Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

A182/01

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Modules P4 P5 P6 (Foundation Tier)

MONDAY 21 MAY 2012: Morning

DURATION: 1 hour

plus your additional time allowance

MODIFIED ENLARGED

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

DC (CW/JG) 12MEP06258 63568/1

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

- **Your quality of written communication is assessed in questions marked with a pencil (✏).**
- **A list of useful relationships is printed on pages 4–5.**
- **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.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

THE EARTH IN THE UNIVERSE

distance = wave speed × time

wave speed = frequency × wavelength

SUSTAINABLE ENERGY

energy transferred = power × time

power = voltage × 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

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

Answer ALL the questions.

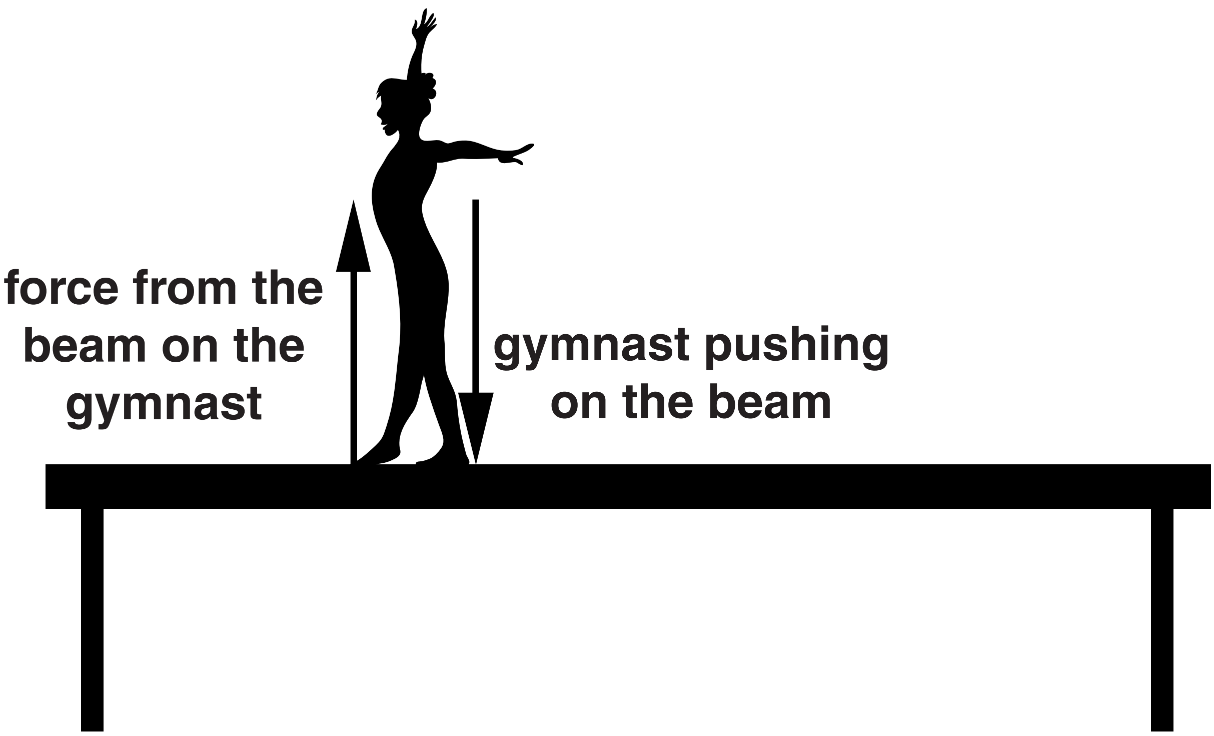
1 There are many sports in the Olympics.

All of them use forces and energy.

(a) A gymnast is balancing on a beam.

As she pushes down on the beam she exerts a force on the beam. The beam pushes back upwards on the gymnast.

These forces form an interaction pair.



(i) What is the name of the UPWARDS force?

Put a ring around the correct answer.

DRIVE FRICTION

REACTION WEIGHT

[1]

(ii) How do the upward force and the downward force compare?

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

The upward force is bigger than the downward force. ☐

The upward force is the same size as the downward force. ☐

The upward force is smaller than the downward force. ☐

[1]

(b) Another gymnast is jumping on a trampoline.

The weight of the gymnast is 500 N.

She jumps to a height of 2 metres above the trampoline.

(i) What type of energy has she gained at the top of her jump?

Put a (ring) around the correct answer.

ELASTIC   ELECTRICAL

GRAVITATIONAL POTENTIAL   KINETIC

[1]

(ii) How much energy has she gained at the top of her jump?

Put a (ring) around the correct answer.

250 J   498 J   502 J   1000 J

[1]

(iii) **As the gymnast falls down to the trampoline again, her speed changes.**

Describe how her speed changes as she falls. Use ideas about energy to explain why.

____

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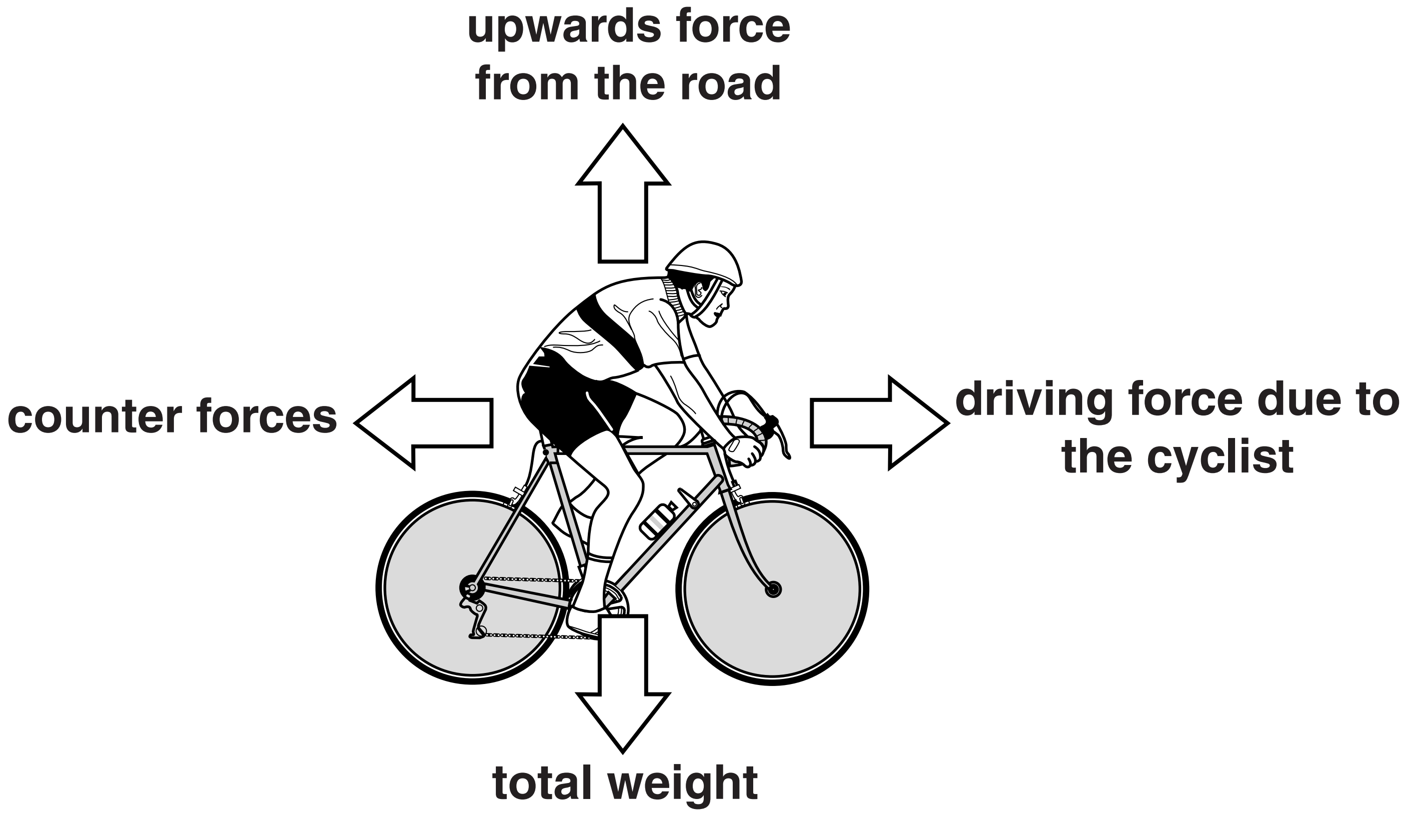
____ **[3]**

(c) A cyclist is travelling along a flat, straight road.

The forces acting on the bicycle are shown below.



The speed of the bicycle will change when the forces change.

Describe what happens to each of these forces when the cyclist is speeding up.

____

____

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____ [3]

[Total: 10]

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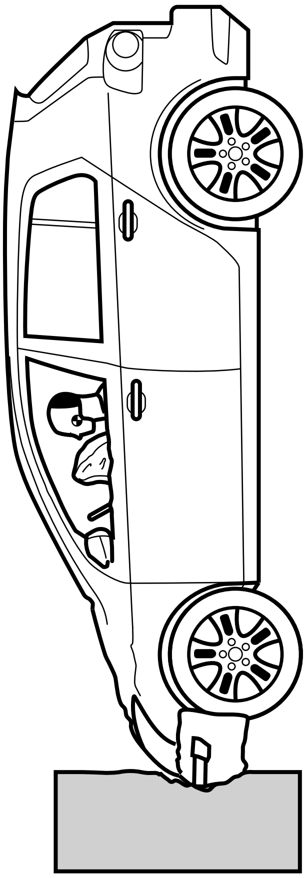
TURN OVER FOR QUESTION 2

2 **Two cars, A and B, (opposite), are crash tested by scientists. Car A has a crumple zone but car B does not. Both cars have the same mass.**

The scientists make the following measurements during a crash.

	CAR A	CAR B
Force on driver in N	1200	6000
Time taken to stop in s	1.0	0.2
Change in speed during crash in m/s	15 to 0	15 to 0
Mass of driver in kg	80	80
Mass of car in kg	1500	1500

A government group looks at the data. The data is used as evidence to pass a new law to make crumple zones a legal requirement.



CAR B: no crumple zone

CAR A: crumple zone

Two people are talking about the new law.

Kat says "Making all cars have crumple zones is going to cost us more money. I don't understand why we should pay for something that may never be useful to us."

Alex says "The data show that it was a fair test, and help to explain how crumple zones save lives. The Government is trying to reduce the risk to everyone."

Use the data to explain why the Government would choose to make crumple zones a legal requirement even though not everyone agrees with the new law.

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

[6]

[Total: 6]

3 A delivery company wants to track where their vehicles are at any time.

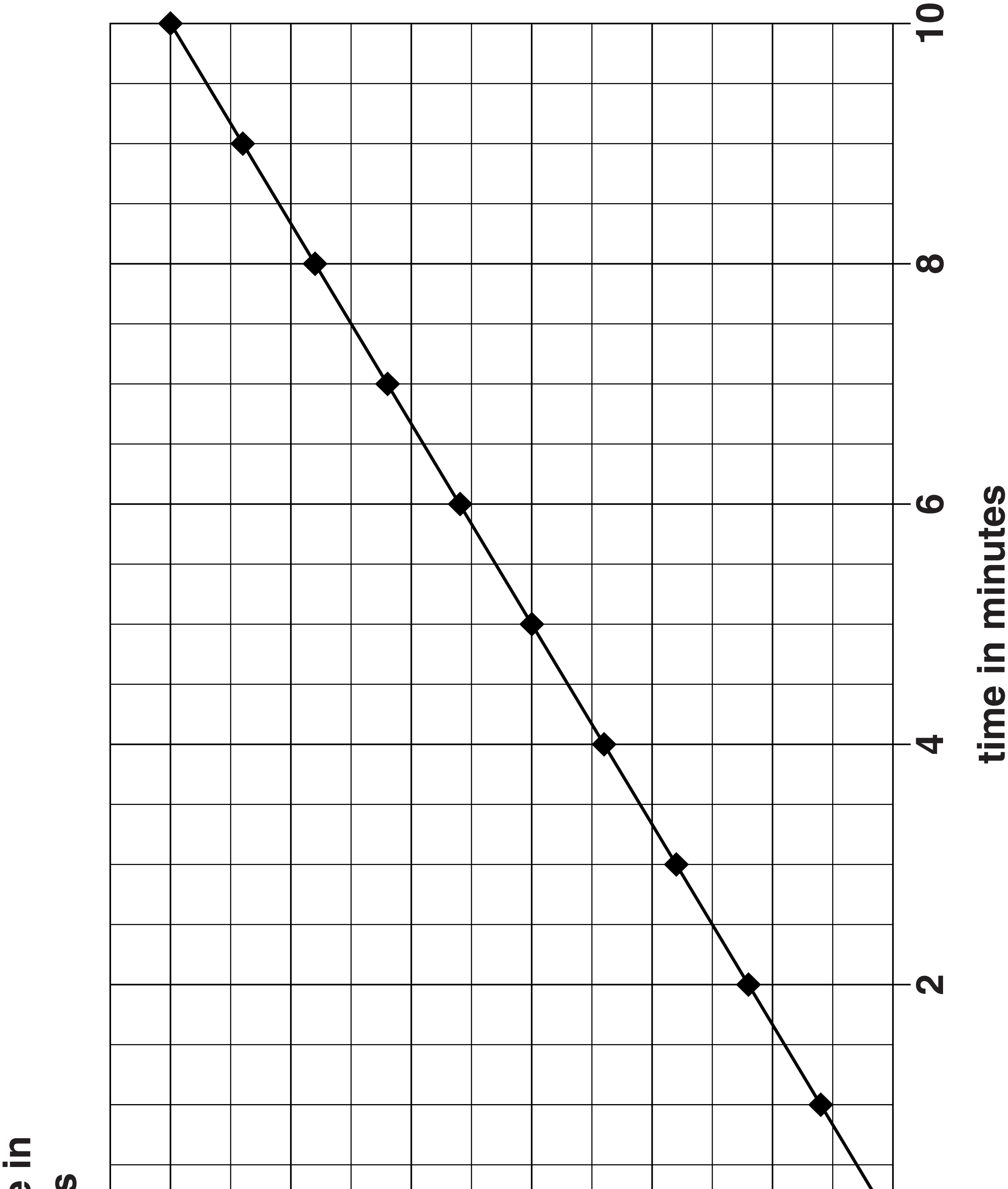
They install GPS trackers in two vehicles which transmit the vehicle's positions over time.

The graph opposite is a distance-time graph for VAN A.

(a) Use information from the graph to calculate the average speed of VAN A in m/s.

Show your working.

speed = ______________________________ m/s [2]



distance in metres
6000
5000
4000
3000
2000
1000
0
0
2
4
6
8
10
time in minutes

(b) This table shows some of the GPS data from VAN B.

TIME IN MINUTES	DISTANCE IN METRES
0	0
4	2000
7	3500
10	5000

(i) Add this data to the graph. [1]

(ii) Explain how the company can use the GRAPH to tell which van had the greatest average speed, without doing any calculations.

____

____

____ [2]

[Total: 5]

4 **Mike is investigating motors.**

(a) (i) Which of the following devices use a motor?

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

DVD players	☐
electric cars	☐
electric irons	☐
flat screen televisions	☐

[1]

(ii) Choose one of the devices you have ticked and explain the purpose of the motor in this device.

device ____________

the purpose of the motor __________________

______________________________________ **[2]**

(b) **Mike makes some notes about the motor effect but misses out some words.**

Complete the sentence by using words from this list.

CURRENT FORCE POWER

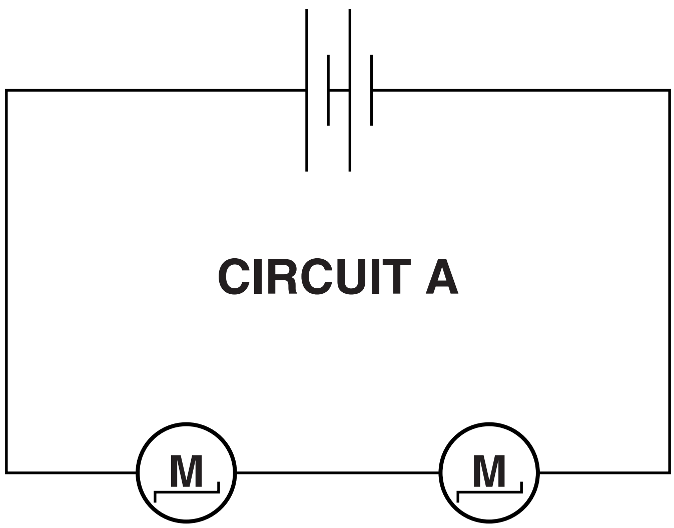
RESISTANCE VOLTAGE

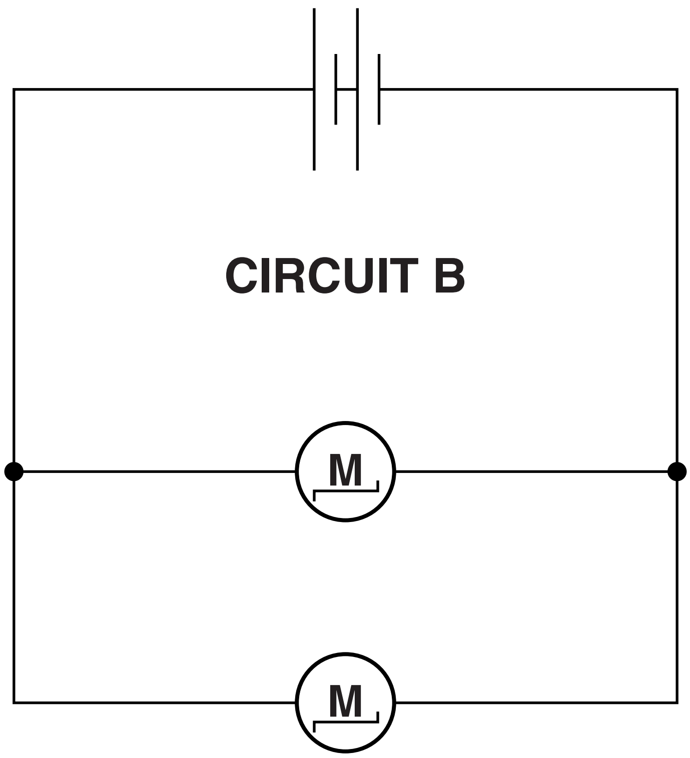
If a wire that carries a ______________________ is placed in a magnetic field, it experiences a

______________________ . [2]

(c) **Mike takes two identical motors and connects them together in two different ways.**

The circuit diagrams below show the arrangements.





The motors run slower in CIRCUIT A.

Explain why.

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____ **[3]**

[Total: 8]

5 **Angela is installing some security lights in her garden.**

(a) The circuit in the security light includes a filament lamp, a switch and an LDR.

Complete the diagrams of the circuit symbols for these components in the boxes below.

— —	— —	— —
filament lamp	**switch**	**LDR**

[3]

(b) The lamps have a voltage of 230V and take a current of 0.5A.

What is the power of the lamps?

answer ________________ W [1]

(c) **The security lights come on whenever something moves in the garden.**

Suggest and explain an example of an unwanted impact that security lighting could have.

____

____

______________________________________ **[2]**

[Total: 6]

6 **Tim walks on a nylon carpet wearing shoes with rubber soles.**

When he touches a metal rail, he feels an electric shock.

Tim is worried about the risk from these electric shocks.

Explain these observations, and discuss what Tim will need to consider to decide the size of the risk.

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

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____ **[6]**

[Total: 6]

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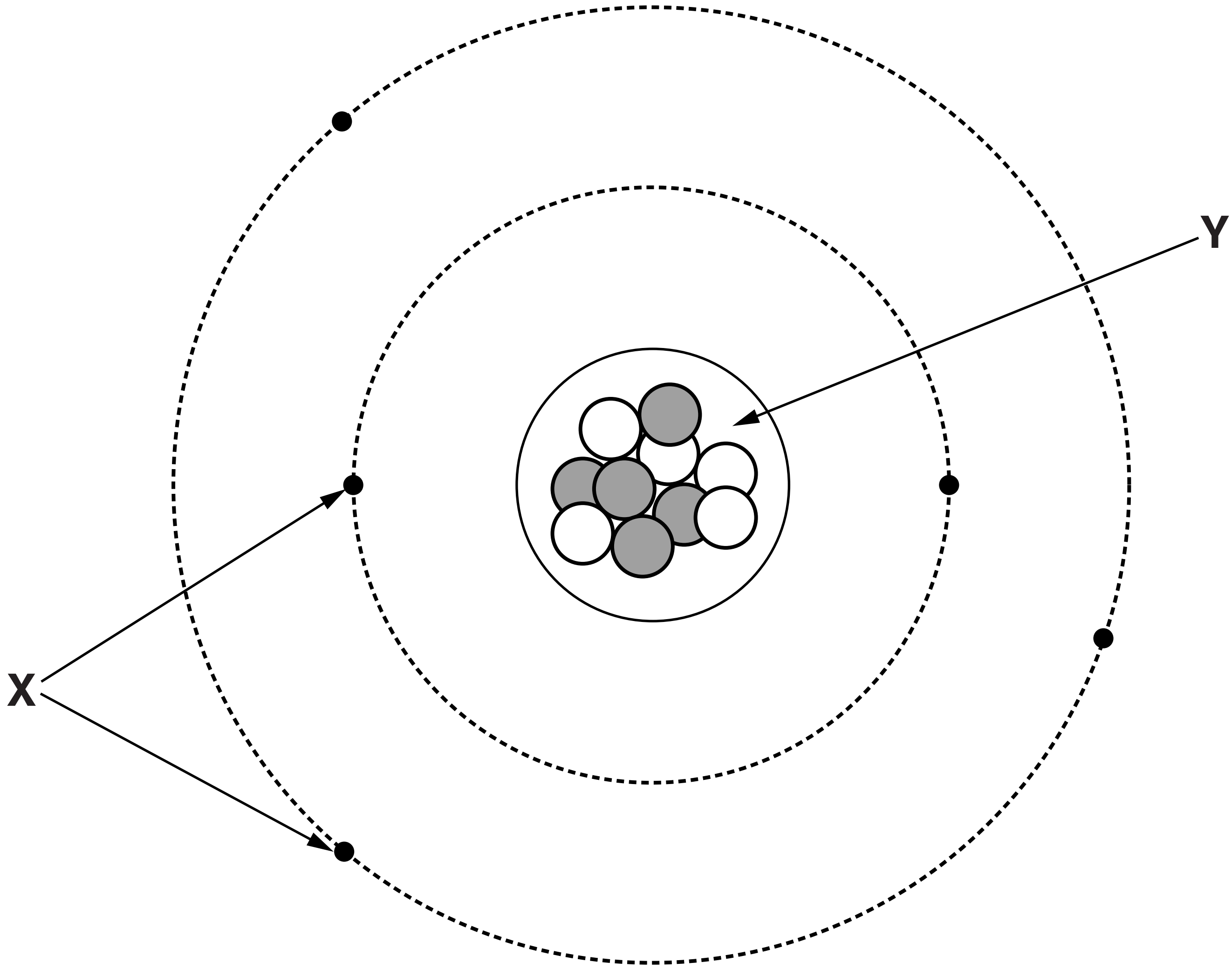
TURN OVER FOR QUESTION 7

7 **The diagram below is one way of showing the particles that make up an atom.**



(a) What labels should be on parts X and Y?

Choose the correct labels using words from this list.

ELECTRONS NEUTRONS NUCLEUS

MOLECULE PROTONS

X ________________________

Y ________________________ containing

____

and ________________________

[2]

(b) Part Y was first discovered by the scientists Rutherford, Geiger and Marsden.

What was their experiment about?

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

- alpha particle scattering ☐
- half-life ☐
- nuclear fission ☐
- nuclear fusion ☐

[1]

(c) Shami and Puj are discussing a material that gives out ionising radiation.

Shami says "Substances that give out ionising radiation are always man-made."

Puj says "We can stop a substance from giving out ionising radiation by reacting it with acid."

(i) What name is given to materials that give out ionising radiation?

Put a ring around the correct answer.

ALPHA BETA

MOLECULE RADIOACTIVE

[1]

(ii) Explain whether Shami and Puj are correct in what they say.

____

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____ **[2]**

[Total: 6]

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TURN OVER FOR QUESTION 8

8 **Jon works in a nuclear power station. He wants to have children but is worried about the risk of his children having cancer.**

He reads the following news report.

> **Scientists have investigated whether the children of people working in nuclear power stations are at greater risk of getting cancer, including leukaemia (cancer of the blood), before their 25th birthday.**
>
> **They looked at the health records of about 50 000 children of nuclear workers and used radiation monitoring data from the power stations.**
>
> **111 of the children had cancer, of which 28 cases were leukaemia. It might be expected that between 70 and 180 out of 50 000 children in the whole UK population could get cancer of some kind.**

Use ideas about risk and the harmful effects of radiation to discuss whether this report should reassure Jon.

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

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____ **[6]**

[Total: 6]

9 **Amy reads that low-sodium salt contains a source of ionising radiation.**

She measures the amount of radiation coming from a sample of low-sodium salt for one minute.

She does this three times.

She then repeats the experiment without the container of low-sodium salt.

These are Amy's results.

EXPERIMENT	COUNTS PER MINUTE
1	56
2	65
3	62
without low-sodium salt	46

(a) **Suggest why there are differences in her first three results.**

____

____ **[1]**

(b) **Explain why the count rate was not zero when there was no low-sodium salt.**

____

____ **[1]**

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TURN OVER FOR QUESTION 9(c)

(c) Amy's friend Billy carries out the same experiment.

Their results are shown in the graph (opposite).

Amy thinks she must have had a different batch of salt from Billy.

Is she correct?

Justify your answer.

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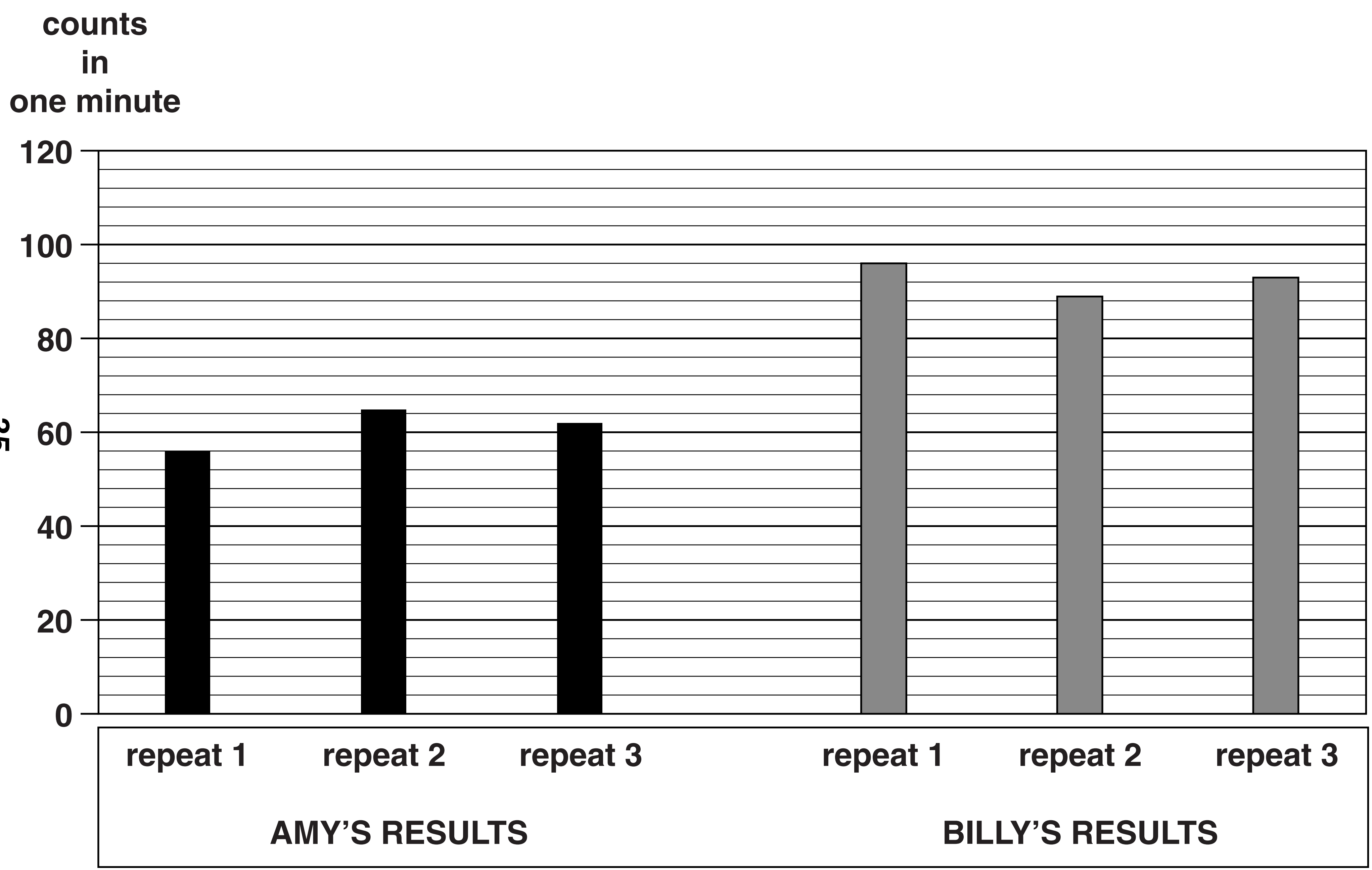
____ [2]


counts
in
one minute
120
100
80
60
40
20
0
repeat 1
repeat 2
repeat 3
repeat 1
repeat 2
repeat 3
AMY'S RESULTS
BILLY'S RESULTS

(d) **Amy puts different materials on the top of the container between the salt and the detector.**

Here are her results.

MATERIAL	EFFECT
paper	does not stop radiation
aluminium	stops radiation
lead	stops radiation

What type of ionising radiation is given out by the low-sodium salt?

Put a (ring) around the correct answer.

ALPHA **BETA**

GAMMA **HALF-LIFE**

[1]

(e) **Amy repeats the same experiment six months later with the same sample of salt.**

She finds that the count rate has NOT changed.

Amy reads this statement in a textbook,

"The amount of radiation from a radioactive source will decrease over time."

Put a tick (✓) in the correct box in each row to show whether the statement FITS THE TEXTBOOK ONLY, FITS AMY'S RESULTS ONLY, FITS BOTH or FITS NEITHER.

	FITS THE TEXTBOOK ONLY	FITS AMY'S RESULTS ONLY	FITS BOTH	FITS NEITHER
The activity of the sample stays the same from day to day.				
All of the radioactivity has been used up.				
The half-life of the radioactive material is very long.				

[2]

[Total: 7]

END OF QUESTION PAPER

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