Paper Reference(s) **5PH2H/01**

Edexcel GCSE

Physics/Additional Science
Unit P2: Physics for Your Future
Higher Tier

Tuesday 18 June 2013 – Morning

Time: 1 hour plus your additional time allowance

INSTRUCTIONS TO CANDIDATES
Write your centre number, candidate number, surname, initials and your signature in the boxes below. Check that you have the correct question paper.

Centre No.							
Candidate No.							
Surname							
Initial(s)							
Signature							
Paper Reference	5	P	H	2	H	/	0	1

Q41945A

PEARSON

Use BLACK ink or ball-point pen.
Answer ALL questions.
Answer the questions in the spaces provided – there may be more space than you need.

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Nil

INFORMATION FOR CANDIDATES

- **The total mark for this paper is 60.**
- **The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**
- **Questions labelled with an ASTERISK (*) are ones where the quality of your written communication will be assessed – you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.**

ADVICE TO CANDIDATES

- **Read each question carefully before you start to answer it.**
- **Keep an eye on the time.**
- **Try to answer every question.**
- **Check your answers if you have time at the end.**

FORMULAE

You may find the following formulae useful.

charge = current × time $Q = I \times t$

potential difference = current × resistance $V = I \times R$

electrical power = current × potential difference $P = I \times V$

energy transferred = current × potential difference × time $E = I \times V \times t$

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

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \qquad a = \frac{(v - u)}{t}$$

force = mass × acceleration $F = m \times a$

weight = mass × gravitational field strength $W = m \times g$

momentum = mass × velocity $P = m \times v$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}} \qquad F = \frac{(mv - mu)}{t}$$

(Formulae continues on next page)

work done = force × distance moved in the direction of the force

$$E = F \times d$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{E}{t}$$

gravitational potential energy = mass × gravitational field strength × vertical height

$$GPE = m \times g \times h$$

kinetic energy = ½ × mass × velocity^2

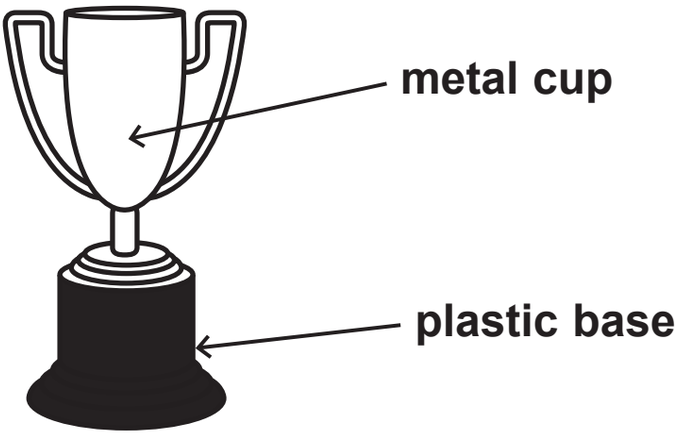
$$KE = \tfrac{1}{2} \times m \times v^2$$

Answer ALL questions.

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

STATIC ELECTRICITY

1 (a) A student wins a trophy. It is a metal cup on a black plastic base.



The student cleans the trophy.
She holds one of the metal handles and rubs the rest of the trophy with a dry cloth.

(Question continues on next page)

(i) Complete the sentence by putting a cross (☒) in the box next to your answer. (1 mark)

The plastic base becomes negatively charged because it gains

☐ A atoms

☐ B electrons

☐ C neutrons

☐ D protons

(ii) Explain why the base gains a negative charge when she rubs the trophy with the cloth. (2 marks)

(Question continues on next page)

(iii) The metal cup does not become charged when she rubs the trophy.
Suggest why the cup does not become charged. (2 marks)

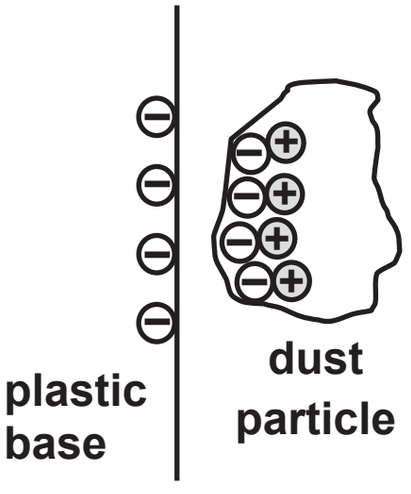
(Question continues on next page)

(iv) Some dust particles in the air drift near to the plastic base just after she cleans the trophy.

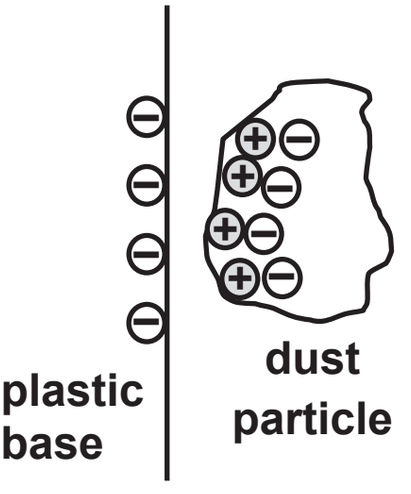
Which diagram shows the correct distribution of charges on a dust particle near to the charged plastic base?

Put a cross (☒) in the box next to your answer. (1 mark)

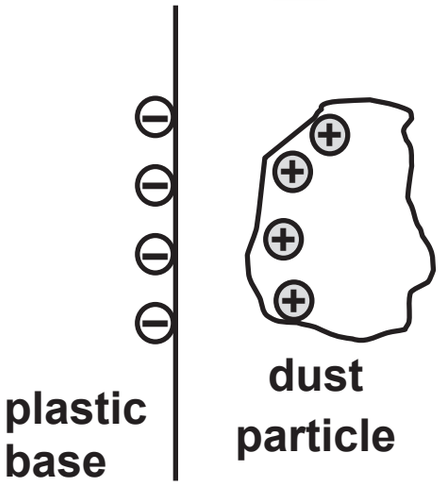
☐ A



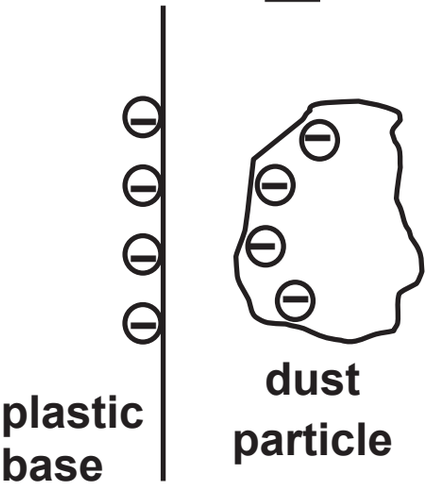
☐ B



☐ C



☐ D



(Question continues on next page)

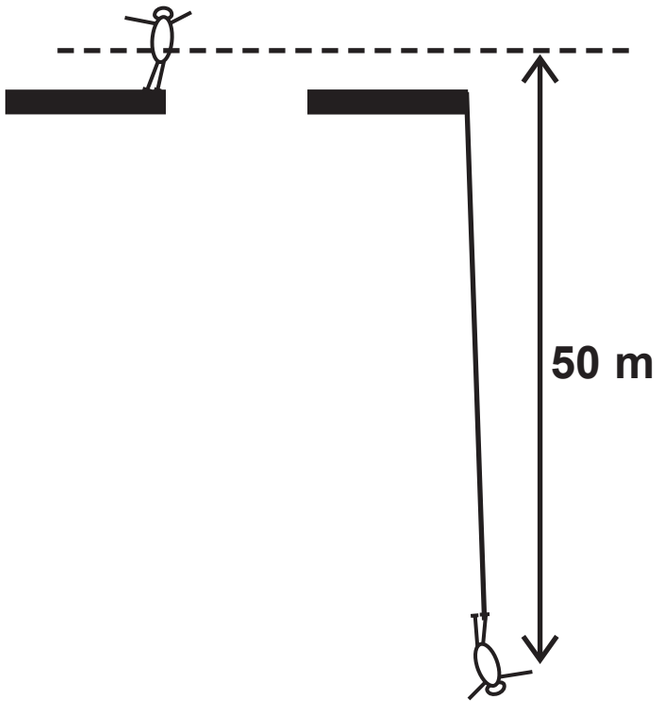
(b) Describe ONE situation where separation of electric charge can create a spark. (2 marks)

(TOTAL FOR QUESTION 1 = 8 MARKS)

(Questions continue on next page)

BUNGEE JUMPING

2 A 60 kg student weighs 600 N.
He does a bungee jump.



The bungee cord becomes straight and starts to stretch when he has fallen 50 m.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer. (1 mark)

He first stops moving

☐ A before all the energy has disappeared

☐ B before the bungee cord starts to stretch

☐ C when the bungee cord is stretched the most

☐ D when the elastic potential energy is zero

(Question continues on next page) (Turn over)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer. (1 mark)

When his speed is 10 m/s his momentum is

☐ A 600 kg m/s

☐ B 3 000 kg m/s

☐ C 6 000 N m/s

☐ D 30 000 N m/s

(Question continues on next page)

(c) (i) Calculate the change in gravitational potential energy as the student falls 50 m. (3 marks)

Give the unit.

change in gravitational potential energy =

_____ unit _____

(ii) State at what point in the bungee jump the student has maximum kinetic energy. (1 mark)

_____

_____

_____

(Question continues on next page)

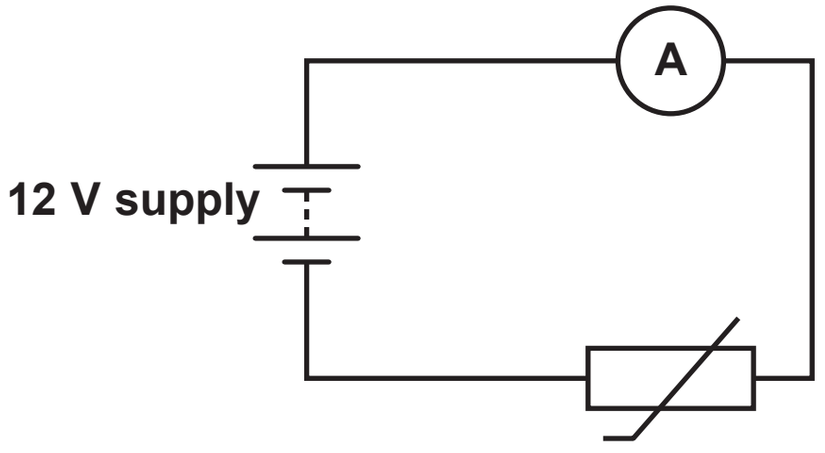
(iii) Explain why his maximum kinetic energy is likely to be less than your answer to (c)(i).
(2 marks)

(TOTAL FOR QUESTION 2 = 8 MARKS)

(Questions continue on next page)

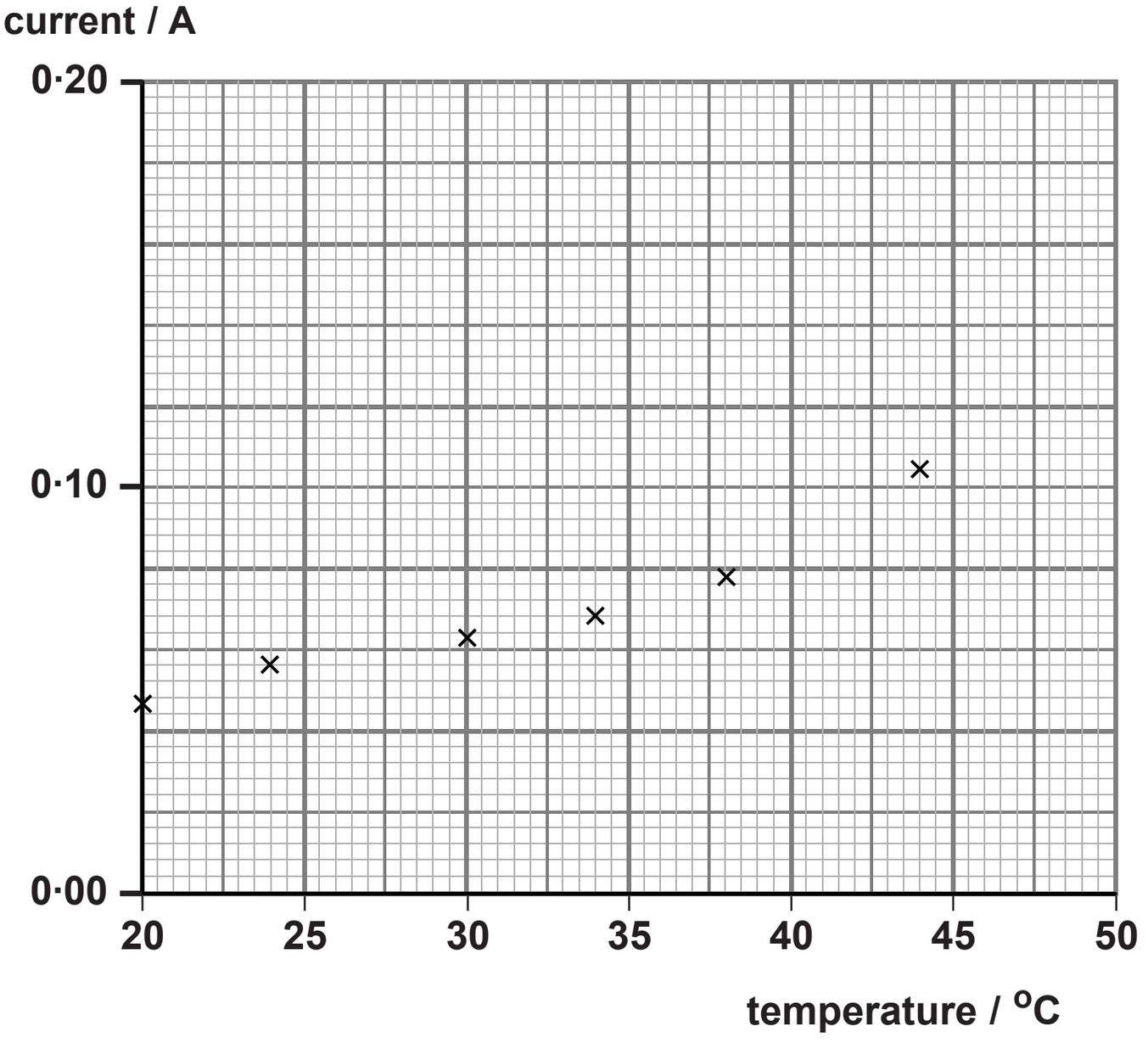
ELECTRIC CURRENT AND TEMPERATURE

3 (a) A designer is going to use a thermistor in a temperature gauge. He connects the thermistor into this circuit.



He heats the thermistor and measures the current at different temperatures. On page 15 are some of the results plotted on a graph.

(Question continues on next page)



At 47 °C the current was 0·138 A.

(i) Plot this value on the graph. (1 mark)

(ii) Draw the curve of best fit through the points. (1 mark)

(Question continues on next page)

(iii) The supply voltage is 12 V.
At 20 °C the current is 0·047 A.

Calculate the resistance of the thermistor at this temperature. (3 marks)

resistance = _____ Ω

(iv) Use this graph of current against temperature to explain the relationship between resistance and temperature for this thermistor. (2 marks)

_____

_____

_____

_____

_____

_____

(Question continues on next page)

(b) (i) When there is an electric current in a resistor, the resistor gets hot.

Explain why the resistor gets hot. (2 marks)

(Question continues on next page)

(ii) Suggest why the thermistor in a temperature gauge might indicate a temperature slightly higher than the actual temperature of its surroundings. (1 mark)

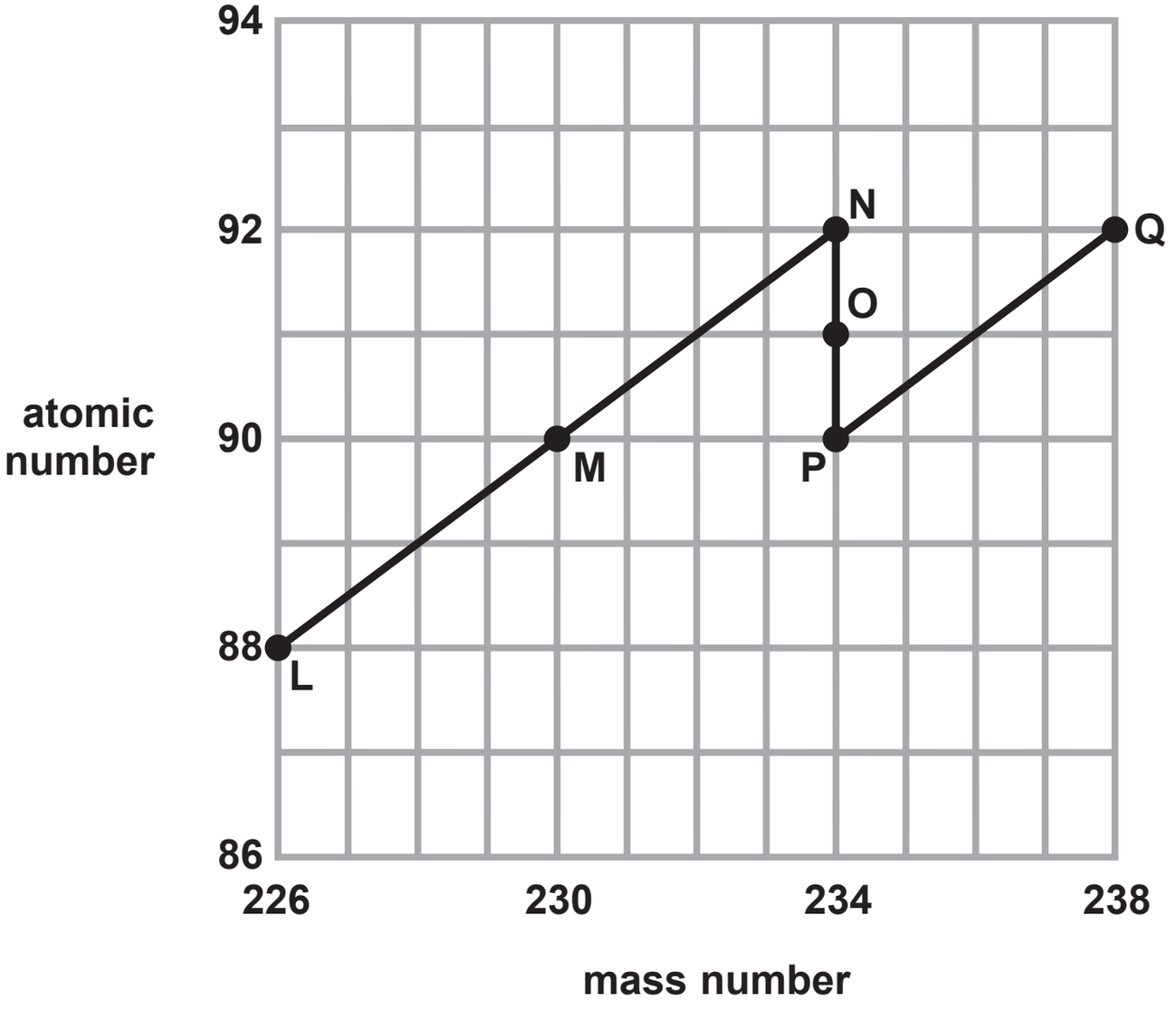
(TOTAL FOR QUESTION 3 = 10 MARKS)

(Questions continue on next page)

URANIUM-238

4 Uranium-238 is an isotope of uranium. It may undergo either radioactive decay or nuclear fission.

A nucleus of uranium-238 is shown as Q in the chart.



(a) State TWO letters from the chart which show isotopes of the same element. (1 mark)

_____ and _____

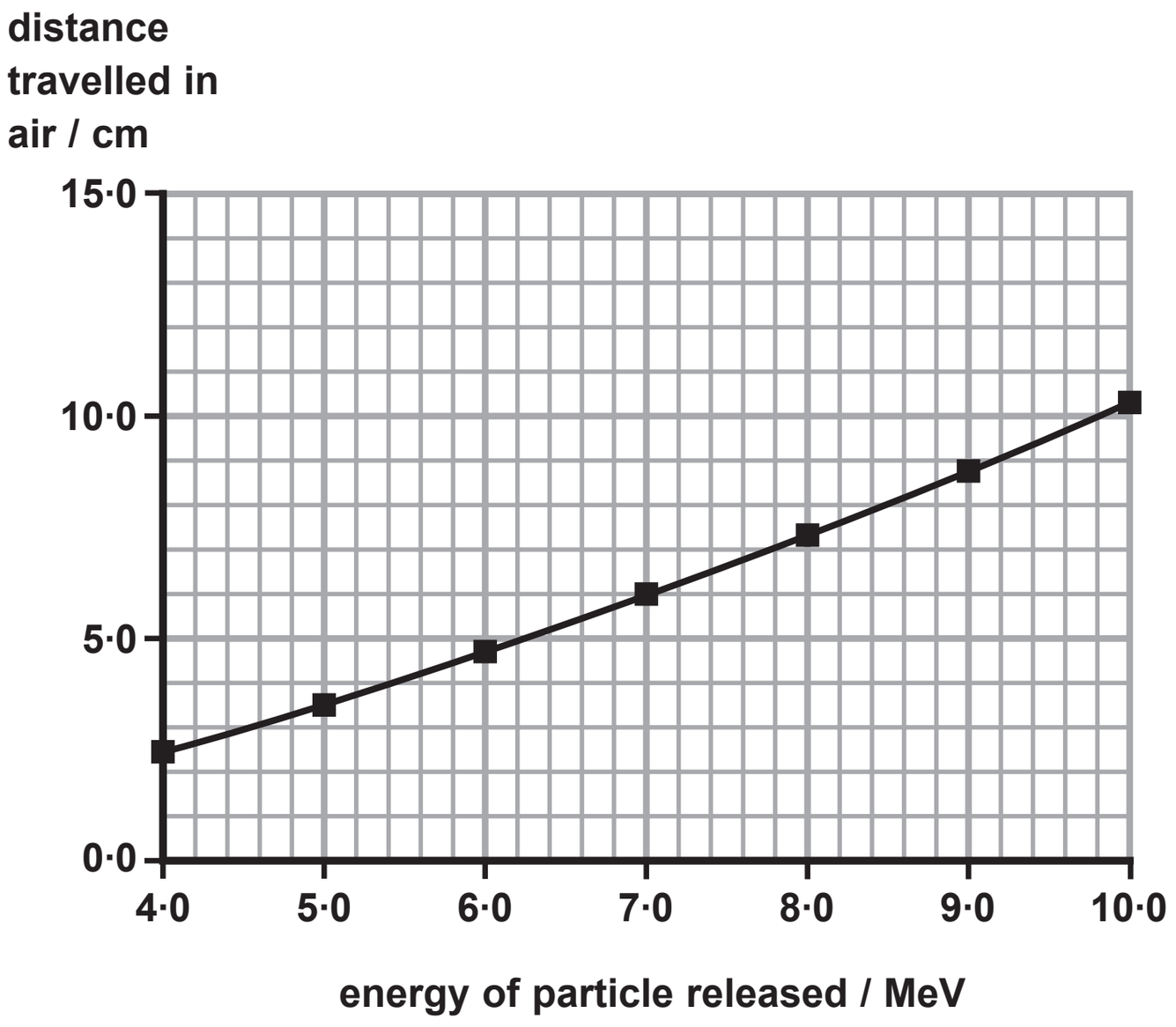
(Question continues on next page)

(b) Explain what happens when Q decays to P. (2 marks)

(c) Explain what happens when P decays to O. (2 marks)

(Question continues on next page)

(d) Particles released during radioactive decay can have different energies.
A suitable unit for these energies is MeV.
For one type of decay, the particles released have energies between 4·0 MeV and 10·0 MeV.
The graph shows how far the particles with these energies travel in air.



(Question continues on next page)

(i) State the name of this type of particle.
(1 mark)

(ii) Use information from the graph to describe how the distance travelled in air depends on the energy of the particle. (2 marks)

(Question continues on next page)

(e) Uranium-238 can only undergo nuclear fission by absorbing fast neutrons.
The fission emits neutrons which very quickly lose their energy.

Suggest why the fission of uranium-238 does not produce a chain reaction. (2 marks)

(TOTAL FOR QUESTION 4 = 10 MARKS)

(Questions continue on next page)

FORCE AND ACCELERATION

5 (a) A car is travelling along a level road.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer. (1 mark)

When the velocity of the car is constant, the force of friction on it is

☐ **A zero**

☐ **B greater than the driving force**

☐ **C smaller than the driving force**

☐ **D the same size as the driving force**

(Question continues on next page)

(ii) The car now accelerates in a straight line.
Its average acceleration is 12 m/s^2.

Calculate the increase in velocity of the car in 4·0 s.
(3 marks)

speed = _____ m/s

(Question continues on next page)

(b) This table shows data about two other cars.

CAR	MASS	TIME TAKEN TO REACH 30 m/s FROM REST
family car	1400 kg	10 s
sports car	600 kg	5 s

The owner of the family car claims that although the sports car has greater acceleration, it produces a smaller accelerating force than his family car.

Explain how these figures support his claim.
(2 marks)

(Question continues on next page)

*(c) After going to the shops, a car driver places a bag of shopping on the passenger seat. During the journey home, the driver has to use the brakes to stop very suddenly. The driver is wearing a seat belt.

Explain what happens next to the car, the driver and the shopping bag. (6 marks)

(Continue your answer on next page)

(TOTAL FOR QUESTION 5 = 12 MARKS)

(Questions continue on next page)

RADIOACTIVITY

6 (a) An underground oil pipe starts to leak oil. To find the leak, a technician adds a gamma source to the oil flowing in the pipe.

Describe how the technician can find the position of the leak. (2 marks)

(Question continues on next page)

(b) Which of these is correct for half-life? (1 mark)

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

☐ A It is half the time for all the atoms to decay

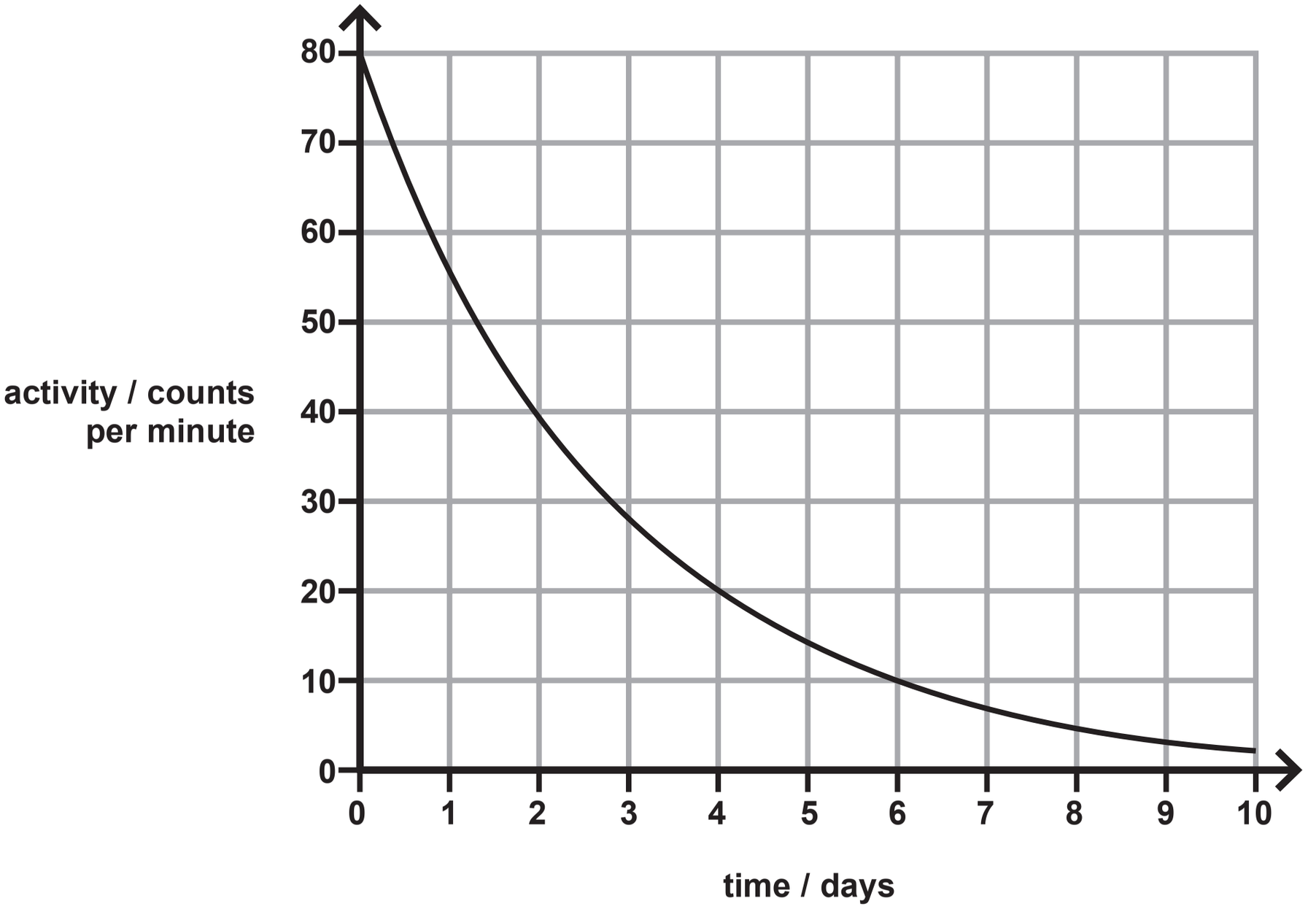
☐ B It is the time it takes for an atom to half decay

☐ C It is the time it takes for half an atom to decay

☐ D It is the time it takes for half the atoms to decay

(c) The graph on page 31 shows how the activity of a sample of a radioactive material changes with time. The sample has an initial activity of 80 counts per minute.

(Question continues on next page)



(Question continues on next page)

(Turn over)

(i) Use the graph to find the half-life of the material. (1 mark)

half life = _____ days

(ii) Another sample of the material has an initial count rate of 40 counts per minute.

Sketch, on the same axes, the activity of this sample for the first 4 days. (2 marks)

(Question continues on next page)

*(d) Some scientists carry out an experiment to measure the radioactivity from a source to be used in a factory.
They measure the background radiation before and after their experiment.
They take the background count at the same place as they do their experiment.

Explain how this procedure helps to make sure that the results of the experiment are valid. (6 marks)

(Continue your answer on next page)

(TOTAL FOR QUESTION 6 = 12 MARKS)

TOTAL FOR PAPER = 60 MARKS

END