

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE**

**A182/01**

**TWENTY FIRST CENTURY SCIENCE**  
**PHYSICS A/ADDITIONAL SCIENCE A**  
**Modules P4 P5 P6 (Foundation Tier)**

**FRIDAY 12 JUNE 2015: Afternoon**

**DURATION: 1 hour**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**  
**A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**  
**None**

**OTHER MATERIALS REQUIRED:**  
**Pencil**  
**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**

**Use black ink. HB pencil may be used for graphs and diagrams only.**

**Answer ALL the questions.**

**Read each question carefully. Make sure you know what you have to do before starting your answer.**

**Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil ().**

**A list of useful relationships is printed on pages 4 and 5.**

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

**The total number of marks for this paper is 60.**

**Any blank pages are indicated.**

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# **TWENTY FIRST CENTURY SCIENCE EQUATIONS**

## **Useful relationships**

### **The Earth in the Universe**

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

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

### **Sustainable energy**

$$\text{energy transferred} = \text{power} \times \text{time}$$

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

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

## Explaining motion

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

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\frac{\text{change of momentum}}{\text{force}} = \frac{\text{resultant}}{\text{force}} \times \frac{\text{time for which it acts}}{\text{it acts}}$$

$$\frac{\text{work done by a force}}{\text{force}} = \frac{\text{distance moved in the direction of the force}}{\text{direction of the force}}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\frac{\text{change in gravitational potential energy}}{\text{weight}} = \frac{\text{vertical height difference}}{\text{vertical height difference}}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

## Electric circuits

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

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

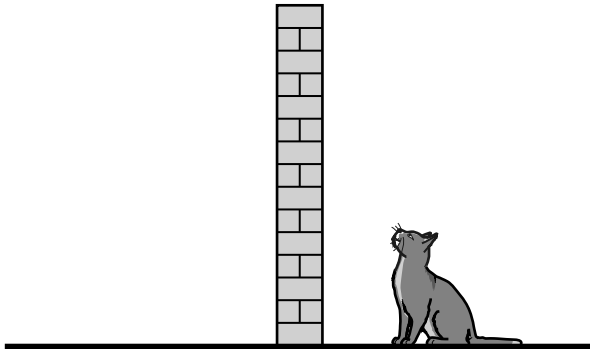
$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

## Radioactive materials

$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

**Answer ALL the questions.**

- 1 Iggy the cat is sitting next to the bottom of a wall.**



**He jumps from the ground onto the wall.  
Iggy has mass 5 kg and weighs 50 N. The wall is 1.2 m high.**

- (a) What is the correct way to calculate the gravitational potential energy gained by Iggy?**

**Put a ring around the correct answer.**

$$\frac{5 \text{ kg}}{1.2 \text{ m}}$$

$$5 \text{ kg} \times 1.2 \text{ m}$$

$$\frac{50 \text{ N}}{1.2 \text{ m}}$$

$$50 \text{ N} \times 1.2 \text{ m}$$

**[1]**

- (b) As Iggy walks along the wall he knocks a plant pot off the wall.  
The pot falls to the ground.**

**(i) What force pulls the pot to the ground?**

\_\_\_\_\_ **[1]**

**(ii) What type of energy does the pot gain as it falls?**

\_\_\_\_\_ **[1]**

- (c) The pot hits the ground and breaks.**

**Complete the sentence, using ONE of the phrases below:**

**less than**

**more than**

**the same as**

**The total energy of the broken pot and its surroundings when it is on the ground is**

**\_\_\_\_\_ the total energy of the pot and its surroundings when it is on the wall. [1]**

**(d) George and Kate are doing an experiment with falling objects.**

**They use two balls of the same shape and size, but DIFFERENT MASSES.**

**They release the balls from the same height above the floor.**

**The balls take the same time to drop to the floor.**

**Explain why the balls have the SAME SPEED but DIFFERENT KINETIC ENERGY.**

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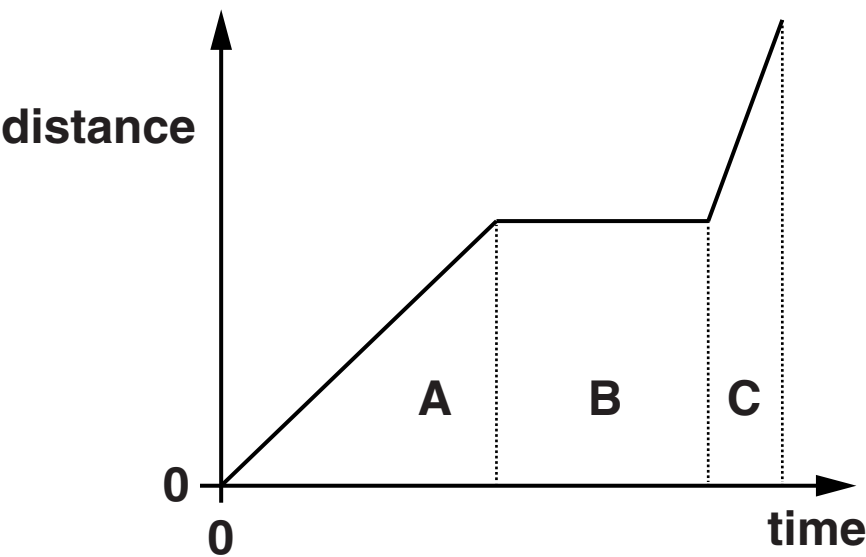
**[2]**

**[TOTAL: 6]**



**2 Alex goes for a ride on his bike.**

**The graph shows how his distance from the start of his ride changes with time.**



**(a) The graph has been divided into three regions A, B and C.**

**Which region or regions show each type of motion?**

**Put ticks (✓) in the correct box or boxes for each row.**

**You may tick more than one box in a row.**

TYPE OF MOTION	REGION		
	A	B	C
Stationary			
Moving with constant speed			
Fastest speed			

**[3]**

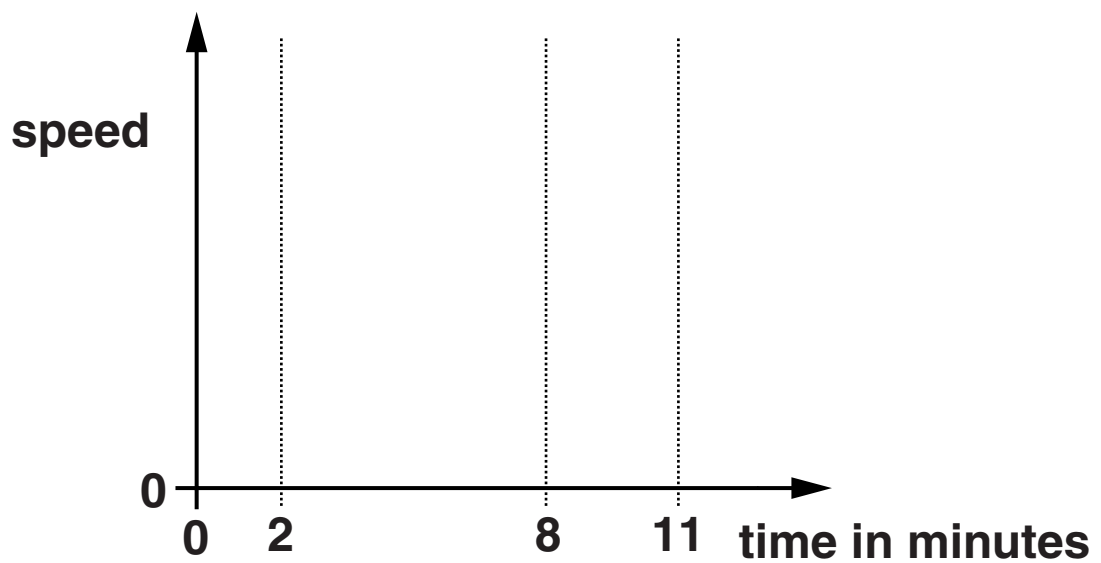
**(b) On his return ride, Alex:**

**accelerates from rest from 0 to 2 minutes**

**then rides at constant speed from 2 to 8 minutes**

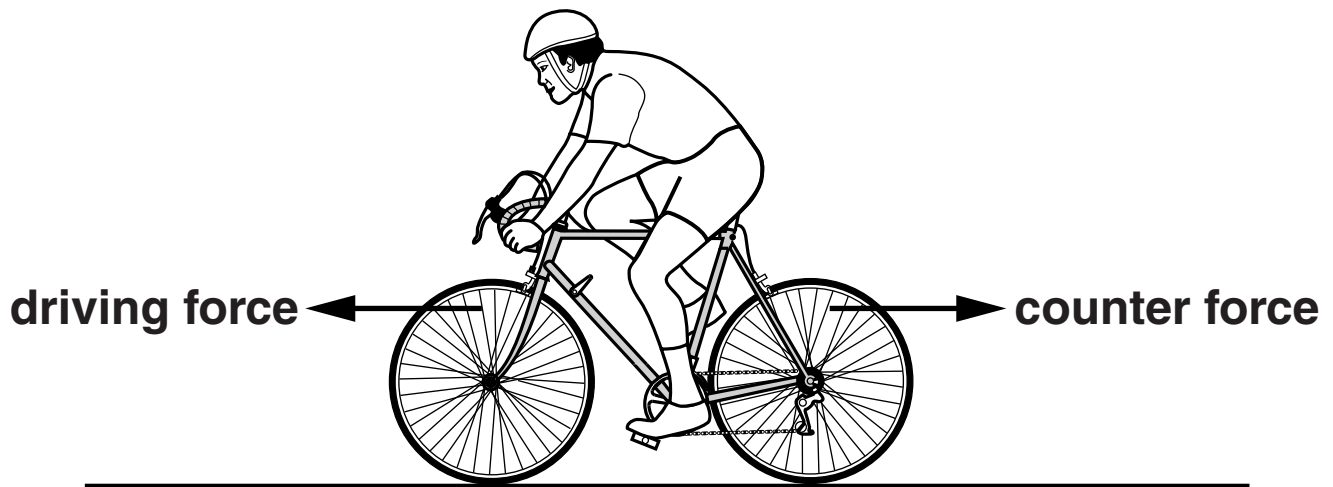
**and finally slows down and comes to rest at 11 minutes.**

**On the sketch graph below show how Alex's SPEED changes with time during his return ride.**



**[3]**

- (c) Alex rides along a straight horizontal road. There are two horizontal forces acting on him and his bike, as shown in the diagram.



- (i) What is the counter force due to?

\_\_\_\_\_ [1]

- (ii) How does the driving force compare with the counter force when he is travelling at **CONSTANT SPEED**?

Put a tick (✓) in the box next to the correct answer.

The driving force is **SLIGHTLY BIGGER** than the counter force. ☐

The driving force is **MUCH BIGGER** than the counter force. ☐

The driving force is **SMALLER** than the counter force. ☐

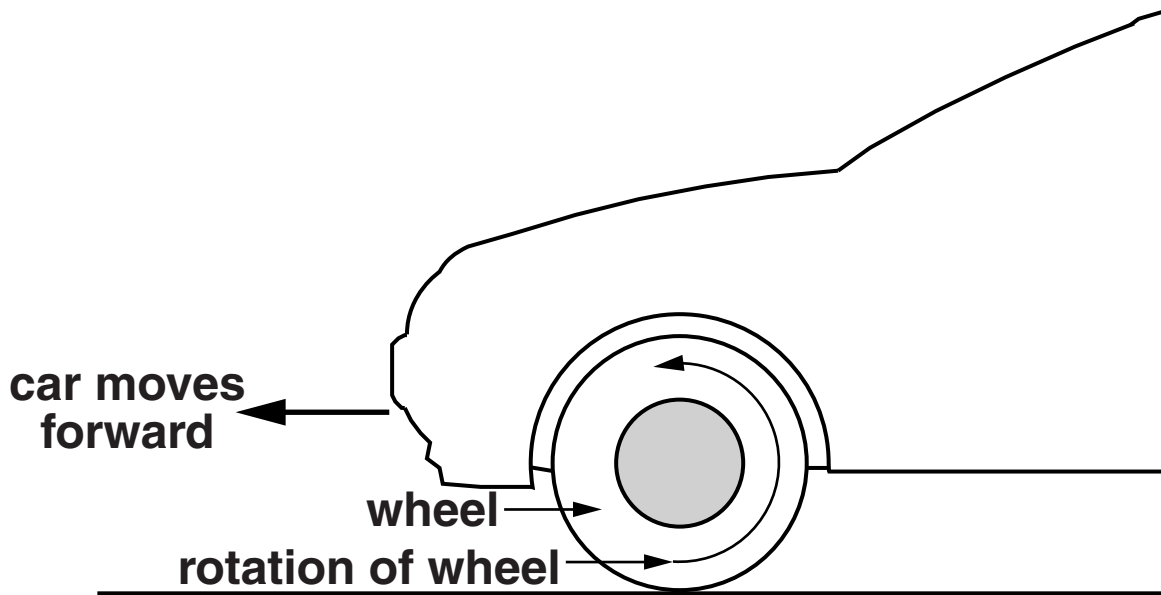
The driving force is **THE SAME AS** the counter force. ☐

[1]

[TOTAL: 8]

- 3 This question is about the forces that make a car move forwards.**

**The rotation of a wheel causes the car to move forward.**



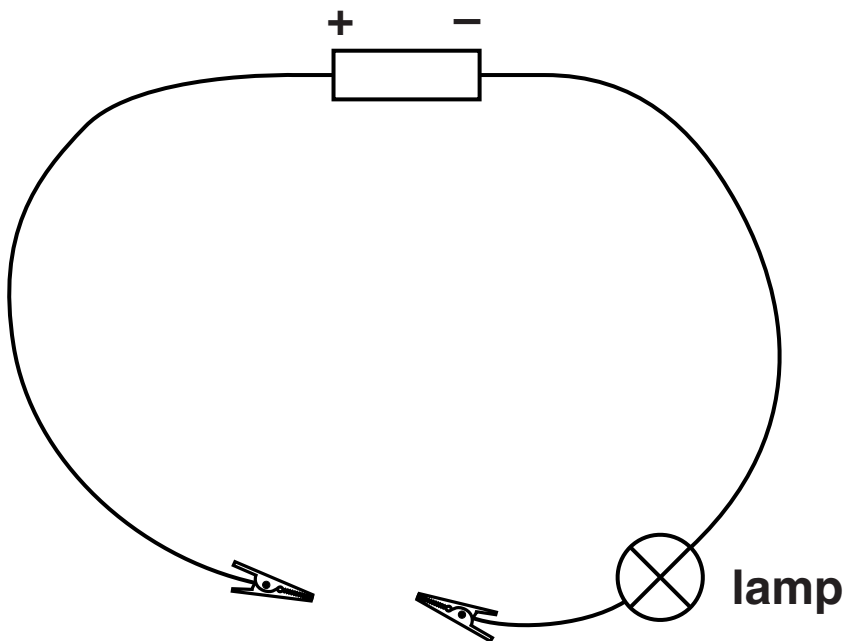
**When the road is icy, it is more difficult to get the car moving.**

**You may draw LABELLED arrows on the diagram to help you answer the question.**



**[TOTAL: 6]**

- 4 Anna sets up an electrical circuit to test different materials.**



- (a) The lamp glows when she puts a piece of copper into the circuit between the clips.**

**(i) Why is there a current in the circuit?**

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**[2]**

**(ii) Suggest a change Anna could make to the circuit so that this lamp is brighter.**

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**[1]**

**(b) Anna replaces the copper in the circuit with plastic. The lamp does not light.**

**Explain why the plastic is not a conductor.**

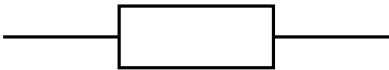
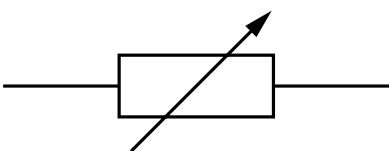
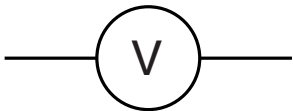
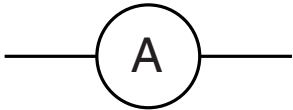
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**[1]**

**[TOTAL: 4]**

- 5 Draw one straight line from each symbol to its correct name.

SYMBOL





NAME
Ammeter
Fixed resistor
Variable resistor
Voltmeter

[3]

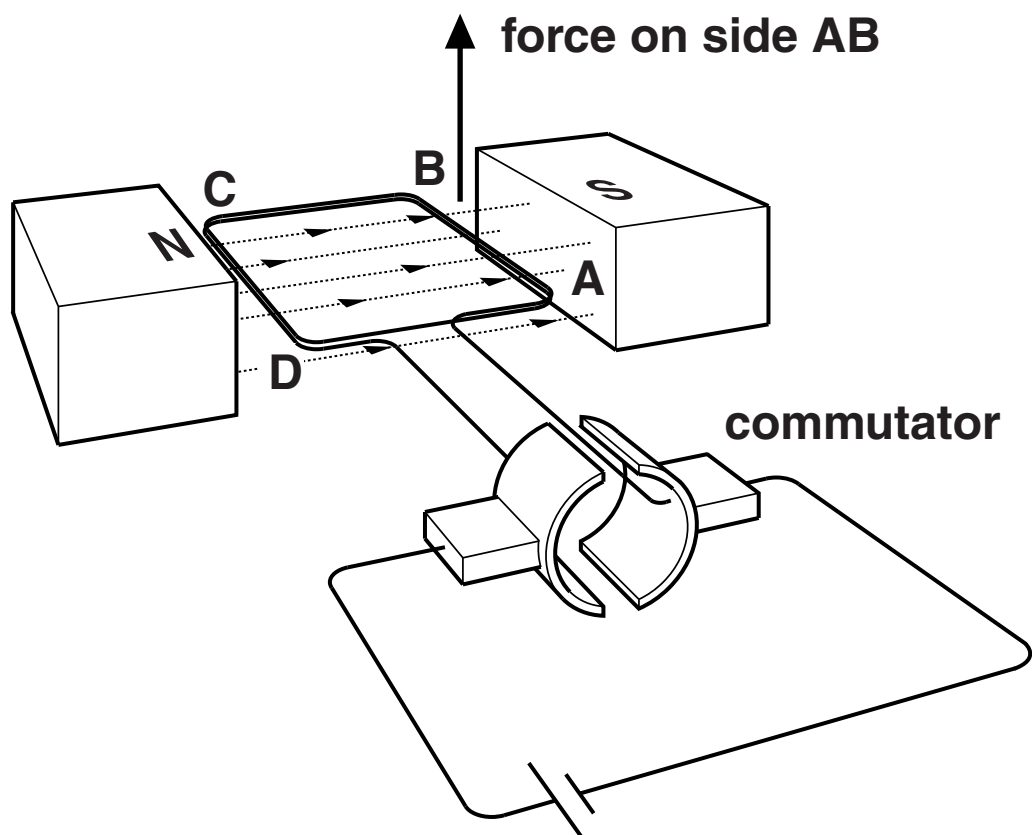
[TOTAL: 3]



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**6 Lots of devices use an electric motor.**

**The diagram shows the main features of a motor.**



**(a) The arrow ON THE DIAGRAM shows the force acting on side AB when a current flows in the coil.**

**(i) Draw another arrow on the diagram showing the force on side CD.** [1]

**(ii) Why are there forces on sides AB and CD?**

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**[2]**

**(b) Explain the function of the commutator in this motor.**

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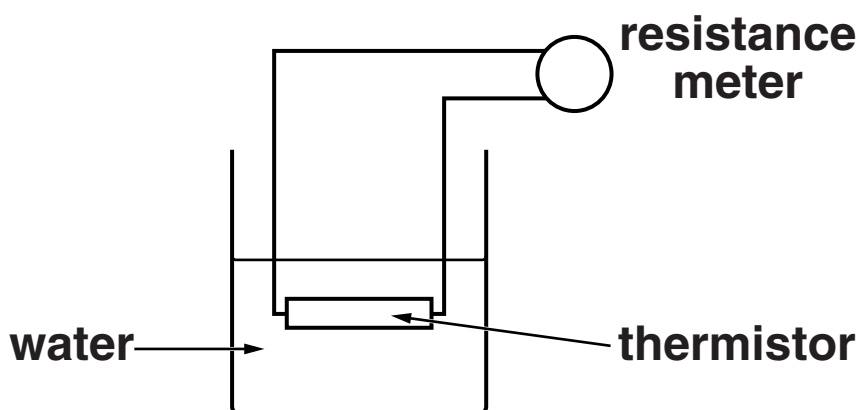
**[3]**

**[TOTAL: 6]**

**7 Sarah is doing an experiment with a thermistor.**

**She connects a meter to the thermistor to measure its resistance.**

**She puts the thermistor in a beaker of cold water and then warm water and records its resistance each time.**



**Here are Sarah's results.**

<b>TEMPERATURE OF WATER</b>	<b>RESISTANCE OF THERMISTOR IN <math>k\Omega</math></b>
<b>cold</b>	<b>33.0</b>
<b>warm</b>	<b>28.5</b>

**Sarah thinks that there is a correlation between the temperature of the water and the resistance of the thermistor.**

**Is Sarah right about a correlation and what should she do to confirm her conclusion?**



**The quality of written communication will be assessed in your answer.**

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**[6]**

**[TOTAL: 6]**

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- 8 A teacher does an experiment to measure the half-life of a radioactive source.**

**She begins by measuring the background radiation.**

- (a) State a source of background radiation.**

\_\_\_\_\_ **[1]**

- (b) She places the source in front of a Geiger counter, which measures the amount of ionising radiation.**

**Radioactive materials give out ionising radiation.**

**Which of the following types of radiation are given out by radioactive materials?**

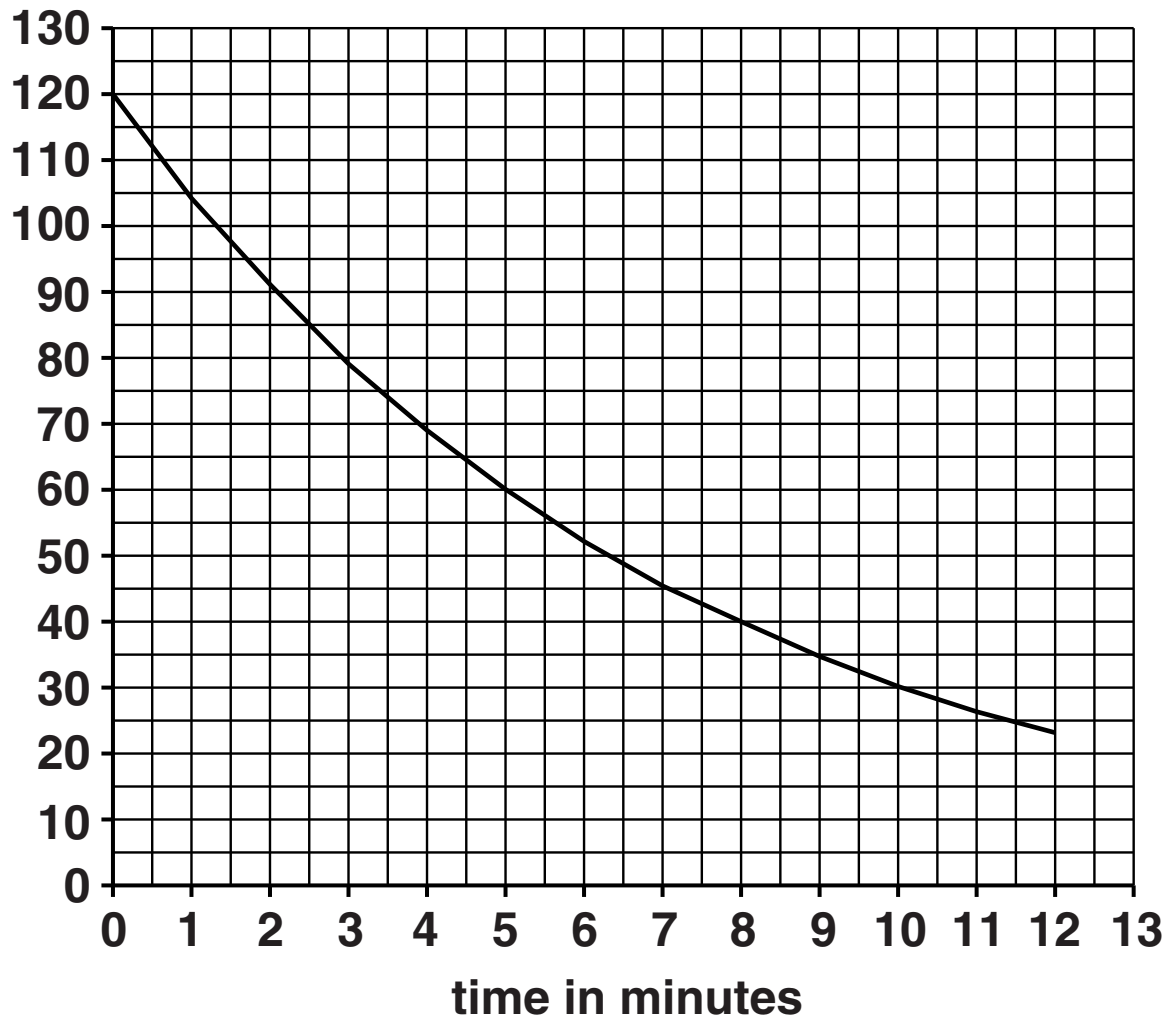
**Put ticks (✓) in the boxes next to the TWO correct answers.**

- |                    |                          |
|--------------------|--------------------------|
| <b>beta</b>        | <input type="checkbox"/> |
| <b>gamma</b>       | <input type="checkbox"/> |
| <b>red light</b>   | <input type="checkbox"/> |
| <b>ultraviolet</b> | <input type="checkbox"/> |
| <b>X-rays</b>      | <input type="checkbox"/> |

**[2]**

**(c) This graph shows how the activity of the radioactive source changes with time.**

**activity  
in counts  
per minute**





**(i) Jo says the half-life is 5 minutes.**

**Use the graph to decide if she is correct.**

**Justify your answer.**

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**[2]**

**(ii) A source is considered safe when its activity becomes the same as background radiation.**

**The background radiation is 30 counts per minute.**

**Use the graph to estimate when this source is considered safe.**

**time = \_\_\_\_\_ minutes [1]**

- (d) The teacher handles the radioactive source very carefully to avoid the risk of IRRADIATION and CONTAMINATION.

What is meant by IRRADIATION and CONTAMINATION?

irradiation \_\_\_\_\_

\_\_\_\_\_

contamination \_\_\_\_\_

\_\_\_\_\_ [2]

[TOTAL: 8]

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- 9 (a) The diagram below is a way of showing the particles that make up an atom.

Draw a straight line from each box on the left to show where the particles are in the atom on the right.

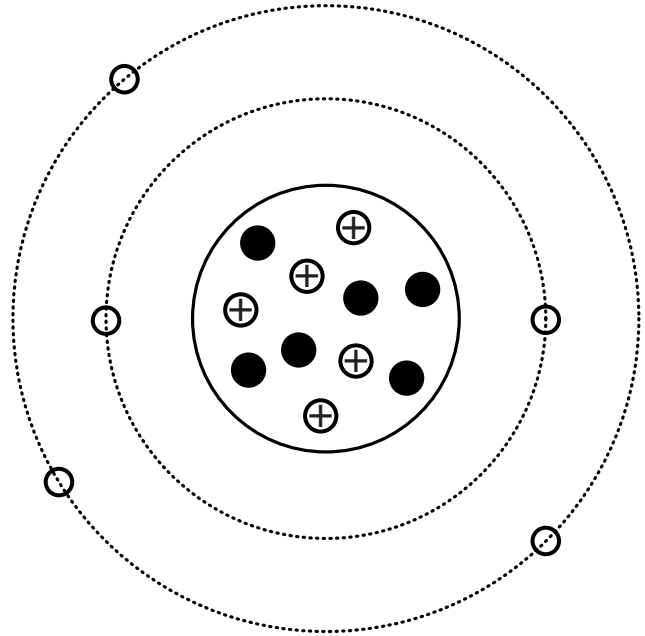
[2]

**PARTICLE**

electron

neutron

proton



- (b) A nuclear reaction takes place in the Sun releasing a lot of energy.

Hydrogen nuclei join together to produce helium.

What is the name of this process?

Put a ring around the correct answer.

fission

fusion

half-life

radioactivity

[1]

**(c) Nuclear power stations produce radioactive waste.**

**The waste is categorised as high level, intermediate level and low level.**

**Draw a straight line from each LEVEL OF WASTE on the left to its METHOD OF DISPOSAL on the right.**

**LEVEL OF  
WASTE**

**High**

**METHOD OF DISPOSAL**

**Mix with concrete; put in steel drums; keep in purpose-built stores.**

**Intermediate**

**Store under water for many years; put in drums in an underground store.**

**Low**

**Put in drums; surround by concrete; keep in landfill sites.**

**[2]**

**(d) Wayne has been thinking about the risk to humans from radioactive nuclear waste.**

**Wayne says ‘send it all up into space so that it is far away from everyone’.**

**Do you think this is a good idea?**

**Justify your answer.**

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**[2]**

**[TOTAL: 7]**

**10 Gail and Tom are discussing whether to have an X-ray taken.**

**Gail says ‘I’m pregnant. Should I have an X-ray taken of my baby?’.**

**Tom says ‘when I go to the dentist he may want to take an X-ray of my teeth. Should I have it taken?’.**

**Here are some data about radiation doses.**

<b>SOURCE OF RADIATION</b>	<b>DOSE IN mSv</b>
<b>Background radiation per year</b>	<b>2.600</b>
<b>X-ray of body</b>	<b>0.700</b>
<b>X-ray of teeth</b>	<b>0.005</b>

**Use the data and your own knowledge to advise Gail and Tom about the benefits and risks of having an X-ray taken.**

**[6]**



**The quality of written communication will be assessed in your answer.**

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**[TOTAL: 6]**

**END OF QUESTION PAPER**



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