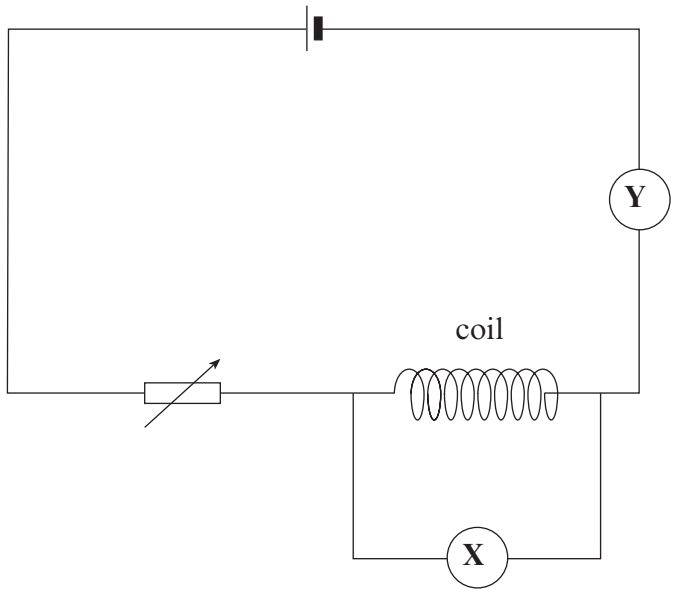
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7. The circuit below may be used to find the resistance of a coil of wire.



(a) What are the following used for in the circuit?

(i) Meter **X** .....

(ii) Meter **Y** .....

(iii) The variable resistor .....

.....

[3]

(b) Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the coil if its voltage is 6 V and the current is 1·5 A. [2]

Resistance = ... Ω

5

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8. Read the information in the box before answering the questions that follow.

> Nuclear medicine uses radioactive tracers to find out what is wrong with a patient. Gamma emitting radioactive materials, with a short half-life, are used as tracers to examine blood flow in a patient's body.
> One tracer used is technetium-99 (Tc-99). It has a half-life of 6 hours. It only emits low energy gamma rays, which easily escape the body to be detected by gamma ray cameras. These cameras feed information to a computer which builds up a picture of the path taken by the tracer through the patient's body.
> Tc-99 can be given to a patient by mouth or by injection. It produces no discomfort and after a few days there is no sign that the test was ever done.

(a) State how a picture of the path taken by the radioactive tracer is produced. [1]

.....

.....

(b) Give **one** reason why Tc-99 is a suitable material to use as a radioactive tracer. [1]

.....

.....

(c) The patient was given an injection, part of which contained 1 280 undecayed atoms of Tc-99.

(i) How many of these atoms will have decayed after 6 hours? **Circle** the correct answer. [1]

1 280 640 320 160 80

(ii) How long will it take for only 80 undecayed atoms to remain in the patient? [1]

Time =..... hours

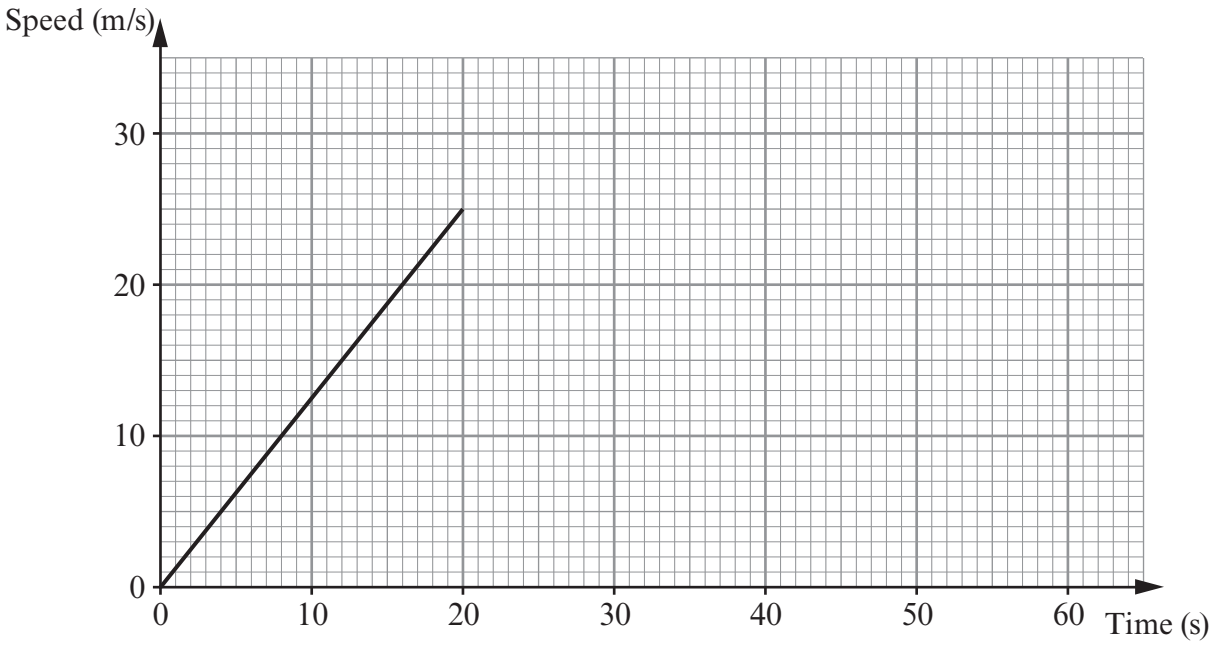
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9. The graph shows part of the motion of an underground train as it travels from one station to the next. It takes 60 s to travel between the two stations. After 20 s the train travels at a constant speed of 25 m/s for 30 s before decelerating steadily to rest under the action of its brakes.



(a) **Complete the graph** to show the motion of the train between the two stations. [2]

(b) Describe the motion of the train in the first 20 s. [1]

.....

.....

(c) Use the equation

$$\text{acceleration or deceleration} = \frac{\text{change in speed}}{\text{time}}$$

together with information from the graph to calculate the **deceleration** of the train. [2]

deceleration =..... m/s^2

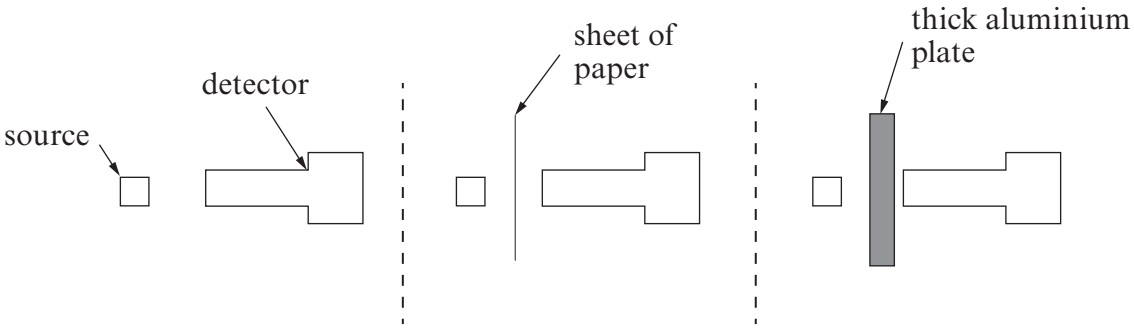
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10. A radioactive source emitting alpha, beta and gamma radiations was placed in front of a detector. The three diagrams show how the count rate in counts per minute (cpm) changed when different absorbers were placed between the source and the detector.



count rate = 300 counts per minute

count rate = 250 counts per minute

count rate = 120 counts per minute

(a) (i) How much of the original count rate was due to gamma radiation?

..... cpm

(ii) Calculate the count rate due to alpha radiation.

..... cpm
[2]

(b) By referring to the diagram explain why the count rate due to beta radiation was 130 cpm. [2]

.....

.....

.....

4

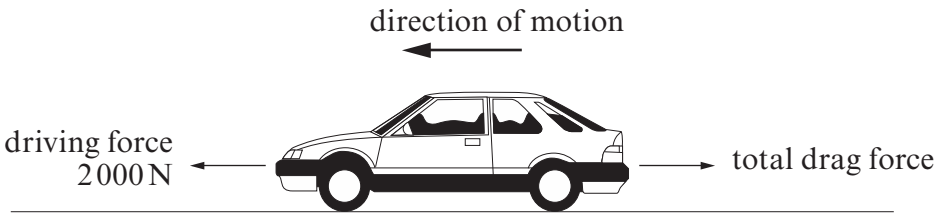
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11. The diagram below shows some of the forces acting on a car of mass 800 kg.



(a) The car is travelling at **constant speed**. State the size of the total drag force. [1]

..... N

(b) The driving force is now **increased** to 3200 N.

(i) Find the resultant force on the car at this instant. [1]

.....

.....

(ii) Select and write down an equation from page 2 and use it to calculate the initial acceleration of the car.

Equation .....

.....

[1]

Acceleration = ... m/s^2

[2]

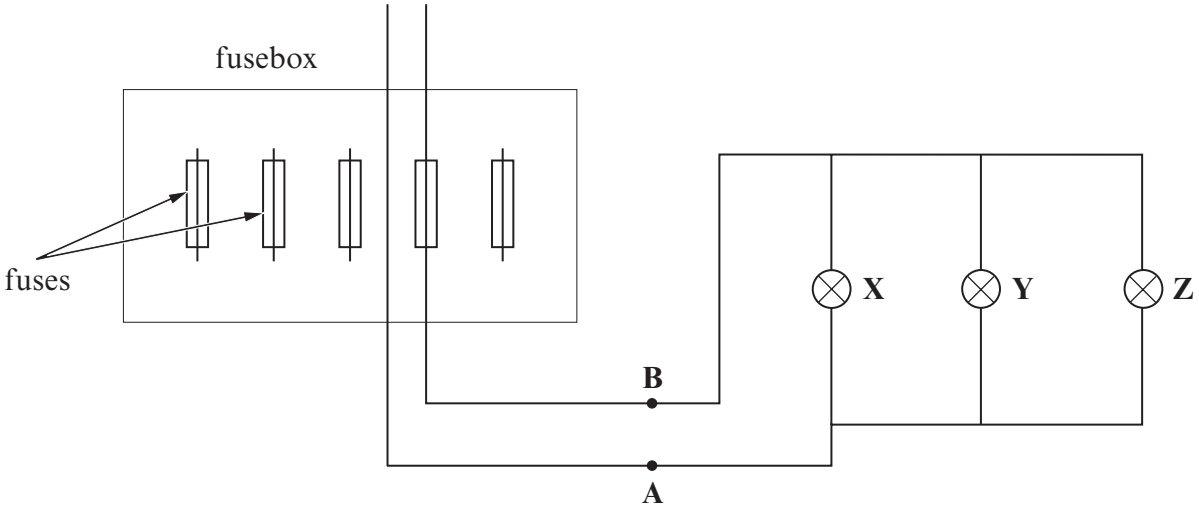
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12. The diagram shows part of the household lighting circuit joined into the fusebox.



(a) How can you tell from the diagram that **B** is the live wire? [1]

.....

.....

(b) **Add to the circuit** in a safe position:

(i) a switch S_1 which controls lamp **X** only,

(ii) a switch S_2 which controls both lamps **Y** and **Z**. [3]

(c) The fuse wire rating for a normal household lighting circuit is 5 A. By describing the purpose of a fuse, explain what a 5 A fuse rating means. [2]

.....

.....

.....

6

END OF PAPER

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GCSE MARKING SCHEME

SCIENCE - PHYSICS (LEGACY)

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE SCIENCE - PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
P1 - FOUNDATION TIER	1
P1 - HIGHER TIER	4
P2 - FOUNDATION TIER	7
P2 - HIGHER TIER	10
P3 - FOUNDATION TIER	13
P3 - HIGHER TIER	16

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GCSE Science - Physics (Legacy) - P2

Mark Scheme

FOUNDATION TIER

Question			Marking details	Marks Available
1.	*(a)*	(i)	H and A	1
		(ii)	G and B	1
	(b)		Good insulator / poor conductor or implied	2
			Question total	**[4]**
2.	*(a)*		150 x 2 = 300 [J] substitution (1) answer (1)	2
	(b)		Energy required to operate lifting gear	1
			Question total	**[3]**
3.	*(a)*		Statement (ii) (1) Low level radiation from surroundings (1)	2
	(b)	(i)	$\frac{108}{5}$ (1) = 21 / 22 [cpm] (1)	2
		(ii)	Statement 2	1
			Question total	**[5]**
4.	*(a)*		6 400 [W]	1
	(b)		$\frac{6400}{230}$ = 27.8 [A] Substitution (1) answer (1)	2
	(c)		m.c.b. needs a value above 28 A / too much current for the m.c.b.	1
			Question total	**[4]**
5.			Any 2 x (1) from: Containment / safe transport / long activity / highly radioactive	2
			Question total	**[2]**

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Question			Marking details	Marks Available
6.	*(a)*	(i)	8 [m]	1
		(ii)	2 [s]	1
	(b)		$\frac{8}{2}$ (1) **ecf** = 4 [m/s] (1)	2
			Question total	**[4]**
7.	*(a)*	(i)	Measure voltage (1)	
		(ii)	Measure current (1)	
		(iii)	Change resistance / change meter readings / change current / change voltage across the coil (1)	3
	(b)		$\frac{6}{1.5}$ = 4 [Ω] Substitution (1) answer (1)	2
			Question total	**[5]**
8.	*(a)*		Computer generated from readings picked up by gamma camera	1
	(b)		Low energy gamma [emitter] / easily escapes the body	1
	(c)	(i)	640	1
		(ii)	24 [hours]	1
			Question total	**[4]**
9.	*(a)*		Straight line to (50,25) (1) Straight line from (50,25) to (60,0) (1) **ecf**	2
	(b)		Accelerates / uniform increase in speed / increase speed to 25 m/s	1
	(c)		$\frac{25-0}{10}$ **ecf** from graph = 2.5 [m/s^2] Substitution (1) answer (1)	2
			Question total	**[5]**

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Question			Marking details	Marks Available
10.	*(a)*	(i)	120 [cpm] (1)	
		(ii)	300-250 = 50 [cpm] (1)	2
	(b)		This was amount absorbed by the aluminium plate (1) and beta are absorbed by aluminium (1)	2
			Question total	**[4]**
11.	*(a)*		2 000 [N]	1
	(b)	(i)	3 200 – 2 000 = 1 200 [N]	1
		(ii)	Acceleration = $\frac{\text{Resultant force}}{\text{Mass}}$	1
			$\frac{1200}{800}$ **ecf** = 1.5 [m/s^2]	2
			Question total	**[5]**
12.	*(a)*		B is connected to the fuse (not goes through the fuse box)	1
	(b)	(i)	S_1 and S_2 in position to control lamp X and lamps Y and Z (2 x (1))	3
		(ii)	Both S_1 and S_2 on live side (B) (1)	
	(c)		Currents in excess of 5 A (1) melts / breaks the fuse (1)	2
			Question total	**[6]**
			Total Foundation paper	**50**

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HIGHER TIER

Question			Marking details	Marks Available
1.	*(a)*	(i)	120 [cpm] (1)	
		(ii)	300-250 = 50 [cpm] (1)	2
	(b)		This was amount absorbed by the aluminium plate (1) and beta are absorbed by aluminium (1)	2
			Question total	**[4]**
2.	*(a)*		2 000 [N]	1
	(b)	(i)	3 200 – 2 000 = 1 200 [N]	1
		(ii)	acceleration = $\frac{\text{resultant force}}{\text{mass}}$	1
			$\frac{1200}{800}$ **ecf** = 1.5 [m/s^2]	2
	(c)		Drag increases as speed increases (1) until it equals the new driving force (1) Or drag becomes equal to the new driving force (2)	2
			Question total	**[7]**
3.	*(a)*		B is connected to the fuse	1
	(b)	(i)	S_1 and S_2 in position to control lamp X and lamps Y and Z (2 x (1))	3
		(ii)	Both S_1 and S_2 on live side (B) (1)	
	(c)		Currents in excess of 5 A (1) melts / breaks the fuse (1)	2
			Question total	**[6]**

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Question			Marking details	Marks Available
4.	*(a)*	(i)	C-14 atoms / their nuclei (1) decay emitting an electron (1)	2
		(ii)	In 5 700 years (1) the activity / number of C-14 atoms halves (1)	2
	(b)	(i)	Dead wood decays, therefore decreasing the activity (1) not taking in C-14 (1) or living wood maintains its activity level (2)	2
		(ii)	7 000 [years] Accept: 6 800 – 7 200	1
	c)		Any 3 x (1) from: • Dangerous to humans • Costly because of containment • Site / transport • Length of time it is active	3
	(d)		X activity = 80 (1) and Y activity = 40 (1) [120 cps]	2
			Question total	**[12]**
5.	*(a)*	(i)	Doubles	1
		(ii)	Quadruples [increase / increase earns 1 mark only]	1
	(b)		24(1) + 160(1) = [184 m]	2
			Question total	**[4]**

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Question			Marking details	Marks Available
6.	*(a)*	(i)	Z (1)	2
		(ii)	Y (1)	
	(b)	(i)	2.3 x 1000 = *I* x 230 Substitution (1) manipulation (1) *I* = 10 [A] (1)	3
		(ii)	R = $\frac{230}{10}$ (1) **ecf** = 23 [Ω](1)	2
	(c)		Faster acting (1) More sensitive / detects small changes in current (1)	2
			Question total	**[9]**
7.		(i)	Work done by engines: 2 x 10^5 x 60 = 1.2 x 10^7 [J](1) Work done by catapult: 10.8 x 10^5 x 60 = 6.48 x 10^7 [J](1) Total work done = 7.68 x 10^7 [J](1) **ecf**	3
		(ii)	½ x 24 000 x v^2 = 7.68 x 10^7 (1) **ecf** $v^2 = \frac{2x7.68x10^7}{24000}$ (1) v^2 = 6 400 *v* = 80 [m/s] (1)	3
		(iii)	$\frac{60}{80}$ (1) **ecf** = 0.75 [s](1)	2
			Question total	**[8]**
			Total Higher Tier	**50**

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Surname	Centre Number	Candidate Number
Other Names		0

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ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

A.M. THURSDAY, 24 May 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**4**	
4.	**7**	
5.	**5**	
6.	**4**	
7.	**5**	
8.	**4**	
9.	**5**	
10.	**6**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

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Answer **all** questions.

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You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

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EQUATIONS

Voltage = current × resistance

Power = current × voltage

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

Resultant force = mass × acceleration

$$\text{Acceleration} = \frac{\text{change in speed}}{\text{time}}$$

$$\text{Force} = \frac{\text{work done}}{\text{distance}}$$

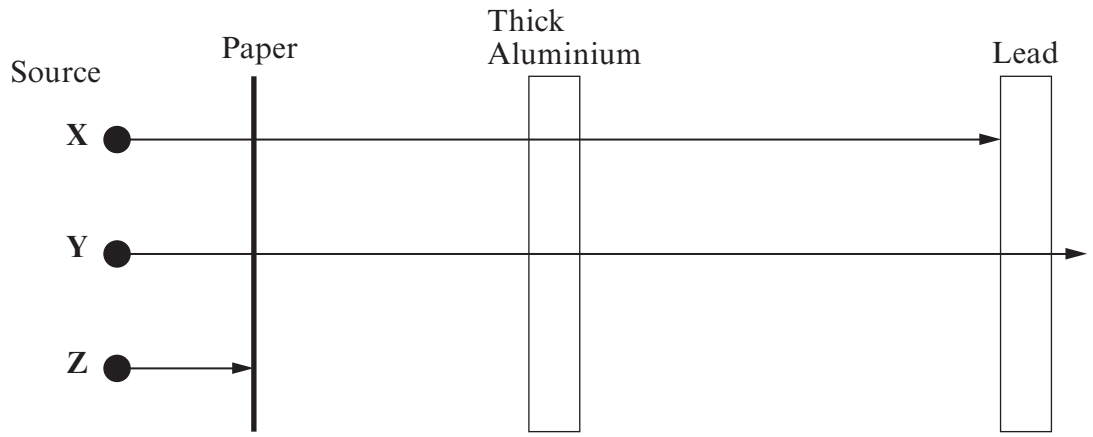
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Examiner only

Answer **all** *questions.*

1. *(a)* Radiations from three sources **X**, **Y** and **Z** pass through the substances shown below. Each source emits only **one** type of radiation, which could be alpha, beta or gamma.



(i) Name the radiation emitted by source **X**. .....

(ii) Name the radiation emitted by source **Y**. .....

(iii) Name the radiation emitted by source **Z**. ..... [3]

(b) State **two** precautions that are taken to protect staff who work with radioactive materials. [2]

1. .....

.....

2. .....

.....

5

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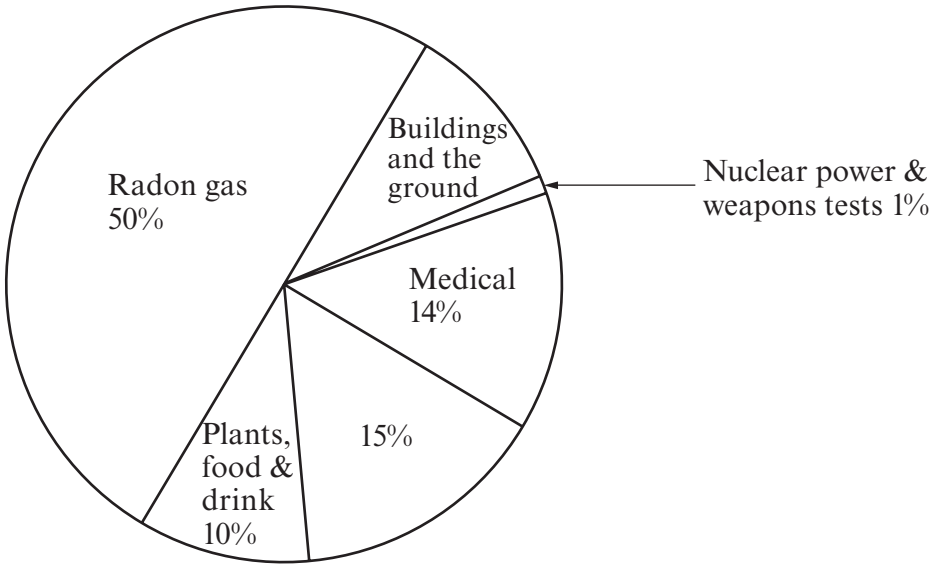
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2. The pie chart shows the sources of natural and man-made radiations in the U.K.



(a) Use the information in the pie chart to answer the following questions.

(i) What percentage of radiation is due to buildings and the ground? ..... % [1]

(ii) One natural source of radiation, supplying 15% of the total, is not named. Suggest what it may be. [1]

.....

(iii) Give a reason why doubling the number of nuclear power stations would hardly affect the level of background radiation. [1]

.....

.....

.....

(iv) In a school, the total background radiation is measured as 60 counts per minute (cpm). How many cpm are due to radon gas? [1]

..... cpm

(b) Give a reason why background radiation varies from place to place. [1]

.....

.....

5

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3. The table gives information about four household appliances.

Appliance	Voltage (V)	Power (W)	Current (A)	Fuse value (A)
Toaster	230	920		
Kettle	230	2000	8.7	.....
Lamp	230	60	0.3	.....
Washing machine	230	2500	10.9	.....

(a) State which appliance converts energy at the rate of 60 J/s. ..... [1]

(b) Use the equation

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

to calculate the current in the **toaster**. [2]

Current = ... A

(c) The following fuses are available.

3 A 5 A 13 A

Complete the final column in the table to show the most suitable fuse for each appliance. Each value may be used once, more than once or not at all. [1]

4

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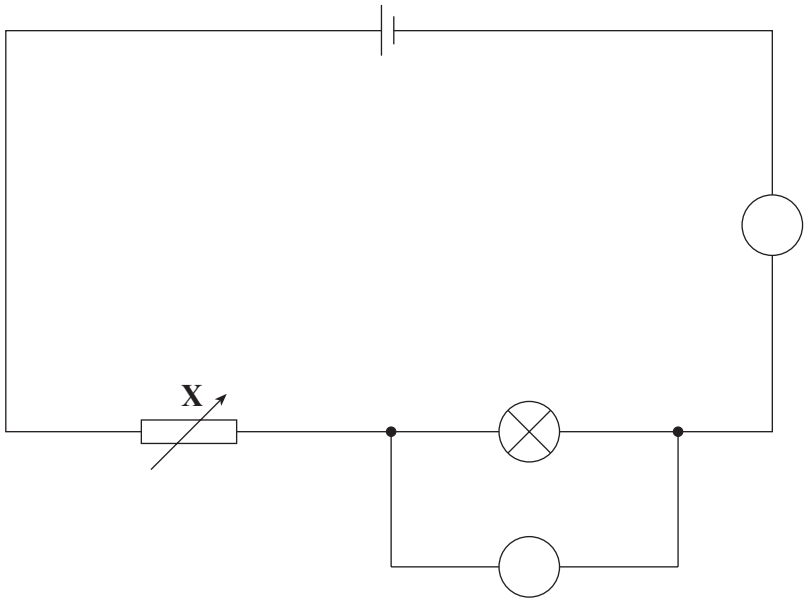
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Turn over.

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4. The diagram shows a circuit used to find the resistance of a lamp.



(a) Write the letters A and V in the meters on the diagram to show which is the ammeter and which the voltmeter. [1]

(b) The voltmeter reads 2 V and the ammeter reads 4 A.
Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the lamp in the circuit. [2]

Resistance = ... Ω

(c) (i) Name component **X**. ..... [1]

(ii) State how a series of readings of voltage and current is obtained from the circuit. [1]

.....

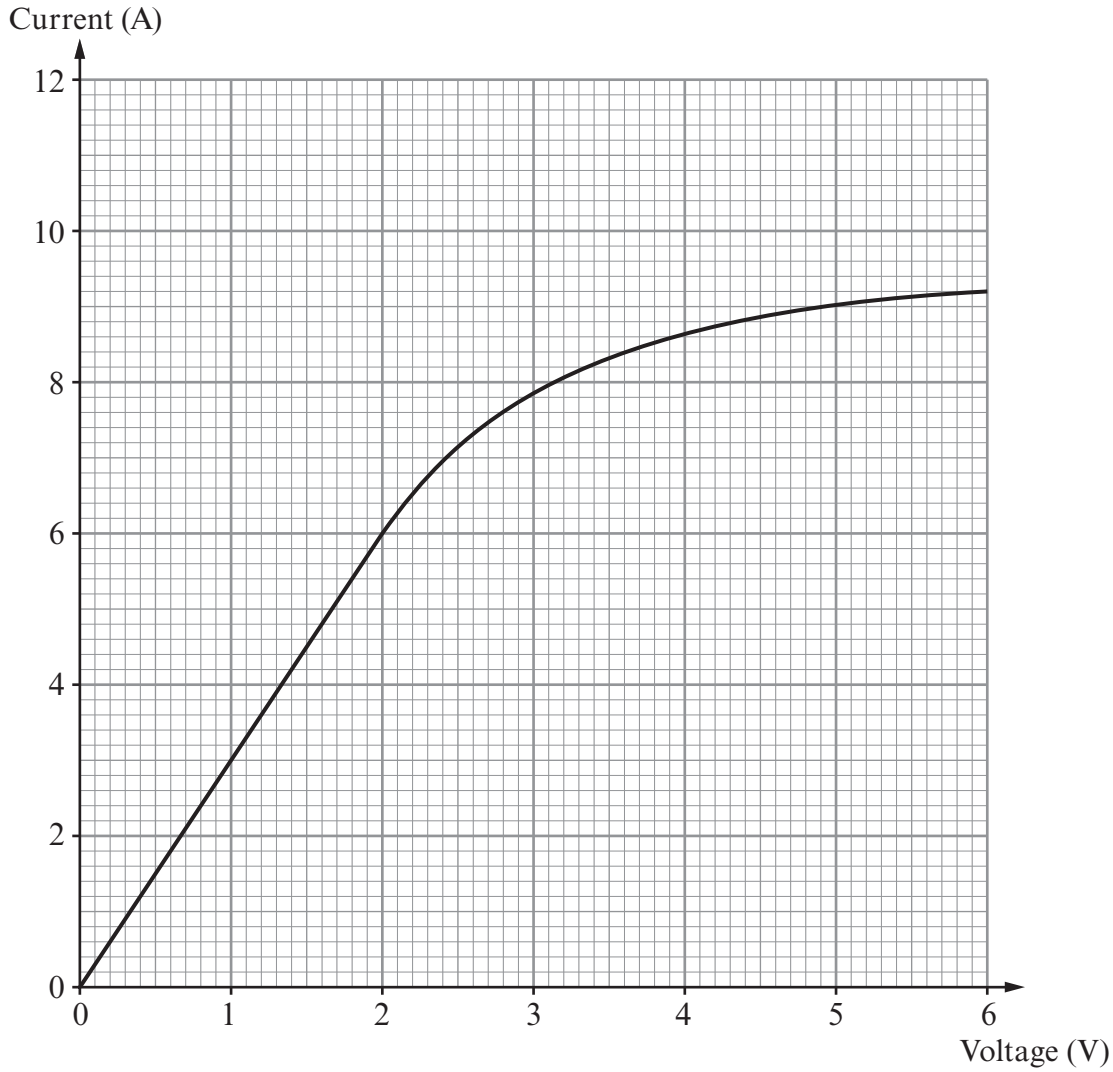
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(d) The following graph was obtained by taking a series of readings.



(i) State the voltage value at the point where the resistance of the lamp starts to change. [1]

..... V

(ii) Use the graph to give a reason for your answer to *(d)*(i). [1]

.....

.....

7

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5. An athlete of mass 90 kg runs a 100 m sprint race.
He starts from rest and increases his speed to 12 m/s in 4 s.

(a) Use the equation

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time}}$$

to calculate his acceleration.
Write down the unit with your answer. [3]

Acceleration = ...

Unit .....

(b) Use your answer to part *(a)* and the equation

resultant force = mass × acceleration

to calculate the force used to accelerate. [2]

Force = ... N

5

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6. In a test run on a car, it was crashed into a concrete wall at a speed of 25 m/s. A force of 500 000 N brought it to a stop in 0.9 m.



(a) Use the equation

work done = force × distance

to calculate the work done in stopping the car. [2]

Work done = ... J

(b) Name **two** safety features (other than a seat belt) that are built into modern cars to help keep the driver safe in such a crash. [2]

1. .....

2. .....

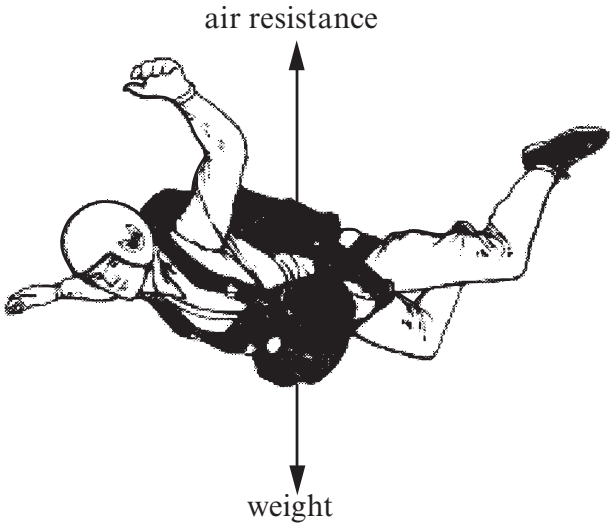
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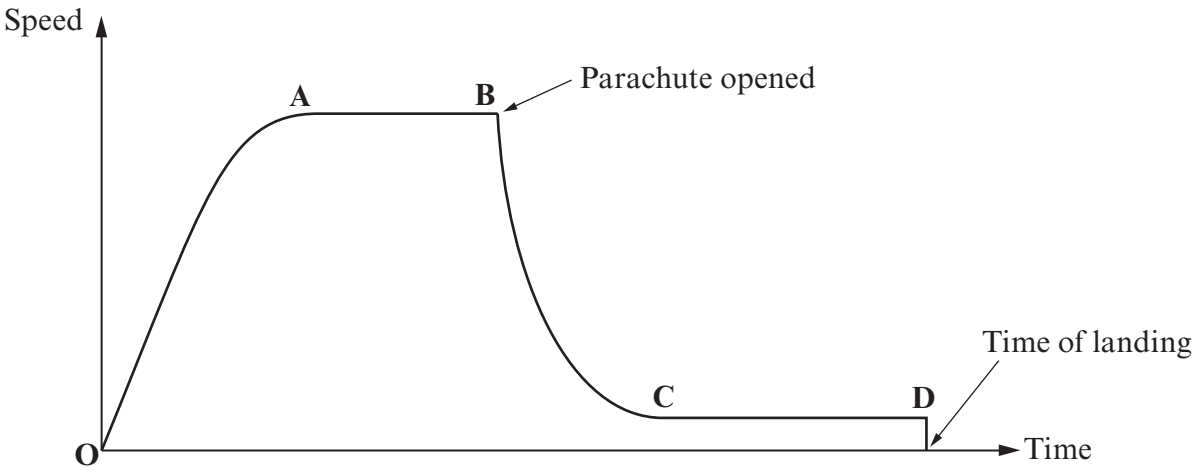
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7. The diagram shows a skydiver falling through the air, acted upon by two forces.



The graph OABCD shows the motion of the skydiver before and after opening the parachute.



(a) Complete the following sentences by choosing words or phrases from the box.

increases	decreases	stays the same	greater than	less than	equal to

(i) Between **O** and **A**, the weight ..... and the air resistance ..... .

(ii) Between **A** and **B** the weight is ..... the air resistance.

[3]

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(b) Use the graph to describe the motion of the skydiver between **B** and **D**. [2]

.....

.....

.....

.....

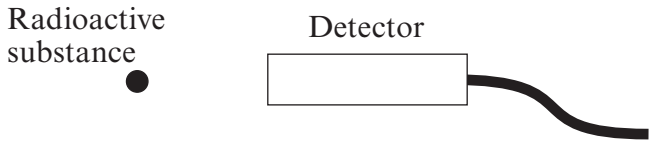
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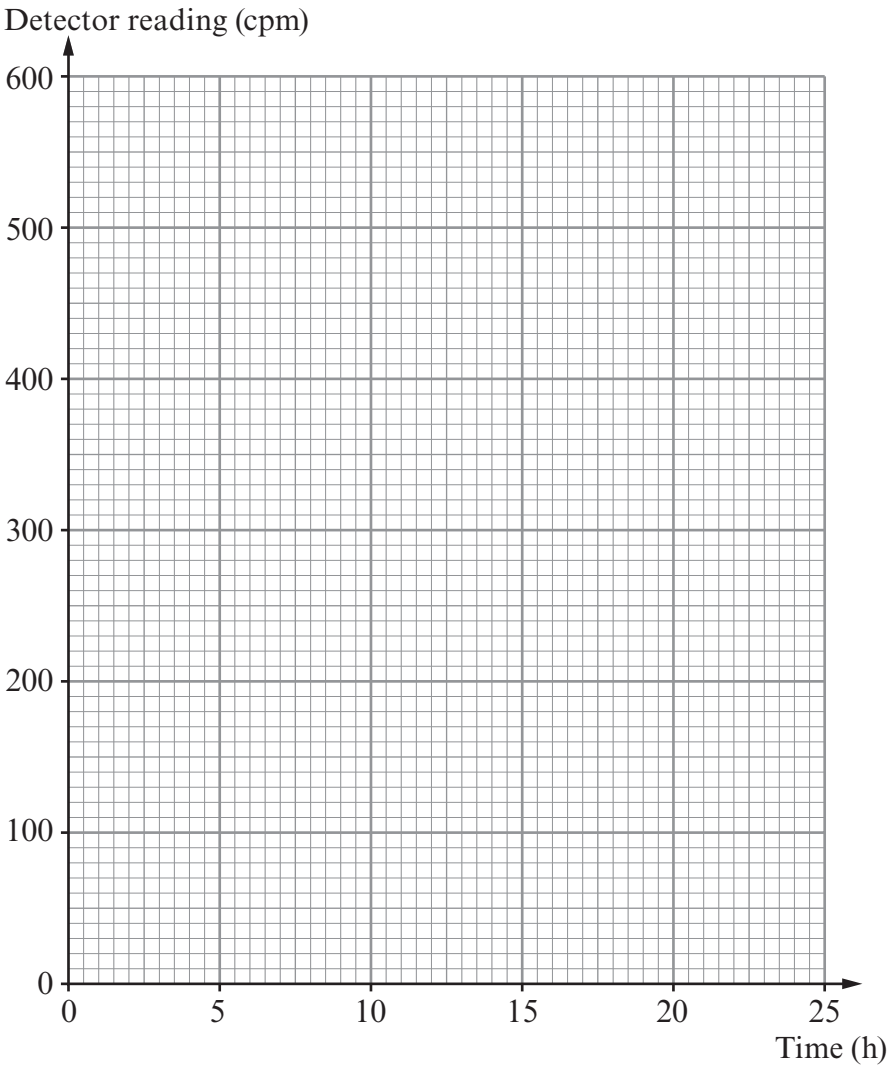
8. A radioactive substance which decays by gamma emission was placed in front of a detector.



The reading on the detector, corrected for background radiation, changed in the way shown in the table.

Time (h)	0	5	10	15	20
Reading on the detector (counts per minute)	480	290	180	110	70

(a) On the grid below, plot the points and draw a decay curve for this substance. [3]



(b) Use your graph to find the half life of this substance. [1]

Half life = ... hours

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9. Electrical appliances and their users are protected in the home by fuses in plugs, earth wires, residual current devices (r.c.d.) and miniature circuit breakers (m.c.b.).

(a) State how the earth wire protects the user. [1]

.....

.....

(b) Explain how an r.c.d. protects household circuits when a fault causes a current to flow to earth. [2]

.....

.....

.....

(c) One advantage of miniature circuit breakers over fuses in circuits is they can be reset after breaking a circuit.
State **two** *other* advantages. [2]

1. .....

.....

2. .....

.....

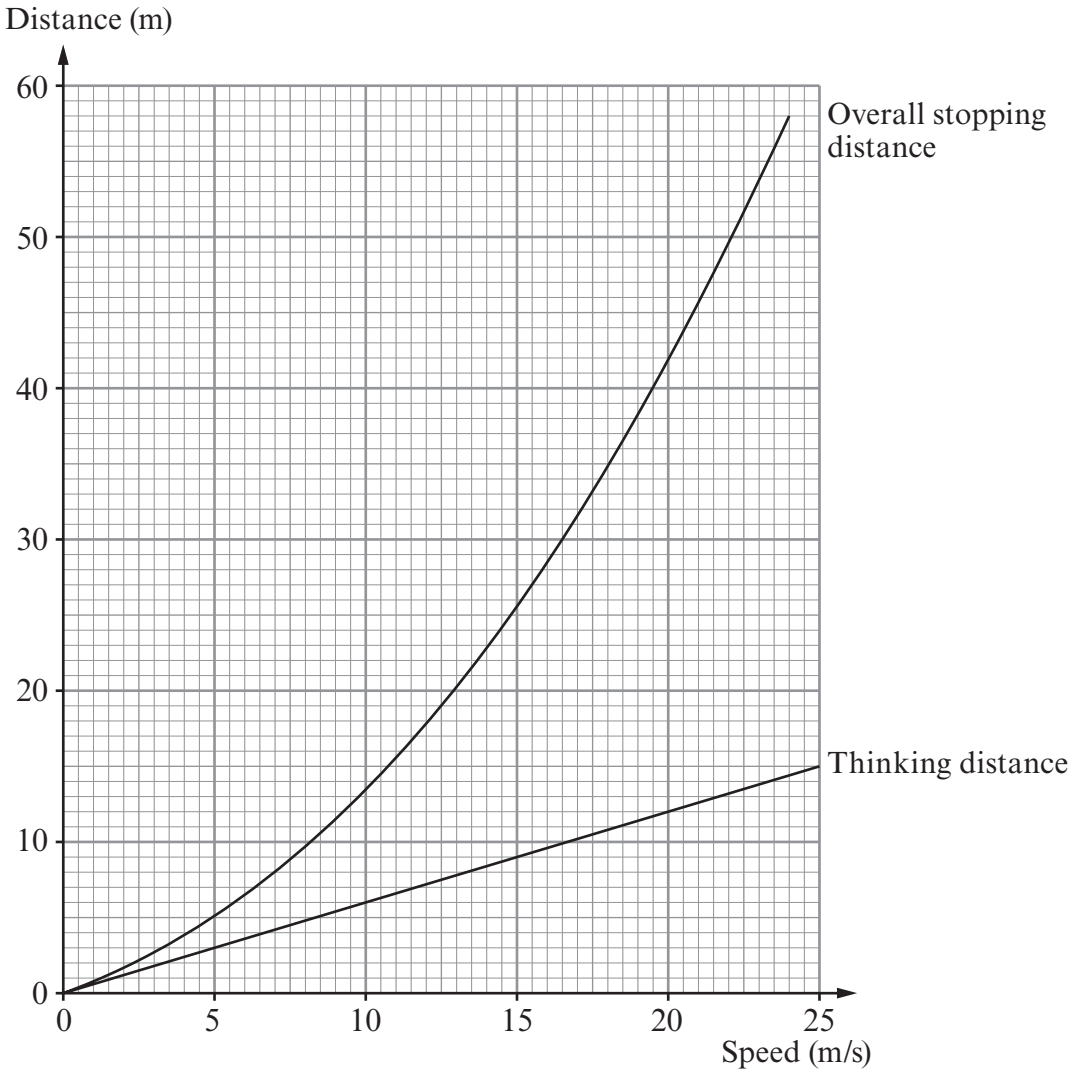
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10. The graph below shows how the **overall stopping distance** for a car and the **driver's thinking distance** change with the speed of the car.



(a) Use information from the graph and the equation

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

to calculate the **thinking time** for the driver of a car travelling at 15 m/s. [2]

Time = ... s

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(b) (i) Use information from the graph to find the braking distance when the car travels at 20 m/s. [2]

Braking distance = ... m

(ii) Use the graph to give a reason why the braking distance at 10 m/s is not half of your answer to *(b)*(i). [1]

.....

.....

(c) Name **one** factor that could make the thinking distance graph steeper. [1]

.....

6

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION.

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GCSE MARKING SCHEME

SCIENCE - PHYSICS (LEGACY)

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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PHYSICS 2 - FOUNDATION TIER

Question			Marking details	Marks Available
1.	*(a)*	(i)	gamma (1) [accept: γ, gama]	
		(ii)	gamma (1) [accept: γ, gama]	
		(iii)	alpha (1) [accept: α, alfa, alffa]	3
	(b)		Any 2 × (1) from: reduce exposure time (✓), protective clothing (✓), barrier (✓), breathing apparatus (✓), handling equipment (1), monitoring equipment (✓) [One mark available for each line – if one line is blank, 2 marks are available for the other line]	2
			Question total	**[5]**
2.	*(a)*	(i)	10%	1
		(ii)	cosmic [accept: rays from the sun]	1
		(iii)	nuclear power stations only contribute a very small part, or equiv [must recognise the low level contribution] – accept the converse argument.	1
		(iv)	30 [cpm]	1
	(b)		radon gas levels vary / difference in rock type / altitude [Not just: proximity to radiation source] **Notes**: Context must be correct if given, e.g. Limestone is more radioactive × Granite / igneous rocks more radioactive ✓ It depends if there are radioactive substances in the area –× not specific enough.	1
			Question total	**[5]**
3.	*(a)*		**Lamp**	1
	(b)		$\frac{920}{230}$ (1) = 4 [A] (1) [correct answer → 2 marks]	2
	(c)		13, 3, 13 in last three cells	1
			Question total	**[4]**

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Question			Marking details	Marks Available
4.	*(a)*		A and V in correct places [accept a and v]	1
	(b)		$R = \frac{2}{4}$ (1 subst) = 0.5 [Ω] (1 ans)	2
	(c)	(i)	variable resistor [accept: rheostat / reostat]	1
		(ii)	variable resistor (ecf on name) altered in steps [Accept: change the resistance / the resistance changes the current]	1
	(d)	(i)	2 [V] [accept 2 – 2.1]	1
		(ii)	line curves beyond that point / it is straight only up to 2 V [accept a resistance calculation up to 2 V and at a higher voltage] **Notes**: The description of the change must be clear, e.g. **not**: the current starts to slow down ✗ **not** increase in current slows down ✗ **but** the current increases at a slower rate - ✓b.o.d.	1
			Question total	**[7]**
5.	*(a)*		$a = \frac{12}{4}$ (1 subs) = 3 (1 ans) Unit: m/s^2 (1)	3
	(b)		F = 90 x 3 **ecf** (1 subs) = 270[N] (1)	2
			Question total	**[5]**

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Question			Marking details	Marks Available
6.	*(a)*		*W*= 500 000 x 0.9 (1) = 450 000 [J] (1)	2
	(b)		Any 2 × (1) from • crumple zone ✓ [**not** crumble zone!] • air bag ✓ • rigid [accept strong] passenger cell ✓	2
			Question total	**[4]**
7.	*(a)*	(i)	stays the same [accept: <u>is</u> constant](1) increases [accept: <u>gets</u> bigger] (1)	3
		(ii)	equal to (1)	
	(b)		decelerates (1) to a [new] constant speed (1)	2
			Question total	**[5]**
8.	*(a)*		all points plotted <u>±</u> half square (2x1) deduct 1 mark for each wrong plot [min 0], smooth curve [ignore t>20 hrs] (1)	3
	(b)		7 ± 0.5 [h] [for incorrect graphs, take the graph reading ± 0.5 h]	1
			Question total	**[4]**
9.	*(a)*		takes current [accept: electricity] to ground / earth [Accept: prevents metal casings becoming live / stops the current going through the user / stops them getting electrocuted / an electric shock] **Notes**: The explanation must not have an incorrect context, e.g. **not** if there is too much current × **not** prevents fire ×	1
	(b)		Context mark: difference in live and neutral currents (1) Effect mark: makes it turn off [all] household circuits [accept: appliance] / operates a <u>magnetic</u> switch (1) 'Stops the current' – accept for the 2nd mark. **Notes:** Effect mark can only be given if the context mark is given.	2
	(c)		Quick[er] acting [however expressed](1) [accept 'straight away'] more sensitive [however expressed] (1)	2
			Question total	**[5]**

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Question			Marking details	Marks Available
10.	*(a)*		$t = = \frac{9(1)}{15}$ [1 for 9 taken from graph] = 0.6 [s](1)	2
	(b)	(i)	42(1) – 12(1) = [30 m] [correct answer, only, implies correct working] **Notes**: Credit 42 (✓) and 12 (✓) and 30 (✓✓) in the working space, but if 30 is further manipulated to give a final incorrect answer, 1 mark is given. Do not credit 42 or 12 in the answer line – × If correct distances are <u>added</u> – 1 mark only.	2
		(ii)	because the total stopping distance increases as a curve / because the graphs are not straight. **Notes**: If numerical answer for 10 m/s given [braking distance 7.5 m] credit only if a suitable comment is given, e.g. 'this is not / less than half the 20 m/s value'	1
	(c)		[The driver is] tired / drunk / drugged / distracted (e.g. phone / inattentive) / old aged [accept just: alcohol]	1
			Question total	**[6]**
			Total For Foundation Tier paper	**50**

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PHYSICS 2 (LEGACY)

HIGHER TIER

Question			Marking details	Marks Available
1.	*(a)*		all points plotted ± half square (2x1) deduct 1 mark for each wrong plot [min 0], smooth curve [ignore t>20 hrs] (1)	3
	(b)		7 ± 0.5 [h] [for incorrect graphs, take the graph reading ± 0.5 h]	1
	(c)		yes because:[it is a gamma emitter] – so it escapes the body / can be detected outside [accept: low ionizing / highly penetrating] (1), suitably short half life (1)	2
			Question total	**[6]**
2.	*(a)*		takes current [accept: electricity] to ground / earth [Accept: prevents metal casings becoming live / stops the current going through the user / stops them getting electrocuted / an electric shock] **Notes**: The explanation must not have an incorrect context, e.g. **not** If there is too much current × **not** prevents fire ×	1
	(b)		Context mark: difference in live and neutral currents (1) Effect mark: makes it turn off [all] household circuits [accept: appliance] / operates a magnetic switch (1) 'Stops the current' – accept for the 2nd mark. **Notes:** Effect mark can only be given if the context mark is given.	2
	(c)		Quicker acting [however expressed](1) [accept 'straight away'] more sensitive [however expressed] (1)	2
			Question total	**[5]**

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Question			Marking details	Marks Available
3.	*(a)*		$t = = \frac{9(1)}{15}$ [1 mark for '9' taken from graph] = 0.6 [s](1) **Notes:** '9' in the answer space does not score	2
	(b)	(i)	42(1) – 12(1) = 30 [m] [correct answer, only, implies correct working] **Notes**: Credit 42 (✓) and 12 (✓) and 30 (✓✓) in the working space, but if 30 is further manipulated to give a final incorrect answer, 1 mark is given. Do not credit 42 or 12 in the answer line – × If correct distances are <u>added</u> – 1 mark only.	2
		(ii)	because the total stopping distance increases as a curve / because the graphs are not straight. **Notes**: If numerical answer for 10 m/s given [braking distance 7.5 m] credit only if a suitable comment is given, e.g. 'this is not / less than half the 20 m/s value'	1
	(c)		[The driver is] tired / drunk / drugged / distracted (e.g. phone / inattentive) / old aged [accept just: alcohol]	1
			Question total	**[6]**
4.	*(a)*	(i)	gamma [nuclear radiation – not enough]	1
		(ii)	Repeat the experiment / carry out similar experiments	1
		(iii)	Publish his results / allow others to verify / share outcomes [however expressed, e.g. patent the experiment] **Note:** 'Recording' – not enough	1
	(b)	(i)	When inhaled (1) radon emits alpha particles [inside the body] (1) which cannot escape [the body] [**not just** 'cannot get through the skin']/ are [highly] ionising / damage DNA / damage cells [**not** <u>destroy</u> cells] (1) [**not** just: 'causes cancer]. **Notes:** It must be clear that <u>radon</u> enters the body and <u>alpha</u> [particles] cause the ionisation	3
		(ii)	Seal floors / increase ventilation. Not 'insulation' - ×	1
		(iii)	Any 2 × (1) from: reduce exposure time (✓), <u>protective</u> clothing (✓), barrier (✓), breathing apparatus (✓), handling equipment (1), monitoring equipment (✓)	2
			Question total	**[9]**

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Question			Marking details	Marks Available
5.	*(a)*		• initially the weight is greater than the air resistance / the resultant force is downwards (1) [accept: the force of gravity / weight produces a downward acceleration] • air resistance [or upward force] increases / resultant force decreases (1) • [eventually] air resistance [or upward force] equals weight [or downward force] / zero resultant force (1) **Notes:** Unless the terms air resistance [or drag or equiv] **and** weight [or gravitational force – accept gravity] are correctly used at least once, a maximum of 2 marks can be awarded.	3
	(b)		correct initial curvature (1) levelling off [NB must not be higher than the parachute opening point – but allow some tolerance] (1)	2
			Question total	**[5]**
6.	*(a)*	(i)	Current = $\frac{2000(1)}{230}$ = 8.70 [A](1) **Notes:** $\frac{2}{230} \rightarrow 0.0087 \rightarrow$ 1 mark $\frac{2}{230} \rightarrow 8.7 \rightarrow$ 1 mark $\frac{2\text{ kW}}{230\text{ V}} \rightarrow 8.7 \rightarrow$ 2 marks $\frac{2}{230} \rightarrow 115 \rightarrow$ 0 marks	2
		(ii)	110= $I \times 26.45$ (1 sub) Current = $\frac{110}{26.45}$ (1 manip) = 4.16 [A] (1) (Accept 4.2 but not 4.1 or 4)	3
		(iii)	Longer time to boil / converse	1
		(iv)	Would burn out [accept: break] / blow a fuse/overheat **Not** – kettle / fuse will blow <u>up</u>	1
	(b)		Any 3 × (1) from: Advantage: safer (✓), because less likely to <u>be killed</u> by 110 than 230 V / smaller [current] shock (✓) Disadvantage: thicker wires have to be used for the same power appliances (✓) because the current taken is bigger (✓)	3
			Question total	**[10]**

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Question			Marking details	Marks Available
7.	*(a)*		accel = $\frac{1.6\times10^{6}}{1.2\times10^{8}}$ = (1 subst or manip)=0.01[3333] [m/s^2] (1 ans)	2
	(b)	(i)	Work = 2400× 1.6 × 10^6 (1) **= 3.84 × 10^9 [J]** (1)	2
		(ii)	Initial K.E. = 0.5 × (1.2 × 10^8) × 5^2 **= 1.5 × 10^9 J (1)** Final K.E. = 0.5 × (1.2 × 10^8) × 9^2 **= 4.86 × 10^9 J** (1) K.E. increase **= 3.36 × 10^9 [J]** [correct answer → 2 marks] **Notes: If** $\frac{1}{2}mv^2$ used correctly twice but with a numerical slip, 1 method mark is available for subtracting correctly.	2
		(iii)	W.D against drag = 3.84 × 10^9 – 3.36 × 10^9 **= 4.8 × 10^8[J]** (1) e.c.f. from *(b)*(i) and (ii) Force = $\frac{WD}{d} = \frac{4.8\times10^{8}(ecf)}{2400}$ (1 – subs) + (1 – manip) **= 2 × 10^5[N]**	3
			Question total	**[9]**
			Total Higher Tier	**50**

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Surname	Centre Number	Candidate Number
Other Names		0

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GCSE

0241/01

ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

P.M. MONDAY, 30 January 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**2**	
2.	**5**	
3.	**3**	
4.	**7**	
5.	**5**	
6.	**3**	
7.	**6**	
8.	**4**	
9.	**7**	
10.	**4**	
11.	**4**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

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EQUATIONS

Resistance $= \frac{\text{voltage}}{\text{current}}$

Current $= \frac{\text{power}}{\text{voltage}}$

Distance $=$ speed $\times$ time

Acceleration (or deceleration) $= \frac{\text{change in speed}}{\text{time}}$

Resultant force $=$ mass $\times$ acceleration

Work $=$ force $\times$ distance

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Examiner only

Answer **all** *questions in the spaces provided.*

1. Choose one phrase from the box below to complete each of the sentences about car safety. [2]

seat belt	air bag	head rest	crumple zone

(a) In a collision from behind, injury to the driver is reduced by the .....

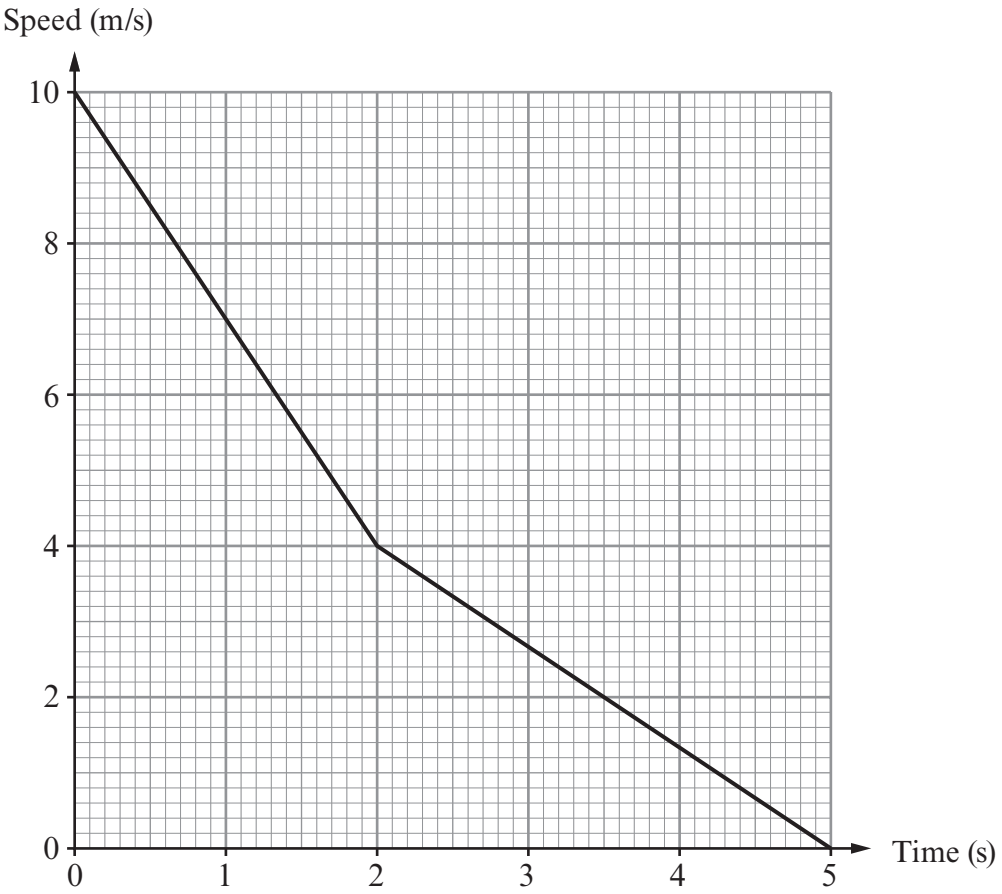
(b) The ..... increases the time for a moving car to stop.

2

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2. The graph shows how the speed of an athlete changes **after crossing** the finishing line of a race.



Use the graph to answer the following questions.

(a) What was his speed when he finished the race? ..... [1]

(b) At what time was his speed equal to 2 m/s? ..... [1]

(c) (i) Use the equation:

$$\text{deceleration} = \frac{\text{change in speed}}{\text{time}}$$

to calculate the deceleration in the first 2 seconds after finishing the race. [2]

Deceleration = ... m/s^2

(ii) How does the graph show that the athlete's deceleration between 2 s and 5 s is lower than that calculated in *(c)*(i)? [1]

.....

.....

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5

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3. Carbon-14 is present in all living material. It emits *beta particles* and has a half life of 5700 years.

(a) Name the part of the carbon-14 atom which emits a beta particle. ..... [1]

(b) A sample of carbon-14 has an activity of 200 counts per minute.

(i) What will be the activity after 5700 years? [1]

Activity = ... counts per minute

(ii) After how many years will the activity have fallen to 50 counts per minute? [1]

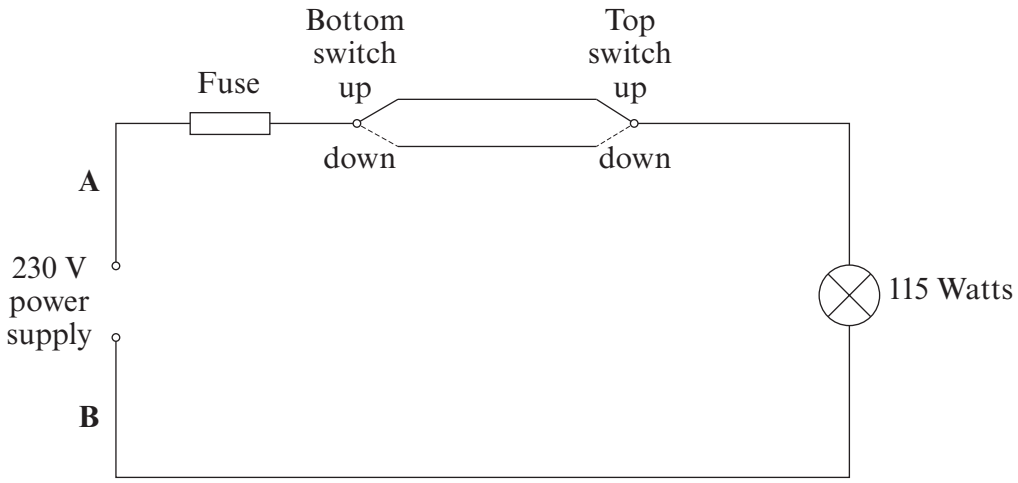
..... years

3

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4. The following diagram shows a simple form of a 2-way switch circuit.
The switches in these circuits are used at the top and bottom of stairways, so that the lights can be turned on or off from either place.



(a) How can you tell from the diagram that wire **A** is the live lead? [1]

.....

.....

(b) Complete the following table. [2]

Bottom switch position	Top switch position	Lamp ON or OFF
UP	UP	ON
UP	DOWN	.....
DOWN	DOWN	.....

(c) Use the equation

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

to calculate the current flowing through the lamp. [2]

Current = ... A

(d) State why a 13 A fuse would be unsuitable for this circuit. [1]

.....

.....

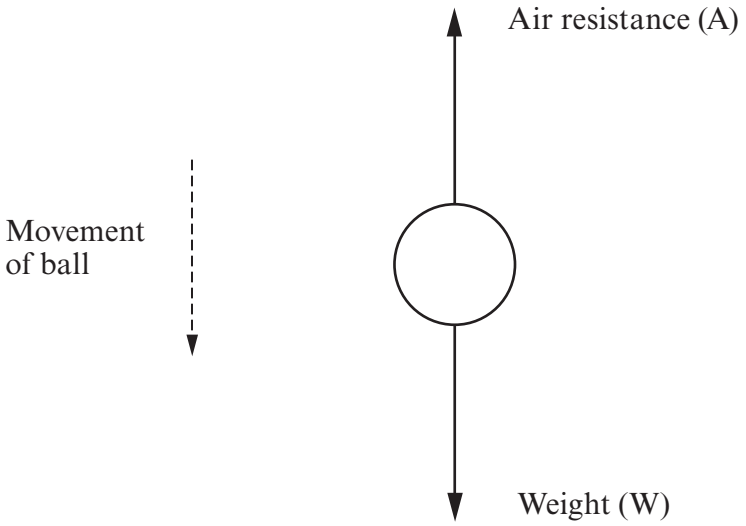
(e) Which wire is included in mains circuits but is not shown in the circuit diagram? [1]

.....

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5. The diagram shows a ball falling through the air. It is acted upon by two forces, weight (W) and air resistance (A).



(a) Choose your answers from the phrases in the box.
Each phrase may be used once, more than once or not at all. [3]

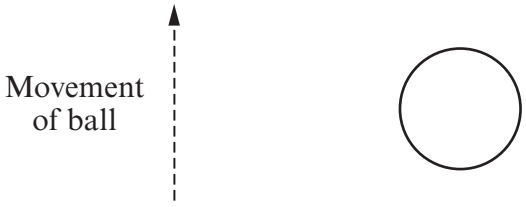
gets smaller	stays the same	gets bigger

(i) As the ball falls, the weight .....

(ii) As the ball falls, the air resistance .....

(iii) When the two forces are equal, the speed of the ball .....

(b) In the diagram below, the ball is now moving **upwards** in the air.
Draw the force arrows on the ball to show their directions.
Label each arrow with one of the letters A and W. [2]



5

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6. Electric circuits in the home use the following devices:

residual current device (r.c.d.)	miniature circuit breaker (m.c.b.)	fuse

These devices break circuits for different reasons.
Use the devices named in the boxes to complete the table.
Each device may be used once, more than once or not at all. [3]

FAULT	DEVICE THAT OPERATES
The current in the live is very slightly different from the current in the neutral wire.	
It uses an electromagnetic switch to break the circuit very quickly when the current becomes too large.	
It breaks the circuit very quickly when the live wire touches the metal body of an appliance.	

3

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7. Radioactive waste is dangerous to the public. The waste has to be disposed of safely.

(a) Explain why radioactive waste is dangerous to people. [2]

.....

.....

.....

.....

(b) Give **two** reasons for not sending the waste into space in rockets. [2]

1. .....

.....

2. .....

.....

(c) Radioactive waste can be buried underground.

(i) State why it needs to be monitored for many thousands of years. [1]

.....

.....

(ii) State a danger from storing waste underground. [1]

.....

.....

6

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8. A moving vehicle makes an emergency stop and comes to rest in a total stopping distance of 82 metres.
The driver's reaction time was 0.6 s and the vehicle was travelling at a speed of 20 m/s.

(a) Use the equation

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

to calculate the distance travelled whilst the driver was reacting. [1]

Distance travelled = ... m

(b) (i) Calculate the **braking** distance for the vehicle. [1]

Braking distance = ... m

(ii) The vehicle's average speed during braking is 10 m/s.
Use the equation

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

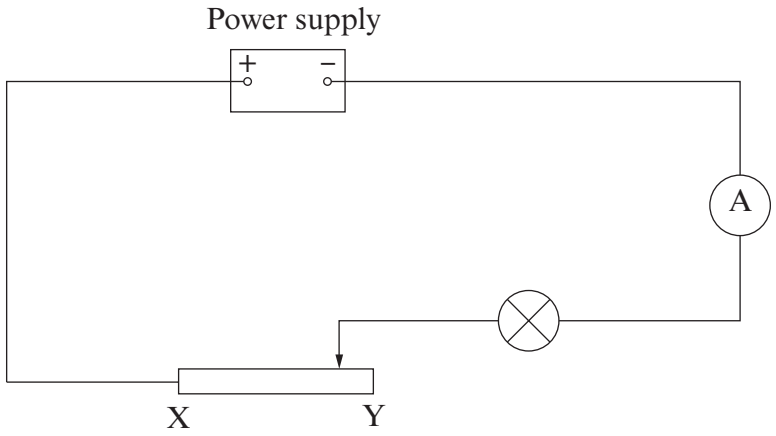
to calculate the braking time. [2]

Braking time = ... s

4

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9. A group of pupils set up the following circuit to investigate how the current through a lamp depends on the voltage applied to it.



(a) The ammeter measures the current through the lamp.
Draw a voltmeter on the circuit above that measures the voltage across the lamp. [1]

(b) The slider on the variable resistor is moved to the end Y.

(i) State what effect this has on the current through the lamp. [1]

.....

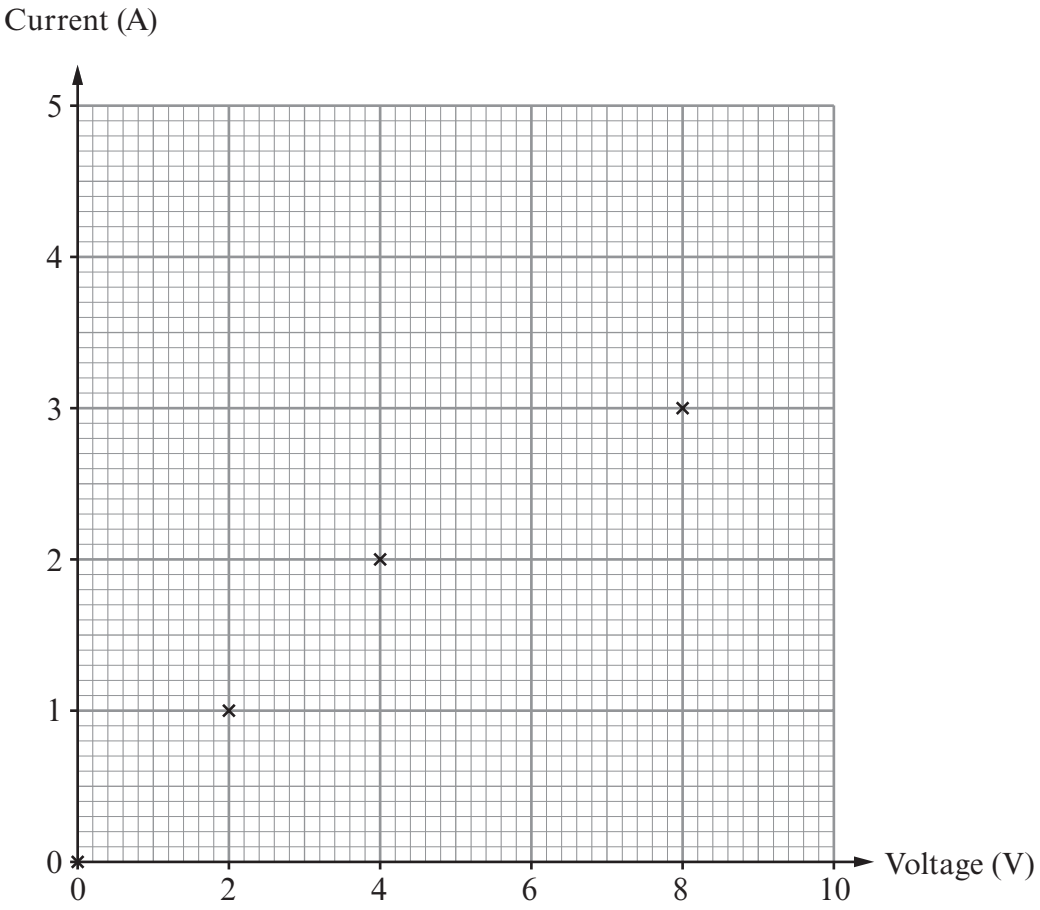
(ii) State what effect this has on the voltage across the lamp. [1]

.....

(c) They obtained the following results and plotted them on the grid on the next page.

Current (A)	Voltage (V)
0.0	0
1.0	2
2.0	4
2.7	6
3.0	8

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(i) One point is missing from the grid.
Plot the missing point on the grid and draw the graph line. [2]

(ii) Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the lamp when the voltage is 8 V. [2]

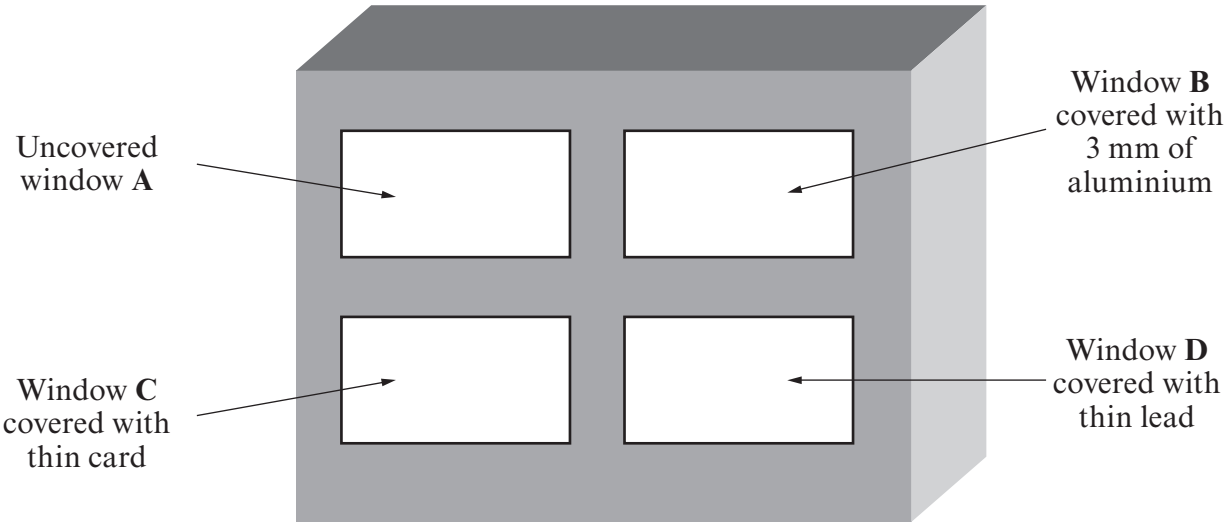
Resistance = ... Ω

7

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10. A radiation film badge is used by scientists who work near radioactive materials. The badges consist of four windows, behind which is a radiation sensitive film. Each badge is inspected at the end of the month and a new one is issued.



(a) What is the purpose of having an uncovered window, **A**? [1]

.....

.....

(b) At the end of a particular month, the number of counts detected at the windows was as follows:

Counts made in the month	Window at which these counts were detected	Types of radiations detected
9 500	A	Alpha, beta, gamma
5 500	B	.....
6 250	C	.....
4 800	D	Gamma

Complete the third column in the table. [2]

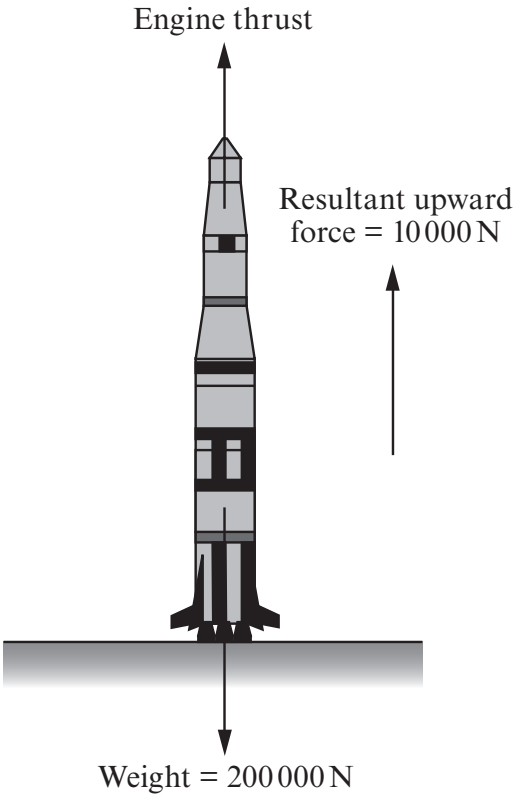
(c) How many of the counts were produced from just beta radiation? ..... [1]

4

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11. The diagram shows a space rocket on its launch pad.



The rocket and fuel have a mass of 20 000 kg and weigh 200 000N.
It is powered by 3 rocket engines.
At lift-off, the resultant upwards force is 10 000 N.

(i) Calculate the upward thrust produced by **each** of the 3 rocket engines. [2]

Thrust = ... N

(ii) Use the equation:

$$\text{acceleration} = \frac{\text{resultant force}}{\text{mass}}$$

to calculate the acceleration at lift-off. [2]

Acceleration = ... m/s^2

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION.

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WJEC
CBAC

GCSE MARKING SCHEME

SCIENCE – PHYSICS (LEGACY)

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCSE SCIENCE – PHYSICS (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
Physics 1 (Legacy) Foundation Tier	1
Physics 1 (Legacy) Higher Tier	4
Physics 2 (Legacy) Foundation Tier	7
Physics 2 (Legacy) Higher Tier	10

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PHYSICS 2 (LEGACY)

FOUNDATION TIER

Question			Answer / Explanatory Notes	Marks Available
1.	(a)		head rest [1] (Accept crumple [zone])	1
	(b)		crumple [zone] [1]	1
				2
2.	(a)		10 (m/s) [1] – no tolerance	1
	(b)		3.5 (s) [1] – no tolerance	1
	(c)	(i)	$\frac{10-4}{2}$ [1] = 3 (m/s^2) [1] (no penalty on negative sign)	2
		(ii)	line is less steep [1] (or equivalent, e.g. in 2 s the speed only decreases by about 3 m/s instead of 6 m/s – reference to speed change **and** time needed in this approach)	1
				5
3.	(a)		nucleus [1] Accept neutron / accept plurals.	1
	(b)	(i)	100 [1]	1
		(ii)	5700 + 5700 **or** 11 400 (years) [1] (Credit 5700 + 5700 or 2 x 5700 where the answer has been miscalculated) Not "2 half lives"	1
				3
4.	(a)		The fuse / switch is always in the live wire **or** it is connected / attached to / contains the fuse/switch [1] NOT "is closer to the fuse" "Wire A runs through the fuse" - ok	1
	(b)		OFF [1], ON [1]	2
	(c)		current = $\frac{115}{230}$ [1 - subs]= 0.5 (A) [1 Ans] (N.B 230/115 = 0.5 gets no credit)	2
	(d)		current is <<13 Amp / fuse [value] much bigger than current [1] (Do not accept 'is less than', accept 'Fuse wouldn't melt before danger of a fire'] A suggested lower value of fuse e.g. 3A or 5A ✓ Not the current will never get that high ×	1
	(e)		Earth [1] [Accept: ground]	1
				7

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Question			Answer / Explanatory Notes	Marks Available
5.	(a)	(i) (ii) (iii)	stays the same / the same / same [1] bigger / gets bigger [1] stays the same / the same / same [1]	3
	(b)		**EITHER:** letter W plus arrow downwards [1] A plus arrow downwards [1] [**OR:** Both arrows downwards [1] both downward arrows labelled [1] – 2nd mark requires 1st] NB No requirement for arrows to make contact with ball but need to be within the horizontal extent of the ball.	2 **5**
6.			r.c.d. / residual current device [1] Accept r.c.b. m.c.b./ miniature circuit breaker [1] Accept m.c.d r.c.d. / residual current device [1] Accept r.c.b. NB – more than 1 answer - s.i.f.	3 **3**
7.	(a)		emits radiation [or a named form of nuclear radiation] [1], which damages [or harms] / ionises cells **or** causes mutations / cancer [1] No credit for reference to exposure. "radioactive waves" × "releases" radiation ✓	2
	(b)		cost [/ costly / expensive [1], danger of accident on take-off] (do not accept waste falling to earth on its own) [1] Accept: "can explode [in space and come back to Earth]" / "collide with space debris"	2
	(c)	(i)	long half life / long time to decay [1] Answer must relate to the time – not corrosion. "May be still active" ok	1
		(ii)	It can [or will] leak – reference to leakage [accept contamination of water, soil, food chain] [1]	1 **6**
8.	(a)		12 (m) [1]	1
	(b)	(i)	70 (m) [1] e.c.f. [ie 82 m – answer to (a)]	1
		(ii)	$t = \frac{70(\text{e.c.f.})}{10}$ = [1] 7 (s) [i.e ans to (b)(i)÷10]	2 **4**

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Question			Answer / Explanatory Notes	Marks Available
9.	(a)		correct symbol for voltmeter [accept line through] in parallel with lamp [1] (Above or below it) Accept the voltmeter shown across the lamp / ammeter pair.	1
	(b)	(i)	decreases [1] [not "slows the current"]["changes" – not enough] Not "dimmer"; accept: "the bulb has a lower current through it."	1
		(ii)	decreases [1]	1
	(c)	(i)	cross on coordinate (6, 2.7) ± ½ division[1] reasonably straight line becoming curved after coordinate (4,2) [1] NB – line must include origin but don't penalise for lies beyond 8 V. Badly plotted point – line mark still possible ecf. No double lines.	2
		(ii)	$\frac{8}{3[1]}$ [1 for 3.0 in denominator]= 2.7 (Ω) [Ans 1] (Accept 2.67 or 2.667 but not 2.6, 2.66 or 2.666) NB 2.6, 2.66... → 1 mark] NB 2.6 dot in the calculation gets the second mark even if the answer line shows 2.6 only.	2 **7**
10.	(a)		total radiation [or strength of rad^{n}] received [1] (Accept 'as a control') "To see if any rad^{n} present" ✓ "To see if any rad^{n} let in without protection "✓ "Monitor amount of each type of rad^{n}" – not enough Ref to background radiation × Accept: "to measure radiation going in" [or equiv.] ✓ Accept "total dose" ✓ Accept "to see how much α / alpha" ✓	1
	(b)		THIRD COLUMN ANSWERS: gamma (only) [1], beta & gamma (only)[1]	2
	(c)		750 [accept 1450]	1 **4**
11.		(i)	$\frac{210\,000(\text{N})[1]}{3}$ = 70 000 (N) [1] (No credit for $\frac{200\,000}{3}$) [$\frac{190\,000}{3}$ = 63000 N → 1 mark (ans)] NB Accept 210 000 [N] whenever it appears for the first mark	2
		(ii)	$\frac{10\,000}{20\,000}$ [1] = 0.5 (m/s^2) [1] (N.B $\frac{20\,000}{10\,000}$ = 0.5 gets no credit)	2 **4**
			Totals for foundation paper	**50**

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HIGHER TIER

Question			Answer / Explanatory Notes	Marks Available
1	(a)		correct symbol for voltmeter [accept line through] in parallel with lamp [1] (Above or below it) Accept the voltmeter shown across the lamp / ammeter pair.	1
	(b)	(i)	decreases [1] [not "slows the current"]["changes" – not enough] Not "dimmer"; accept: the bulb has a lower current through it.	1
		(ii)	decreases [1]	1
	(c)	(i)	cross on coordinate (6, 2.7) ± ½ division[1] reasonably straight line becoming curved after coordinate (4,2) [1] NB – line must include origin but don't penalise for lies beyond 8 V. Badly plotted point – line mark still possible ecf.	2
		(ii)	8/3.0 [1 for 3.0 in denominator]= 2.7 (Ohms) [Ans 1] (Accept 2.67 or 2.667 but not 2.6, 2.66 or 2.666) NB 2.6, 2.66... → 1 mark] NB 2.6 dot in the calculation gets the second mark even if the answer line shows 2.6 only.	2
		(iii)	EITHER: using calculations at early and late points[e.g. from (c)(ii)] [1], states that R has increased [1] OR Any 2 × (1) from • R constant up to 4 V ✓ • statement that gradient has decreased [after 4 V]✓ • states R has increased ✓ "The resistance of the lamp increases up to 4 V and then increases more slowly" → 0 marks "Rate at which the current increases gets less"✓	2 **9**
2.	(a)		total radiation [or strength of rad^{n}] received [1] (Accept 'as a control') "To see if any rad^{n} present" ✓ "To see if any rad^{n} let in without protection "✓ "Monitor amount of each type of rad^{n}" – not enough Ref to background radiation ×	1
	(b)		THIRD COLUMN ANSWERS: gamma (only) [1], beta & gamma (only)[1]	2
	(c)		750 [accept 1450]	1 **4**

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Question			Answer / Explanatory Notes	Marks Available
3.	(a)	(i)	$\frac{210\,000(N)[1]}{3}$ = 70 000 (N) [1] No credit for $\frac{200\,000}{3}$ [$\frac{190\,000}{3}$ = 63000 N → 1 mark (ans)]	2
		(ii)	$\frac{10\,000}{20\,000}$ [1] = 0.5 (m/s^2) [1] (N.B $\frac{20\,000}{10\,000}$ = 0.5 gets no credit)	2
	(b)		Any 3 × (1) from • mass decreases..✓ • because the fuel used up.✓ • <u>resultant</u> force increases ✓ • weight decreases ✓ NB weight decreases because gravity decreases – no additional credit.	3
	(c)		Graph starting at origin sloping upwards with correct curvature [increasing gradient] [1], never becoming vertical [1] NB Straight sloping line with upward curve [not vertical] at end → 1 mark NB Zero initial gradient loses first marking point.	2 **9**
4.	(a)		m.c.b. / miniature [accept: mini] circuit breaker, [1][mcd → bod] [1] r.c.d./ residual current device, [1] [rcb → bod] / e.l.c.b. / <u>earth-leakage</u> circuit breaker [1] accept earth lead / wire.✓ NB Not just "circuit breaker", Not insulated wires / plugs	2
	(b)		m.c.b breaks the circuit [1] because it is faster acting than a fuse[1] "Faster acting than fuses" ok even if referring to rcd. Accept "turn off the circuit" / more sensitive. Accept "fast acting" or "immediately" even if not compared to fuse.	2
	(c)		Current / electricity flows to earth [1] **Either** Then [accept senses / measures] there is a <u>difference</u> between the live and neutral <u>currents</u> [1] so r.c.d. breaks the circuit [1] **Or** Large <u>current</u> flows because it is a low resistance path [ ] so fuse [melts and] breaks the circuit [ ] Current through the Earth wire / lead – ok Large current flows causing fuse to melt → 1 mark	3 **7**

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Question			Answer / Explanatory Notes	Marks Available
5.	(a)		time taken [1] for activity / substance / material / mass / nuclei / atoms to reduce by half [1] [Not radioactivity or radiation] accept "half the substance the substance / material to decay" Not ...."for the count to decrease by ½ " but accept "or the count rate to decrease by ½ "	2
	(b)	(i)	Strontium : needs to be beta because fewer beta particles pass through thicker aluminium (not just IT IS A BETA EMITTER)[1]; it has a [reasonably] long half-life [stand alone] [their choice must have at least 5 years ½ life] [1] absorbed if the aluminium is too thick – ok / can penetrate a certain thickness of aluminium - ok	4 max
		(ii)	technetium : must be a gamma emitter because it passes out of the body easily / equivalent [1]AND it has a short [enough] half life [to decay from the body in a short term] [[stand alone but their choice must be technetium or phosphorus] [1] Not just –ionising. + both sources correct [1]	
	(c)	(i)	decayed radon is continually being replaced [1] [however stated, e.g. "there is a constant flow of radon [through cracks]"]	1
		(ii)	subtraction of 30 from 550 = 520 [1] Danger factor $= \frac{520(\text{ecf})}{200} = 2.6$ **or** $\frac{520(\text{ecf})}{230}$ [Ans 1] 2.6 →(2), 2.75 →(1); 2.3 → (2); 2.4 → (1)	2
		(iii)	activity of radon = 0.6 x 200 [1] = 120 [Ans 1] Total activity = 120 + 30 = 150 [Ans 1] ecf on 230 from (ii) for first 2 marks: 0.6(✓) x 230(✓) = 138(✓) → 3 marks. +30 -1 penalty	3
				12

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Question			Answer / Explanatory Notes	Marks Available
6	*(a)*	(i)	0.5 x 90 x 13 x 13 [1] = 7605 (J)[1]	2
		(ii)	PE = 90 x 10 x 6 [1] = 5400 (J) [1] KE = 0.5 x 90 x 5^2 = 1125 (J)[Ans 1] Total energy = 6525 (J)[1] Allow e.c.f. from error in PE or KE NB use of KE from (i) → only first two marks	4
	(b)		Energy conv to work = 7605-6525 = 1080 (J) [Ans 1] e.c.f.from (a)	3
			Force = $\frac{1080}{18}$ [1] [accept answer to (a)(i) &(ii) e.g. 7605 or 6525] = 60(N)[1] ecf from 2nd mark	
				9
			Total for higher tier paper	**50**

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Candidate Name	Centre Number	Candidate Number
		0

WJEC CBAC

GCSE

241/01

ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

A.M. FRIDAY, 27 May 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**3**	
2.	**5**	
3.	**6**	
4.	**5**	
5.	**5**	
6.	**4**	
7.	**10**	
8.	**7**	
9.	**5**	
Total	**50**	

0241 010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

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EQUATIONS

$$\text{Resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\text{Power} = \text{current} \times \text{voltage}$$

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

$$\text{Resultant force} = \text{mass} \times \text{acceleration}$$

$$\text{Acceleration} = \frac{\text{change in speed}}{\text{time}}$$

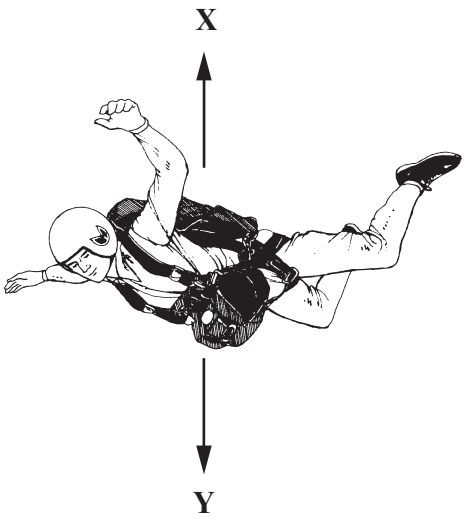
$$\text{Force} = \frac{\text{work done}}{\text{distance}}$$

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Answer **all** *questions in the spaces provided.*

1. The statements below describe what happens during a parachute jump.



A	Drag force X becomes equal to the weight Y
B	Speed increases and drag increases
C	Sky diver jumps from plane and falls
D	Speed decreases
E	Falls with a constant speed
F	Parachute opens increasing drag

Place the statements in the correct order in the boxes below. Two have already been done for you. [3]

C	.....	.....	.....	F	.....

0241 010003

3

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2. *(a)* There are three insulated wires connected to plugs. One of the wires is connected to a fuse. Draw a line from each item to its job. One has already been done for you. [3]

Item	Job
Neutral wire →	To complete the circuit to the appliance
Live wire	To protect user from shock
Earth wire	To carry high voltage
Fuse	To prevent short circuits
Insulation	To protect circuit from overheating

(b) It is recommended that residual current devices (RCD) be fitted to protect circuits. Tick (✓) the boxes next to the reasons why an RCD will provide greater protection to a user than a fuse. [2]

Can be reset	
Quicker acting	
Stops overheating	
Detects small changes in current	

5

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3. Read the following information and answer the questions that follow.

> Radon is a naturally occurring radioactive gas produced by the decay of uranium 238, which is present throughout the Earth's crust. It is concentrated in parts of the country rich in granite, such as Devon and Cornwall.
>
> Radon decays by emitting alpha radiation. We all breathe in radon throughout our lives and it accounts for half of our total annual radiation dosage of 400 units.
>
> It can seep into buildings through cracks and holes in the foundations, where it can build up to dangerous levels.

(a) (i) How is radon produced? [1]

.....

.....

(ii) Give a reason why radon levels are not constant over Britain. [1]

.....

.....

(iii) Name another source of background radiation. [1]

.....

(b) (i) What is our annual radiation dose from radon? [1]

.....

(ii) Describe **one** method taken to prevent the build up of radon in buildings. [1]

.....

.....

.....

(iii) Explain why breathing in large amounts of radon is dangerous to our health. [1]

.....

.....

.....

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6

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4. The table shows some properties of isotopes of plutonium (Pu).

Isotope	Half Life (years)	Activity (units)	Radiation emitted
Pu-238	88	20	α
Pu-240	6 500	0.23	α
Pu-241	14	100	β
Pu-242	380 000	0.0040	α

(a) (i) Which isotope has the greatest activity? ..... [1]

(ii) Which isotope will stay active for longest? ..... [1]

(iii) Which isotope will emit the most penetrating radiation? ..... [1]

(b) (i) A sample of Pu-238 has an activity of 20.

How long will it take to drop to 10? ..... years [1]

(ii) A sample of Pu-241 has an activity of 100.

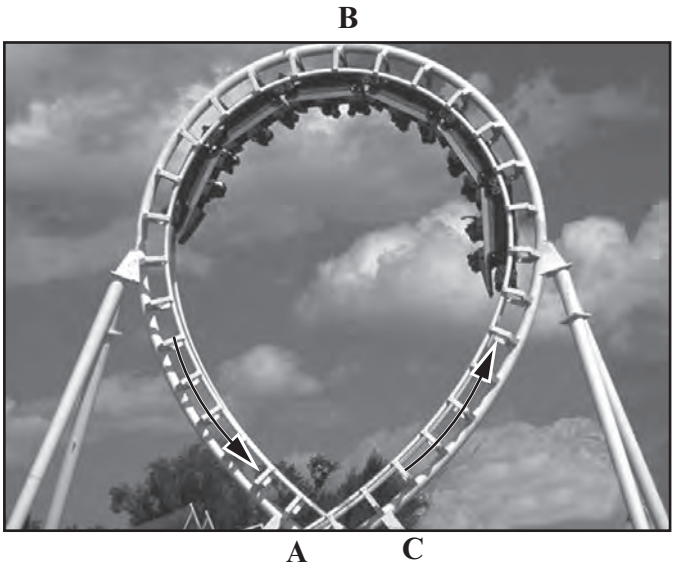
What will the activity be after 28 years? ..... units [1]

5

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5. A fairground ride has a loop in part of the track.



The cars enter the loop at **A** with a kinetic energy of 250 000 J.

At **B**, the total energy of the car is 230 000 J.

The car leaves the loop with a kinetic energy of 190 000 J at **C**.

(a) (i) How much energy is lost between **A** and **B**? [1]

Energy lost = ...J

(ii) At **B**, the car has less kinetic energy than it does at **A**.
Explain why. [1]

.....

.....

(iii) How much work is done against friction between **A** and **C**? [1]

Work done against friction = ...J

(b) Towards the end of the ride, the car has 60 000 J of kinetic energy. A braking force stops the car over a distance of 20 m.
Use the equation

$$\text{Force} = \frac{\text{work done}}{\text{distance}}$$

to calculate the braking force. [2]

Braking force = ...N

5

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Examiner only

6. *(a)* Radioactive waste has to be stored carefully for long periods of time. Give a reason why. [1]

.....

.....

(b) Give a **disadvantage** for each of the following methods that are used for getting rid of radioactive waste. [3]

(i) Store in barrels at the bottom of the sea.

Disadvantage: .....

.....

(ii) Send by rockets into space.

Disadvantage: .....

.....

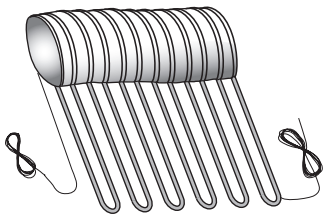
(iii) Store in containers on the surface of the Earth.

Disadvantage: .....

.....

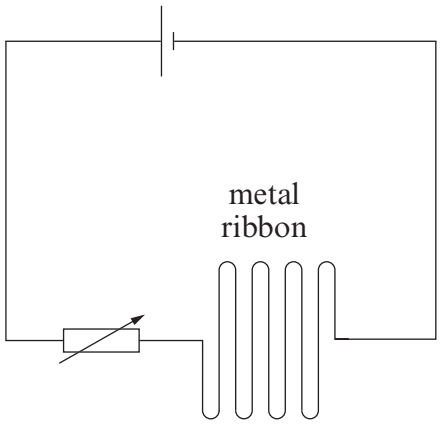
4

7. Homes can now be heated using metal ribbons laid under carpets.



The circuit on the next page is used to find the resistance of the metal ribbons and the power developed in them.

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(a) (i) **Add meters to the circuit** that allow you to calculate the resistance of the metal ribbon. [2]

(ii) What is the purpose of the variable resistor? [1]

.....

.....

(b) When in use the voltage across the ribbons is 230 V and a current of 0.5 A flows through them.

(i) Write down in words an equation from page 2, and use it to calculate the resistance of the ribbons. [3]

Equation: .....

.....

Calculation:

Resistance = ... Ω

(ii) Write down in words an equation from page 2, and use it to calculate the power developed in the ribbons. [3]

Equation: .....

.....

Calculation:

Power = ... W

(c) The metal ribbons are all protected by a miniature circuit breaker (mcb). When they are all in use, the total current is 24 amps.
Circle the mcb rating in the list which should be used to protect this circuit. [1]

15 A 24 A 30 A

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8. A car travels at 30 m/s.

(a) Use the equation

$$\text{deceleration} = \frac{\text{change in speed}}{\text{time}}$$

to find the deceleration when the car stops in 0.2 s. [2]

deceleration = ... m/s^2

(b) During an accident, the force on a passenger will depend on how long the car takes to stop as shown in the table below.

Time to stop (s)	Force (N)
0.2	12 000
0.4	6 000
0.6	4 000
0.8	3 000

(i) Describe what happens to the force as the stopping time increases. [1]

.....

(ii) Use the information in the table and your answer to *(a)* to find the mass of the passenger. [2]

$$\text{mass} = \frac{\text{force}}{\text{deceleration}}$$

Mass of passenger = ... kg

(c) Explain how crumple zones in cars protect passengers. [2]

.....

.....

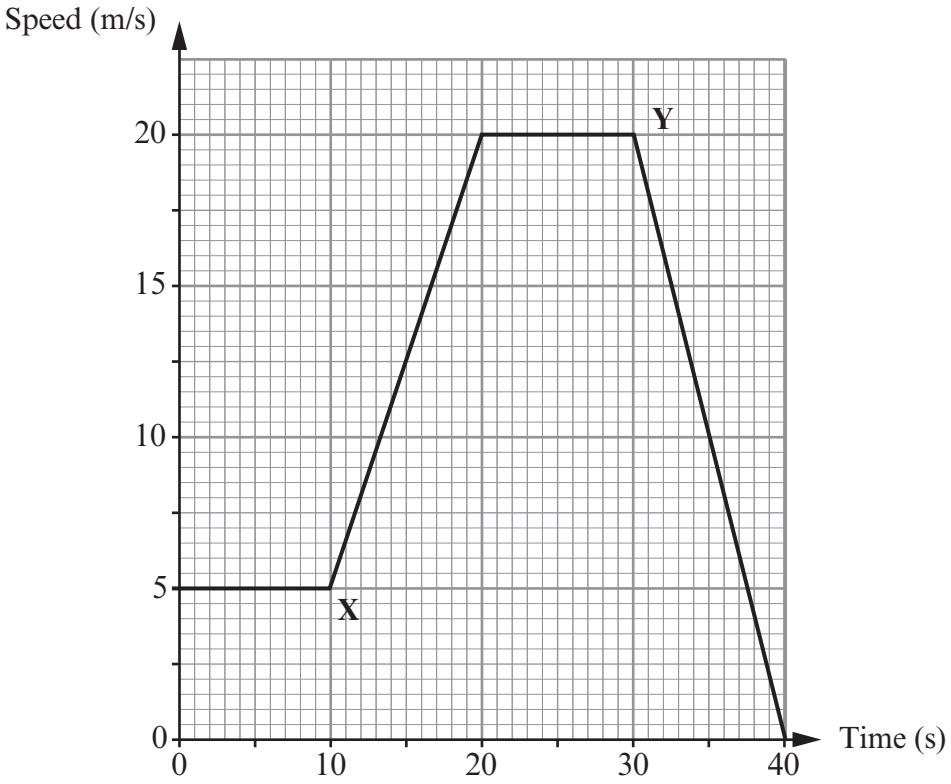
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9. The graph shows the motion of a van for 40s.



(i) State the initial speed of the van. ..... m/s [1]

(ii) Describe carefully, giving numerical values, how the van moves between X and Y. [4]

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Candidate Name	Centre Number	Candidate Number
		0

WJEC CBAC

GCSE

241/01

ADDITIONAL SCIENCE
FOUNDATION TIER
PHYSICS 2

A.M. WEDNESDAY, 19 January 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**6**	
2.	**7**	
3.	**5**	
4.	**7**	
5.	**5**	
6.	**5**	
7.	**5**	
8.	**6**	
9.	**4**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2. In calculations you should show all your working.

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EQUATIONS

$$\text{Resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\text{Current} = \frac{\text{power}}{\text{voltage}}$$

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

$$\text{Resultant force} = \text{mass} \times \text{acceleration}$$

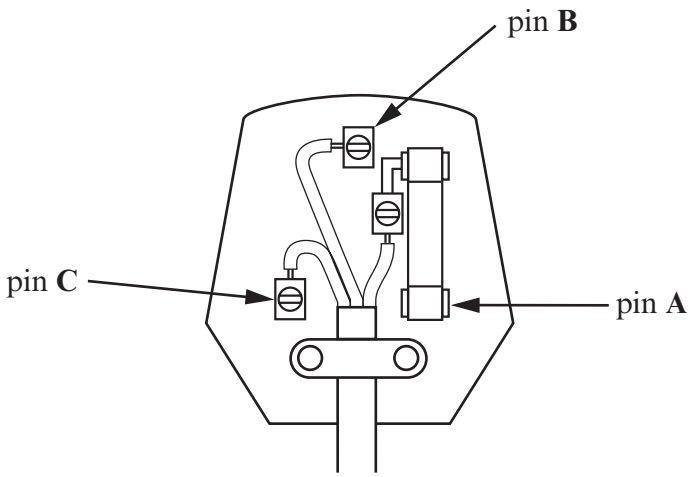
$$\text{Acceleration} = \frac{\text{change in speed}}{\text{time}}$$

$$\text{Force} = \frac{\text{Work done}}{\text{distance}}$$

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Answer **all** *questions.*

1. *(a)* The diagram shows the inside of a plug. The wires from the three core cable entering the plug are covered with coloured plastic.



(i) To which pin, **A**, **B** or **C**, is the brown coloured wire connected? .....

(ii) State the colour of the plastic on the wire connected to pin C. .....

(iii) Give a reason why the wires in the three core cable have a plastic covering.

.....

.....

[3]

(b) When a fuse and earth wire protect users from electric shocks the following steps occur:

A Fuse wire melts
B Metal case becomes live
C Circuit is broken
D Large current flows through earth wire
E User protected from electric shock.

Place the letters A to E in the correct order in the boxes below.
The first box has been completed for you. [3]

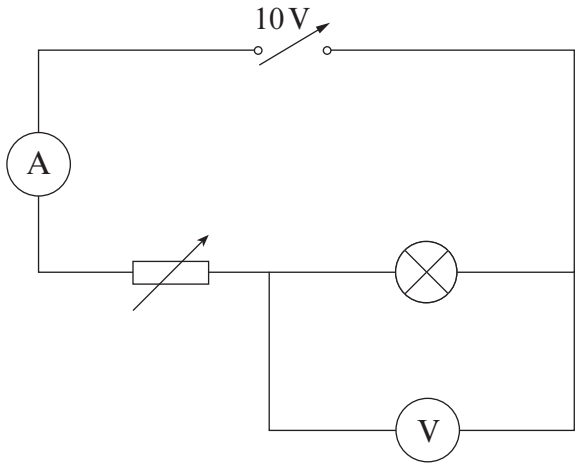
B				

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2. Students use this circuit to investigate how the resistance and power of a lamp change as they alter the current through it.

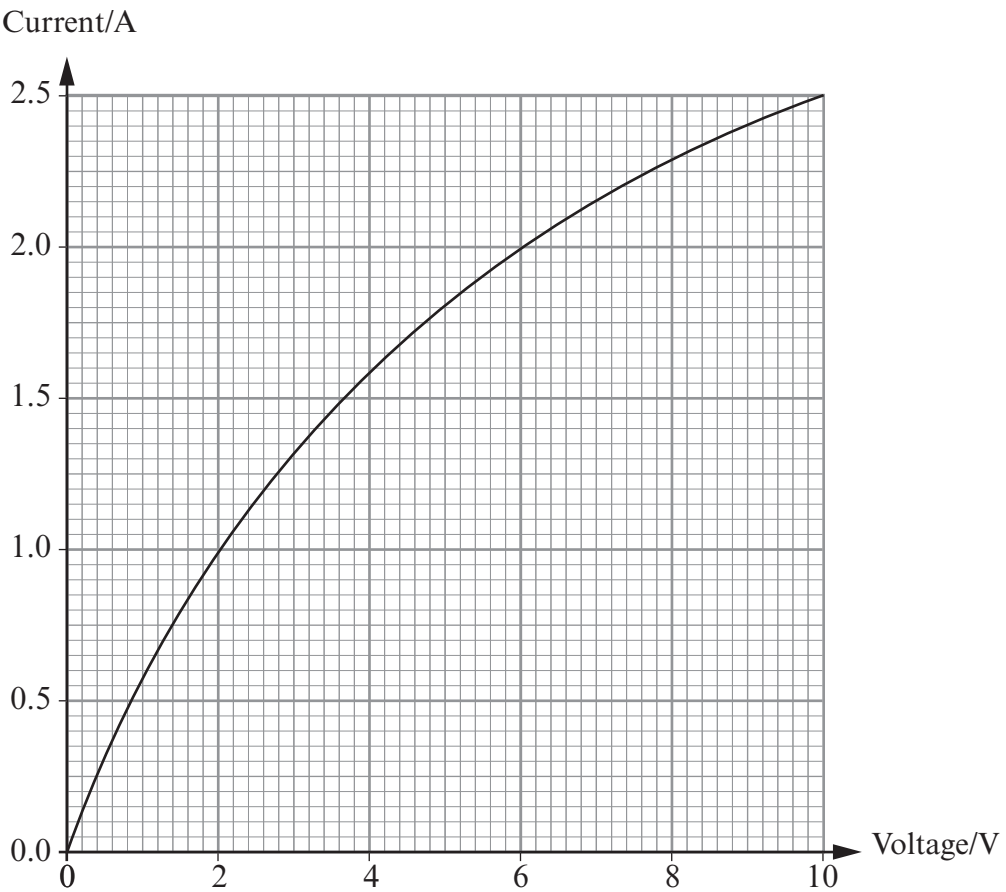


(a) State **two** ways of changing the current. [2]

1. .....

2. .....

(b) They record the values of the current across the lamp as the voltage changes and plot this graph.



(i) Use the graph to find the value of the voltage when the current is 2.0 A. [1]

Voltage = ... V

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(ii) Use the equation

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

to calculate the resistance of the lamp when the voltage is 2.0 V. [2]

Resistance = ... Ω

(iii) Use the equation

$$\text{power} = \text{voltage} \times \text{current}$$

to calculate the power of the lamp when a current of 2.0 A flows through it. [2]

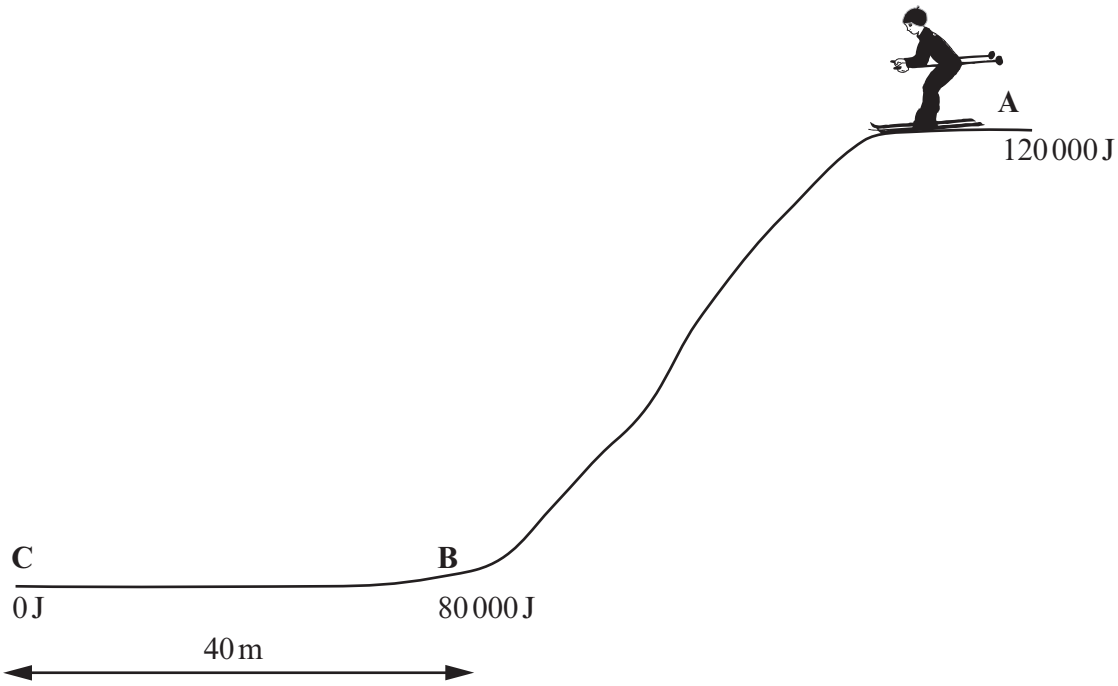
Power = ... W

7

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3. A skier slides down a slope from **A** and comes to rest at **C**. Her energies at points **A**, **B** and **C** are shown on the diagram.



(a) Put a circle around the answer which completes each sentence. [2]

(i) The energy lost in sliding down the slope from **A** to **B** is

40 000 J 80 000 J 120 000 J 200 000 J

(ii) The work done against the force acting on the skier between **B** and **C** is

40 000 J 80 000 J 120 000 J 200 000 J

(b) (i) Give a reason why energy is lost by the skier when she slides from **A** to **B**. [1]

.....

.....

(ii) Use the equation

$$\text{Force} = \frac{\text{Work done}}{\text{distance}}$$

to calculate the size of the force that brings the skier to rest at **C**. [2]

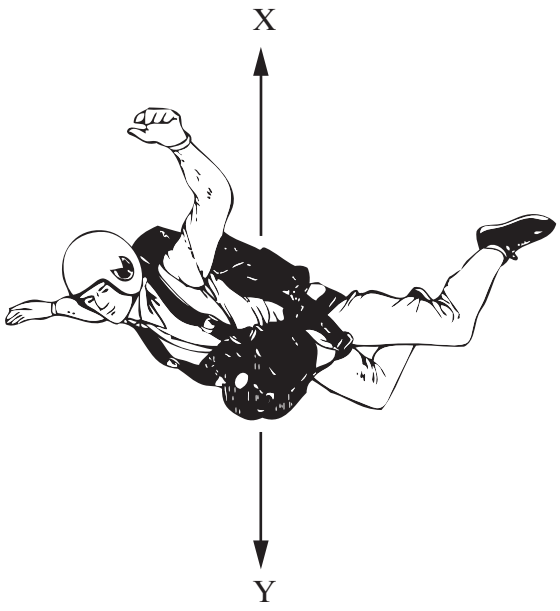
Force = ... N

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4. The diagram shows the forces X and Y acting on a skydiver of mass 70 kg during free fall.



(a) Underline the correct word in the brackets to correctly complete each of the sentences below. [4]

(i) Force X is due to (air resistance, gravity, weight)

(ii) Force Y is due to (air resistance, friction, gravity)

(iii) During the fall, force X (decreases, stays the same, increases)

(iv) During the fall, force Y (decreases, stays the same, increases)

(b) Describe the motion of the skydiver when force X is equal to force Y. [1]

.....

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(c) Use the information above and the equation

resultant force = mass × acceleration

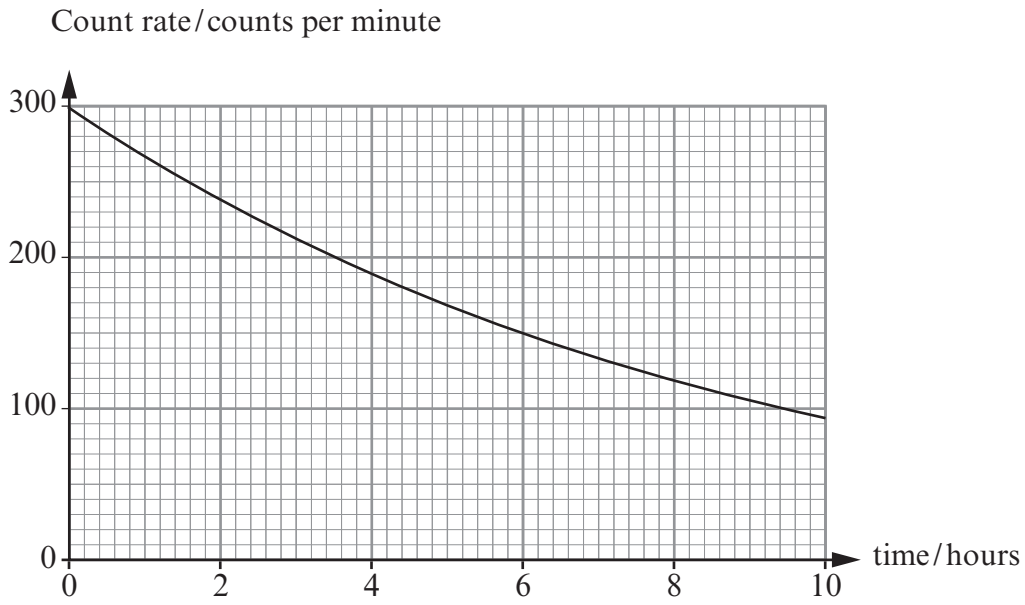
to calculate the resultant force on the skydiver when her acceleration is 5 m/s^2. [2]

Force = ... N

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5. To study the blood flow a doctor injects some technetium-99 (Tc-99) into a patient. The gamma radiation given out by the Tc-99 atoms is detected using a gamma camera outside the patient's body.
The graph shows how the count rate from a sample of Tc-99 changes with time.



(a) (i) How many hours does it take for the count rate to fall from 300 counts per minute to 150 counts per minute? [1]

Number of hours = ...

(ii) What is the half life of Tc-99? [1]

Half life = ...

(iii) How long will it take for the count rate to fall from 300 to 75 counts per minute? [1]

Time taken = ...

(b) Explain why an alpha emitting source would be unsuitable to study blood flow. [2]

.....

.....

.....

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6. The table shows the average annual dose of background radiation everybody receives in a year.

Radiation Source	Average Annual Whole Body Dose (units)
Cosmic	29
Rocks	29
Radon	200
Air	40
X-ray	39
Nuclear Medicine	14
Food	11
TOTAL	.....

(a) (i) Complete the table to find the total average annual dose. [1]

(ii) Which radiation source produces the largest background dose? ..... [1]

(iii) What is the annual dose from man made sources? ..... units [1]

(b) (i) Give a reason why people living at sea level receive a lower natural dose than those who live up a mountain. [1]

.....

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(ii) State **one** method of reducing the build up of radon in homes. [1]

.....

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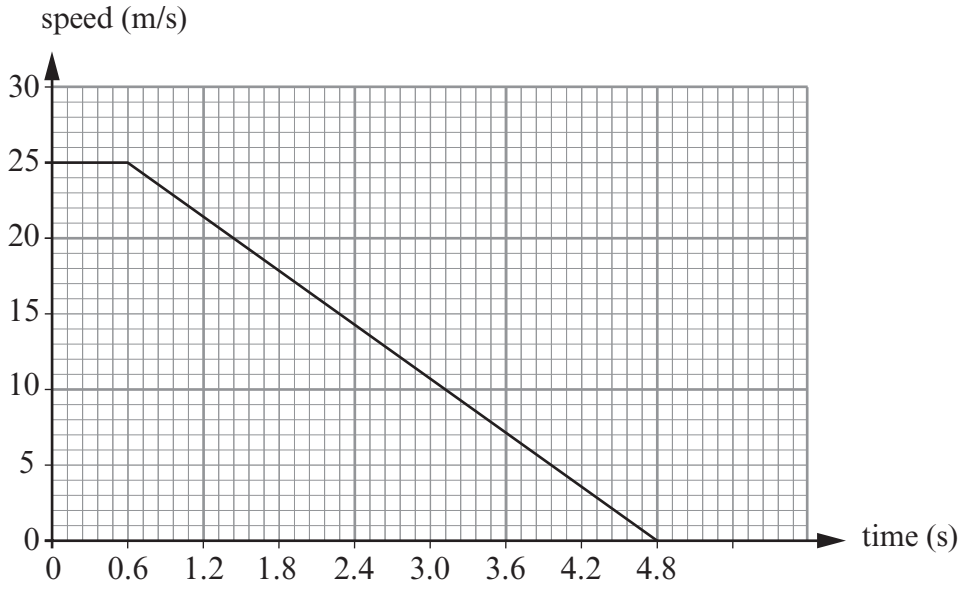
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7. The overall stopping distance for a car is given by the equation below:

Overall stopping distance = Thinking distance + Braking distance

The graph below is the speed-time graph for a car initially travelling at a constant speed. The time starts from the moment the driver sees an obstacle on the road.



(i) What is the reaction (thinking) time of the driver of this car? ..... [1]

(ii) Use the equation

distance = speed × time

to calculate the distance travelled by the car during the driver's thinking time. [2]

distance = ... m

(iii) Use the equation

$$\text{deceleration} = \frac{\text{change in speed}}{\text{time}}$$

to calculate the deceleration of the car during the time when the brakes are applied. [2]

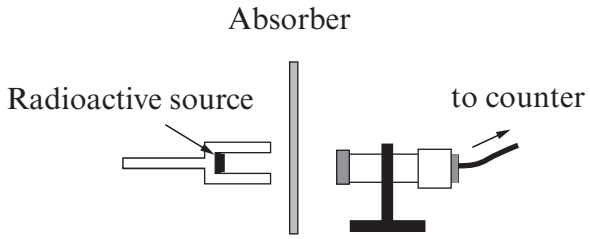
Deceleration = ... m/s^2

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8. *(a)* The diagram shows the apparatus used to investigate the radiation emitted from two sources, **Y** and **Z**.



The table below shows the **counts per minute** obtained when different materials were placed between the sources and the detector. All the readings do not include background radiation.

Radioactive Source	No absorber Present (counts/min)	Paper Absorber (counts/min)	Aluminium absorber 4 mm thick (counts/min)	Lead absorber 3 cm thick (counts/min)
Y	320	320	320	50
Z	315	180	180	0

Use the information in the table to answer the following questions.

(i) How can you tell that source **Y** only emits one type of radiation? [1]

.....

(ii) Explain how you can tell that source **Z** emits alpha and gamma radiation but not beta. [2]

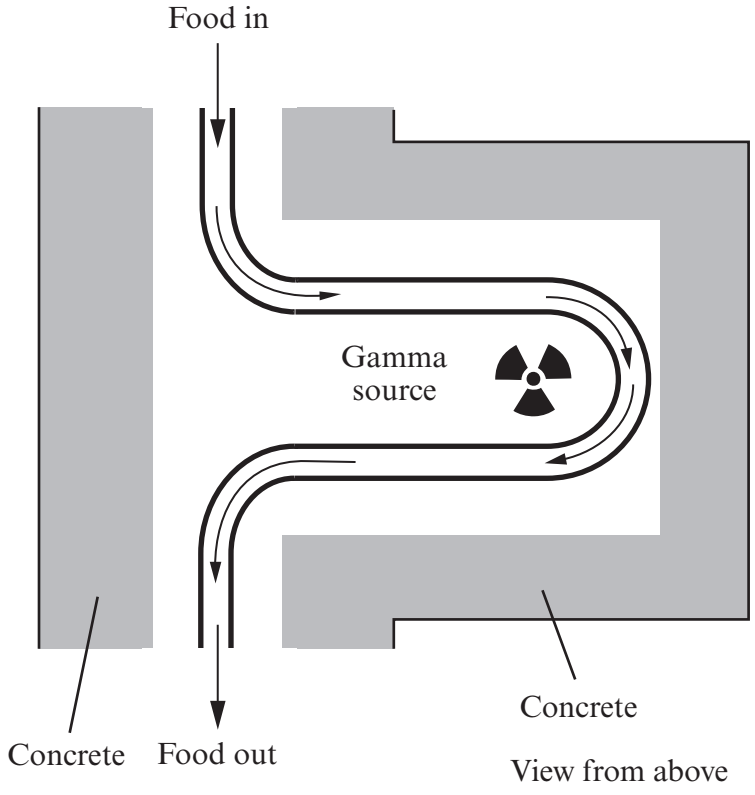
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(b) Fresh fruit and vegetables can be treated with gamma radiation to kill the bacteria that make them rot.
The diagram shows how the food on a conveyor belt passes a gamma source.



(i) The food is packed in crates.
Give a reason why a gamma source must be used rather than alpha or beta. [1]

.....

.....

(ii) Explain why the food treatment area must be enclosed with thick concrete. [2]

.....

.....

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.....

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9. Domestic circuits consist of live, neutral and earth wires.

(i) Describe the purpose of the neutral wire. [1]

.....

.....

(ii) In modern homes, fuses have been replaced with miniature circuit breakers (mcb). What are the advantages of using mcb instead of fuses? [2]

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(iii) State the type of fault that would cause an mcb to break a circuit. [1]

.....

.....

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