

**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 24pt

Candidate forename		Candidate surname	
-------------------------------	--	------------------------------	--

Centre number						Candidate number				
--------------------------	--	--	--	--	--	-----------------------------	--	--	--	--

**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 4–6.

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.

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

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

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

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

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

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

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

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

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

Electric circuits

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

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

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

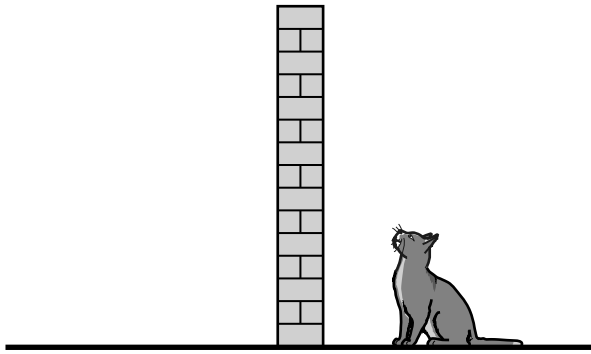
Radioactive materials

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

BLANK PAGE

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.

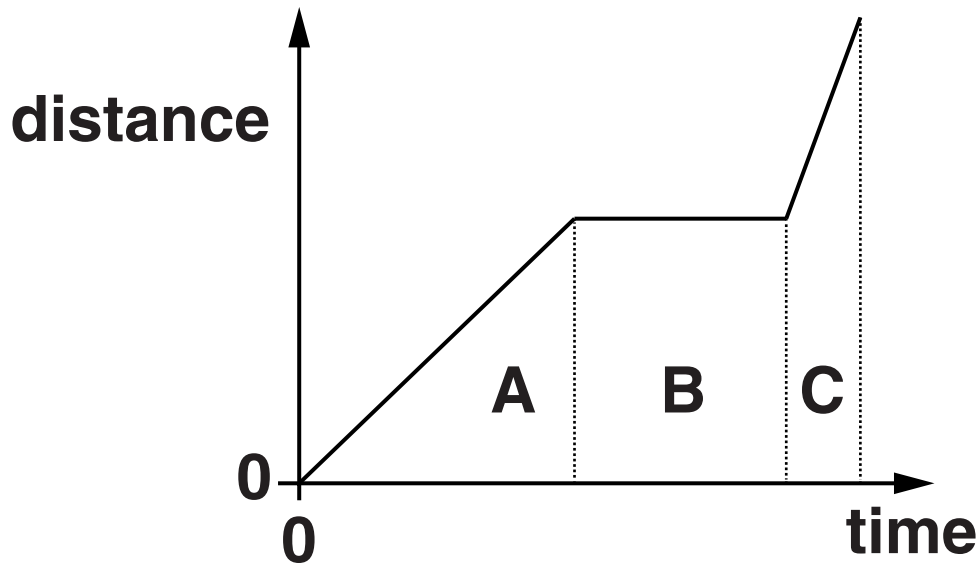
[2]

[TOTAL: 6]

BLANK PAGE

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]

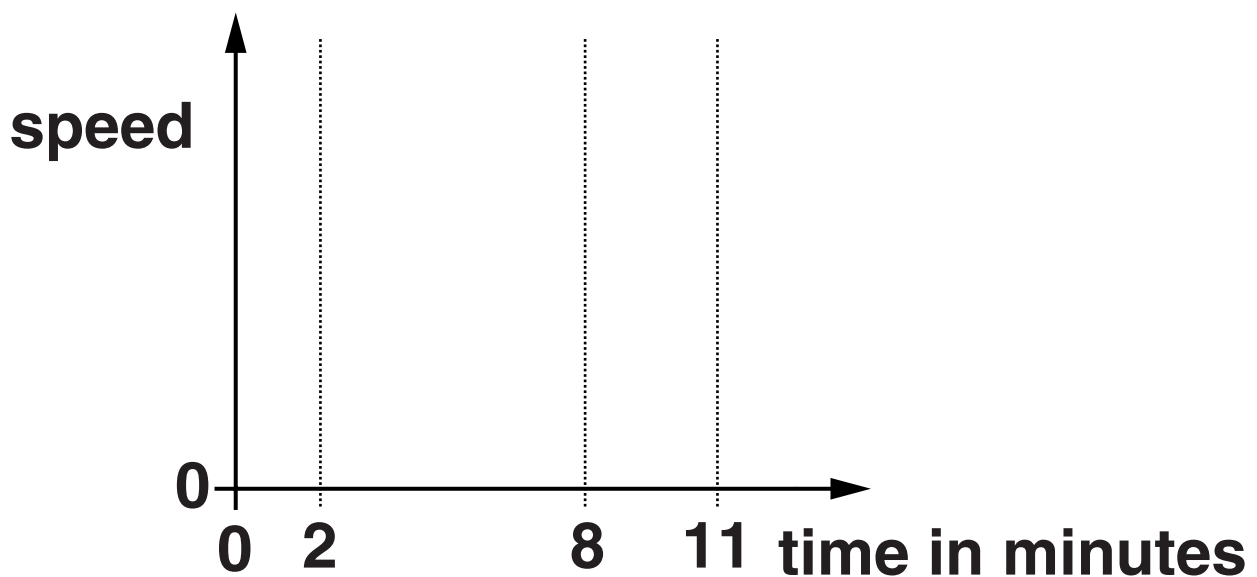
(b) On his return ride, Alex:

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

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

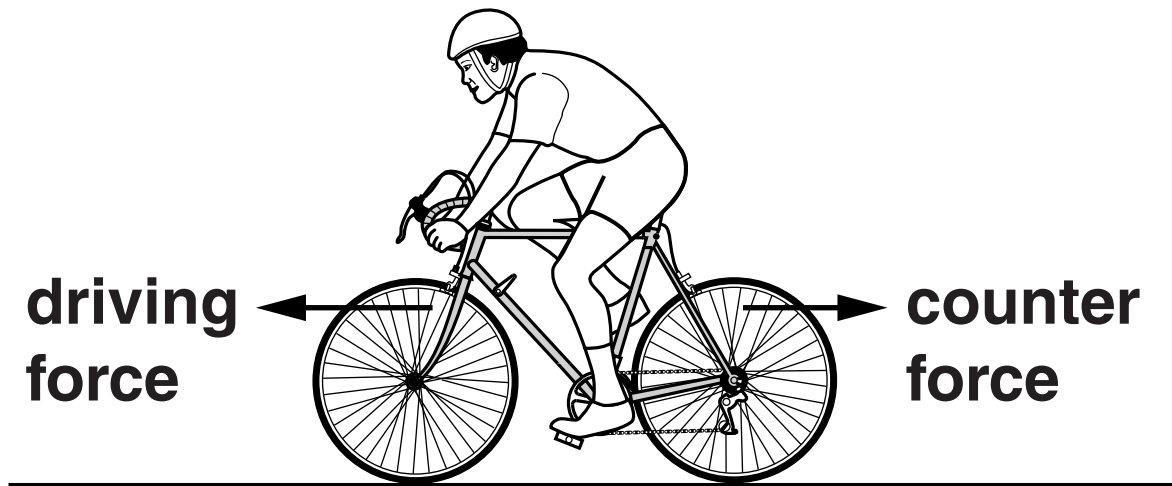
**and finally slows down and comes
to rest at 11 minutes.**

**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. ☐

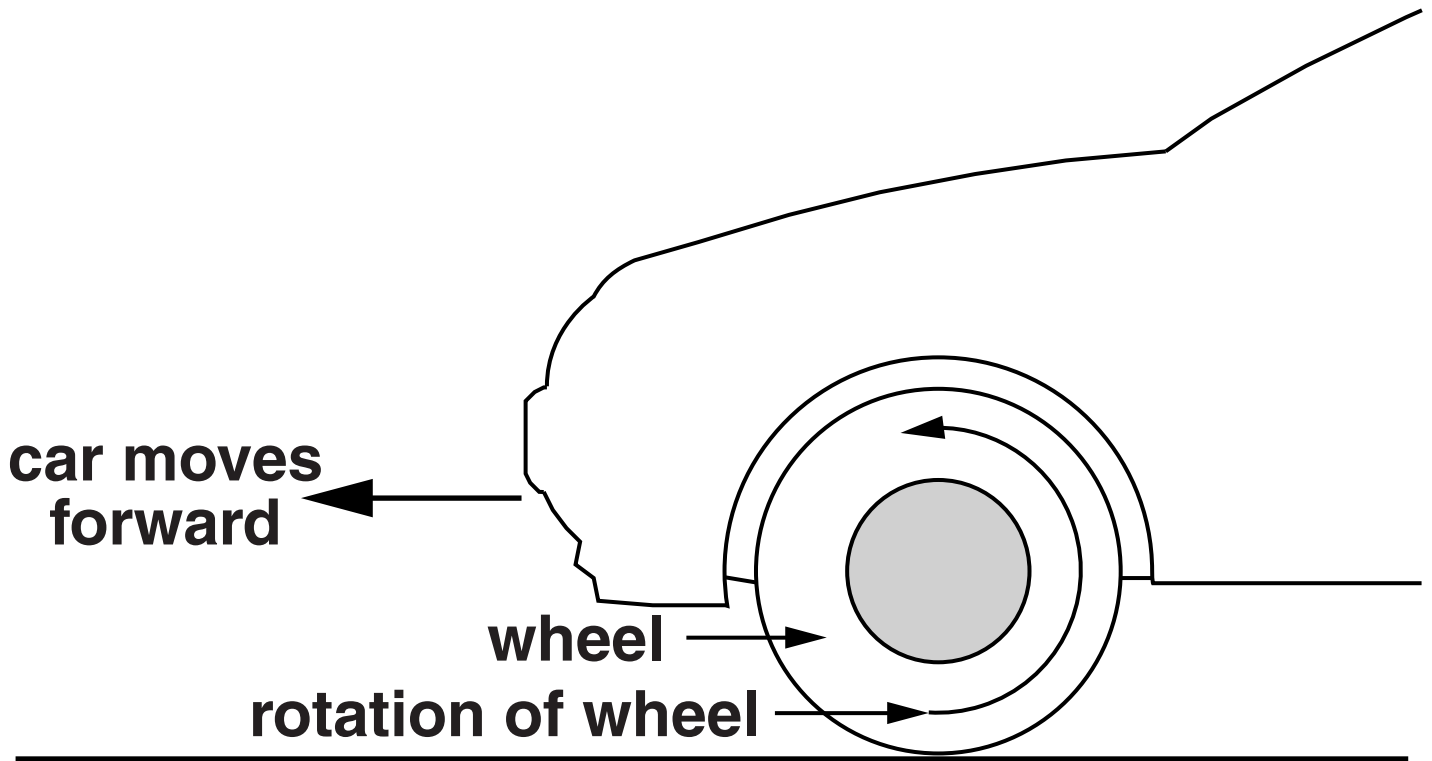
[1]

[TOTAL: 8]

BLANK PAGE

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

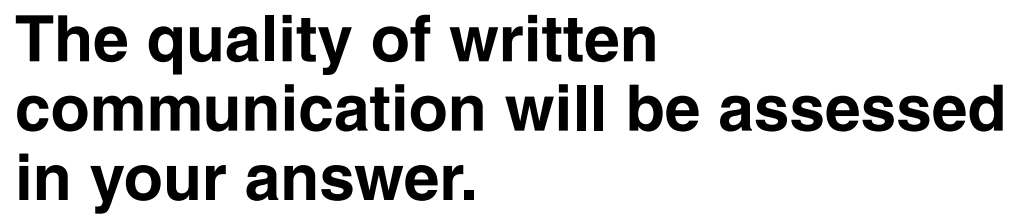
The rotation of a wheel causes the car to move forward.



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

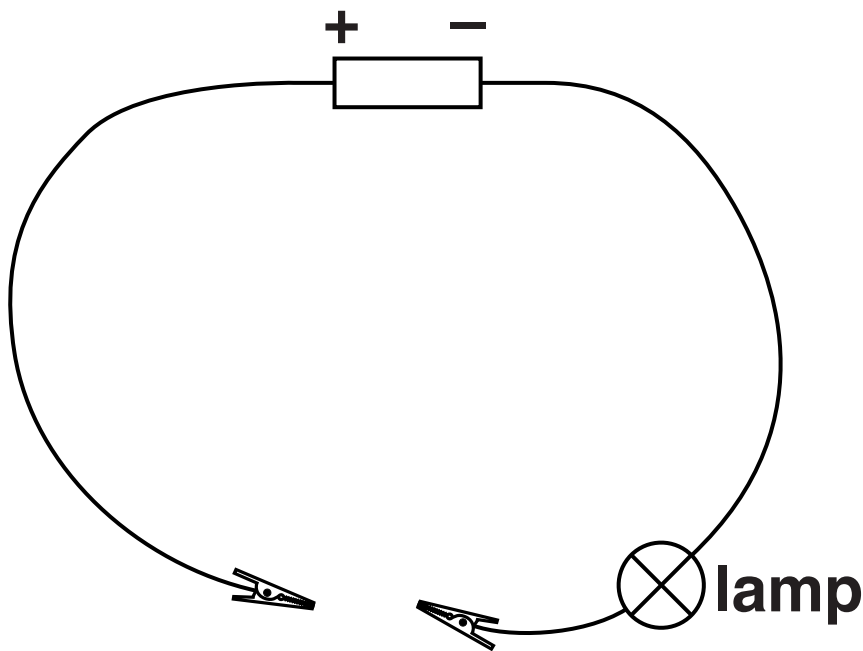
Use ideas about forces to explain how the rotation of a wheel makes the car move forward and why it is more difficult to get the car moving when the road is icy.

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?**

[2]

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

[1]


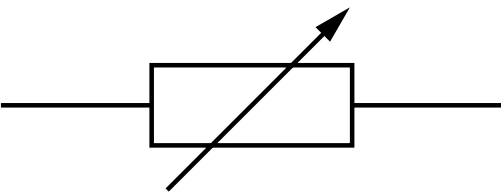
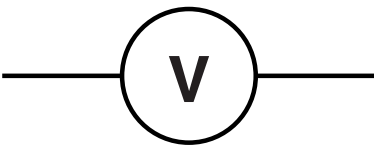
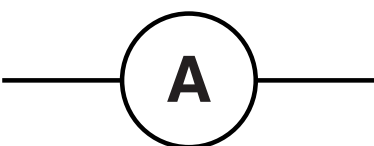
(b) Anna replaces the copper in the circuit with plastic. The lamp does not light.

Explain why the plastic is not a conductor.

[1]

[TOTAL: 4]

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

SYMBOL





NAME
Ammeter
Fixed resistor
Variable resistor
Voltmeter

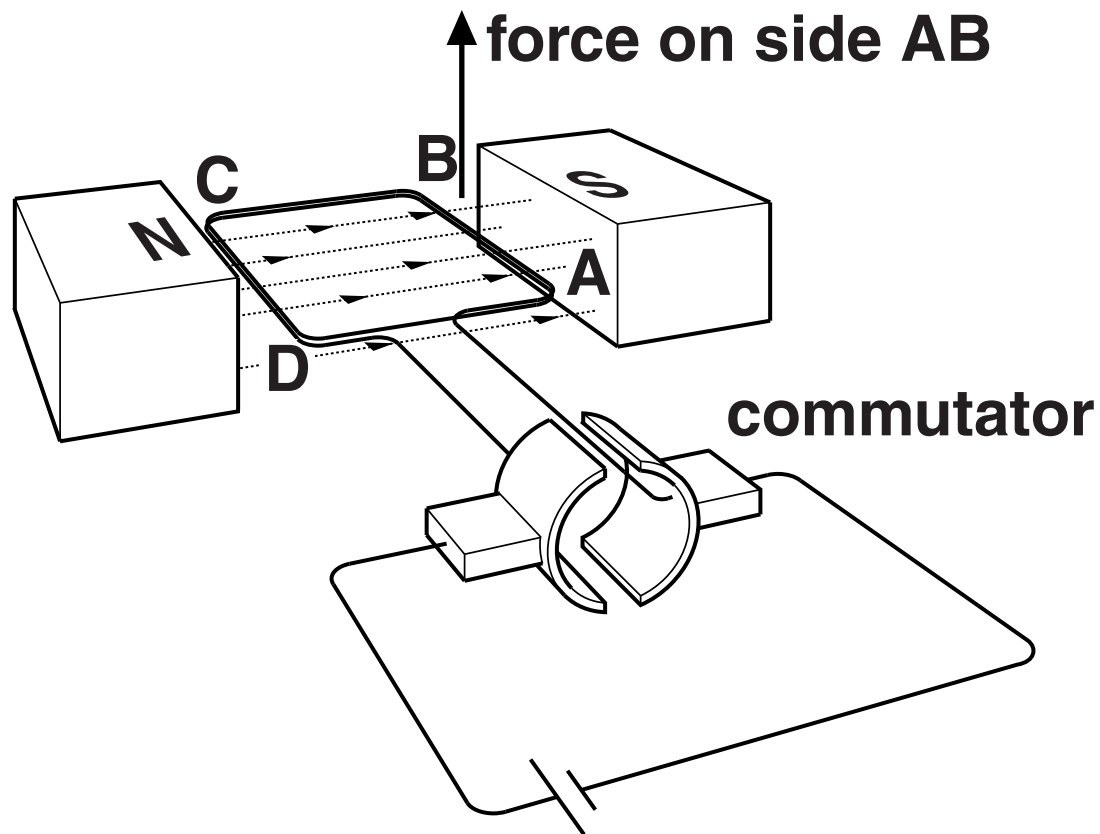
[3]

[TOTAL: 3]

BLANK PAGE

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?

[2]

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

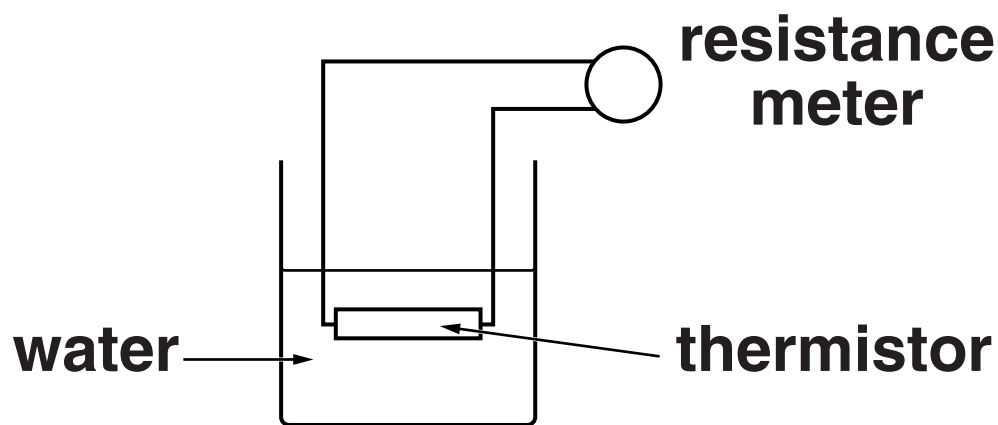
[3]

[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.

TEMPERATURE OF WATER	RESISTANCE OF THERMISTOR IN $k\Omega$
cold	33.0
warm	28.5

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.

[6]

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.

beta

☐

gamma

☐

red light

☐

ultraviolet

☐

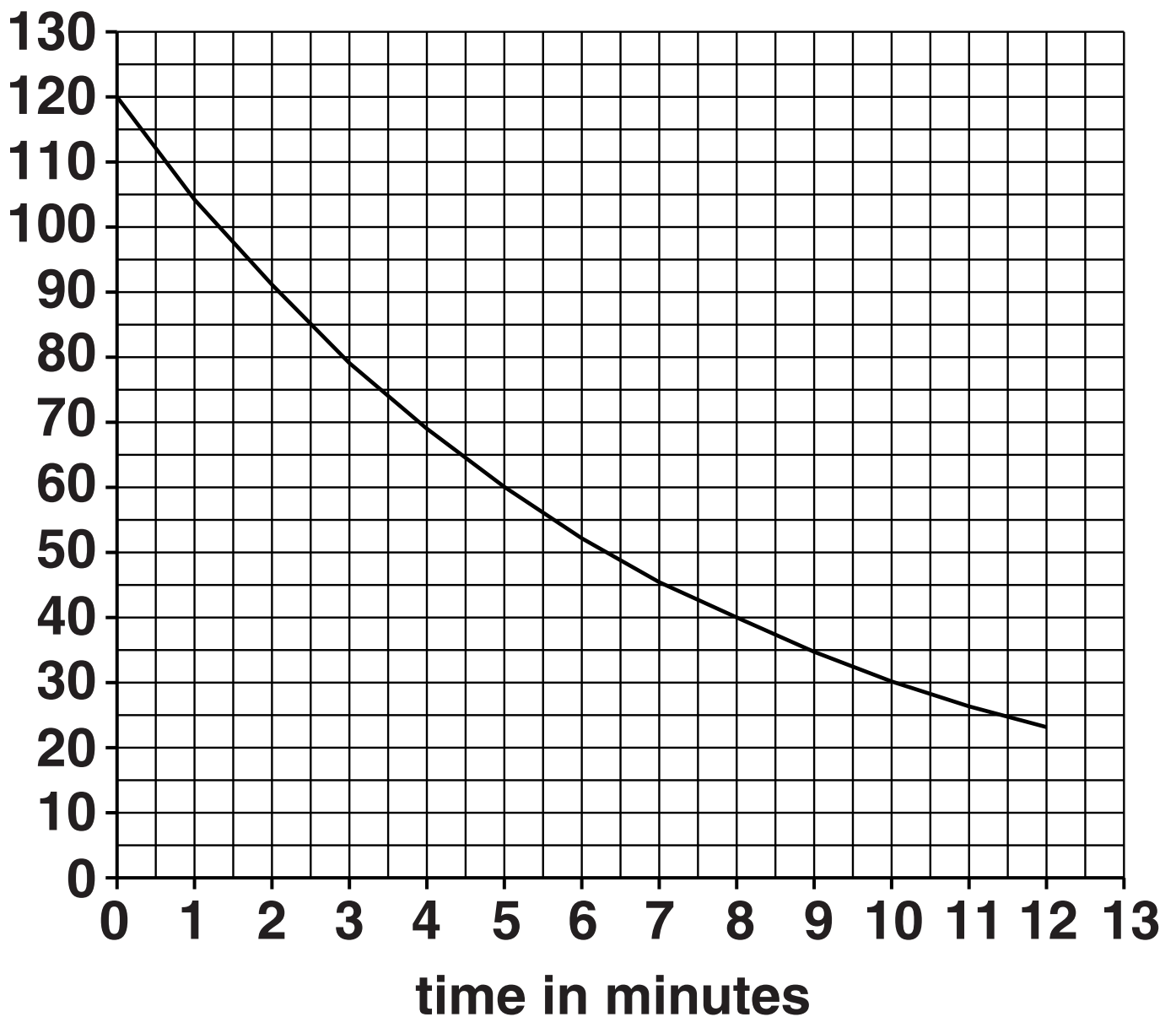
X-rays

☐

[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.

[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]

BLANK PAGE

- 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.

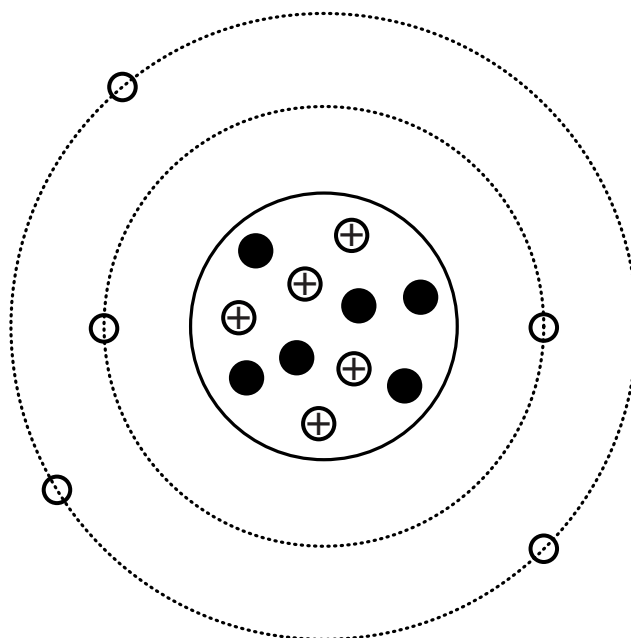
[2]

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	METHOD OF DISPOSAL
High	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.

[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.

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

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.

[TOTAL: 6]

END OF QUESTION PAPER

BLANK PAGE

BLANK PAGE

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

