cea
Rewarding Learning

Centre Number

Candidate Number

Single Award Science: Physics

Unit 3

Higher Tier

[GSA32]   *GSA32*

FRIDAY 13 NOVEMBER 2020, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **3(a)**.

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1 **(a)** The photograph below shows a 3-pin plug used to connect a fan to the mains. The fan has double insulation.
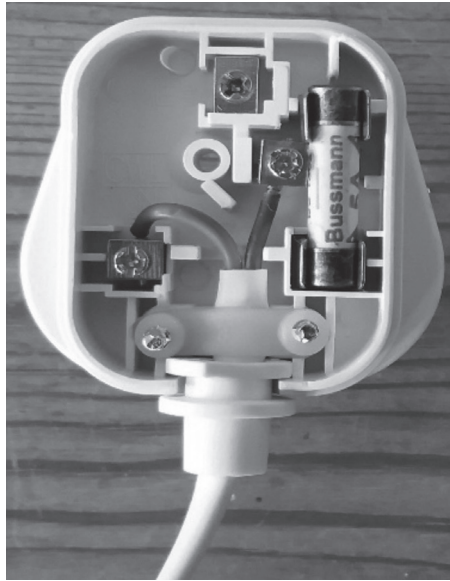
Source: Principal Examiner

(i) Explain what is meant by the term **double insulation**.

_____

_____

_____ [2]

(ii) Name the wire that is **not** needed because the fan is double insulated.

_____ [1]

24GSA3202

(b) (i) The fan uses 2.3 kW of power and is connected to the 230 V mains electricity supply.

Use the equation:

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

to calculate the current being used by the fan.

(Show your working out.)

_____ A [2]

(ii) Which fuse should be used in the plug of this fan?

Circle your answer.

1 A   **3 A**   **5 A**   **13 A**   **30 A**

[1]

(iii) Name the wire connected to the fuse in a plug.

_____ [1]

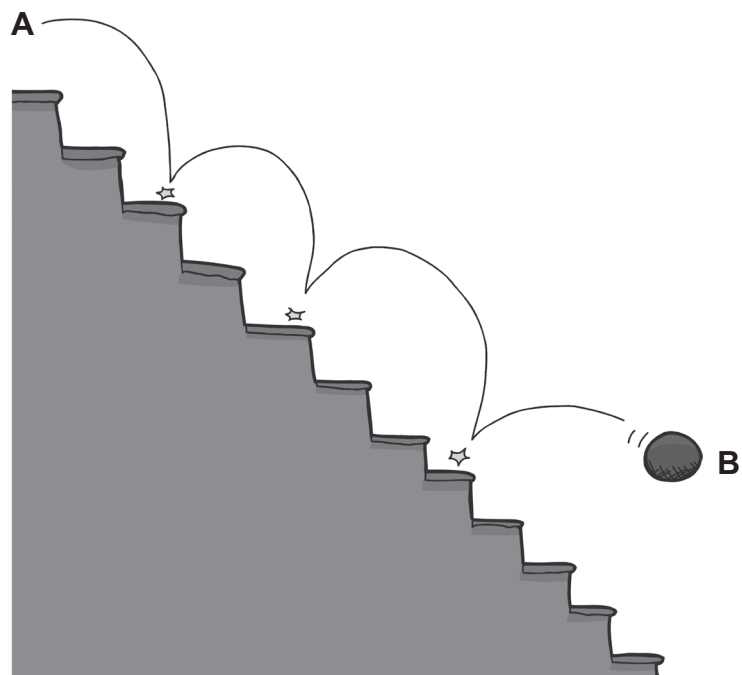**[Turn over**

2 **(a)** State the Principle of Conservation of Energy.

_____

_____

_____ [2]

(b) The diagram below shows a ball bouncing down a staircase. It started from rest at position **A**.

(i) Complete the table below by adding ticks (✓) to show the form(s) of energy at positions **A** and **B**.

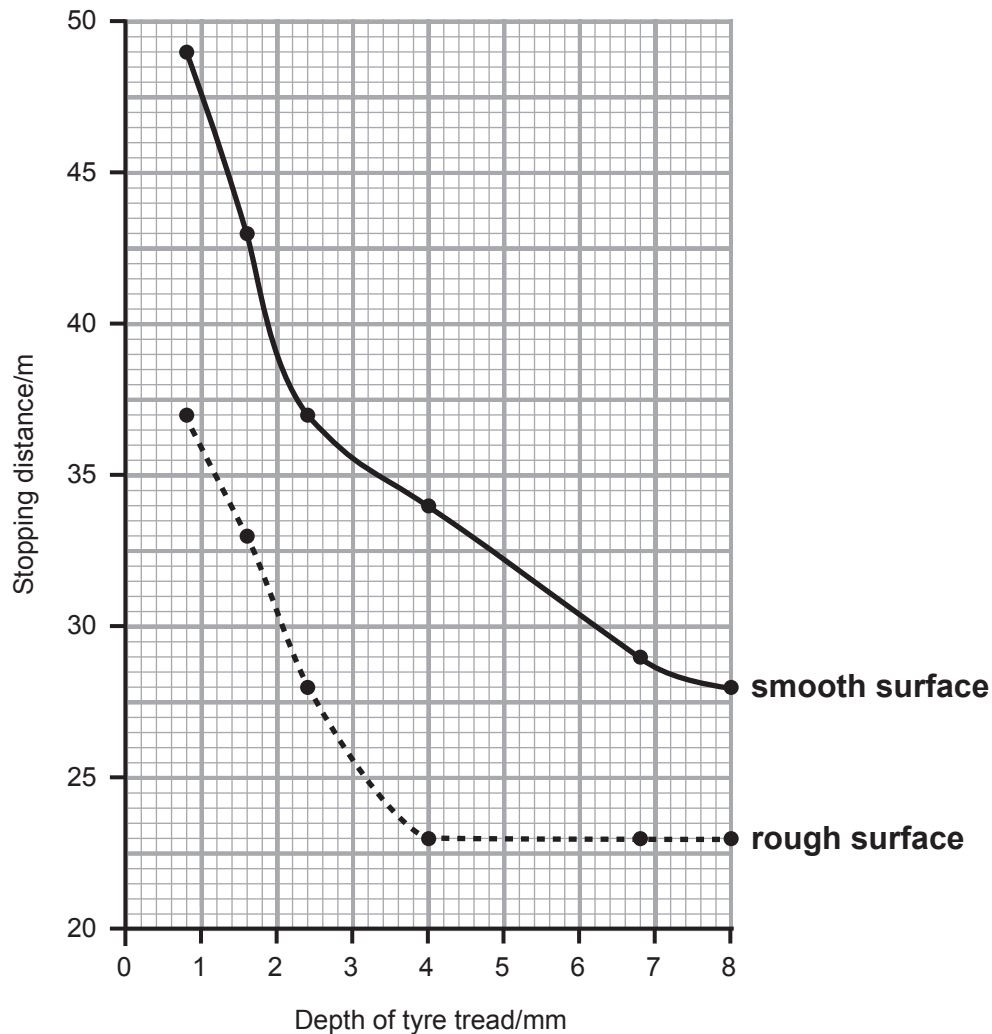|	Potential energy	Kinetic energy
A		
B		

[2]

(ii) Name **one** form of energy that is wasted as the ball bounces down the staircase.

_____ [1]

3   The graph below shows how stopping distance for a car is affected by the depth of the tyre tread on two different road surfaces.

Source: Principal Examiner

(a) Describe and explain how the depth of tyre tread and road surface affect stopping distance and how this is important for road safety.

Your answer should include:
- conclusions that can be made from this graph;
- a definition of friction;
- a link between friction and stopping distance; and
- a link between stopping distance and road safety.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

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_____

_____ [6]

(b) Complete the sentences below to show the effect, if any, of driving on a wet road compared to a dry road.

On a wet road the thinking distance will be _____ ,

the braking distance will be _____ and the overall

stopping distance will be _____ .   [2]

24GSA3207

4 **(a)** Electromagnetic (EM) radiation can be harmful to the human body when absorbed. SAR is a measure of the body's rate of absorption of EM radiation.
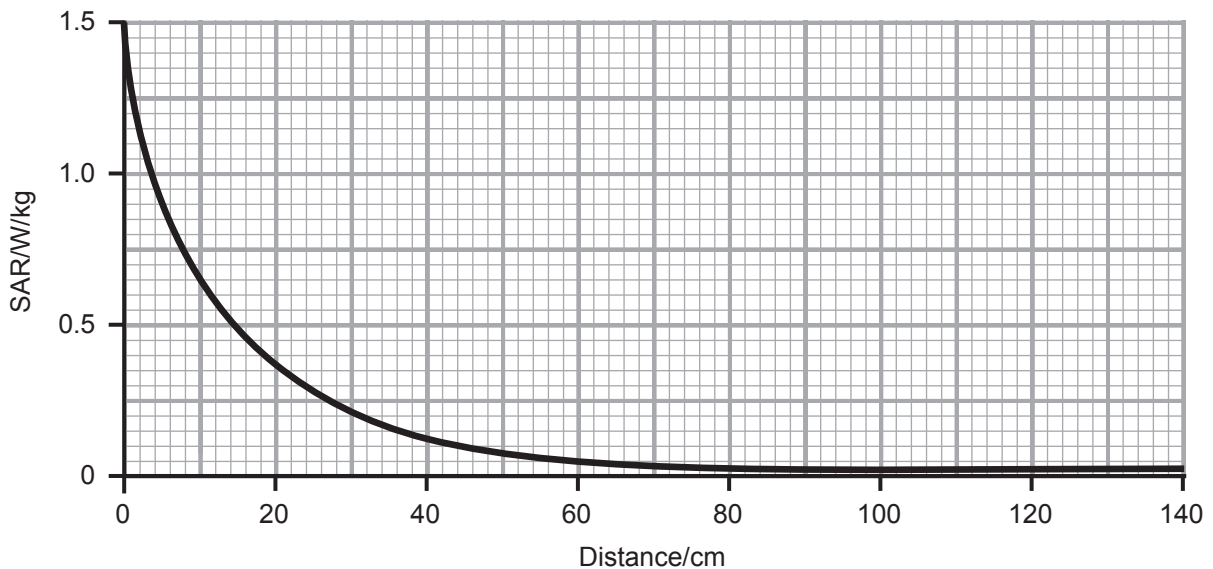
The table below gives the SAR value due to four devices.

Device	SAR/W/kg
wi-fi router	0.01
mobile phone	1.35
laptop	0.50
baby monitor	0.12

(i) Name the health risk associated with the use of mobile phones.

_____ [1]

The graph below shows how SAR values change with distance from the source of EM radiation.

(ii) A mobile phone has the greatest health risk of these devices. Use information from the table and graph to give **two** reasons why it is the most harmful.

1. _____

2. _____ [2]

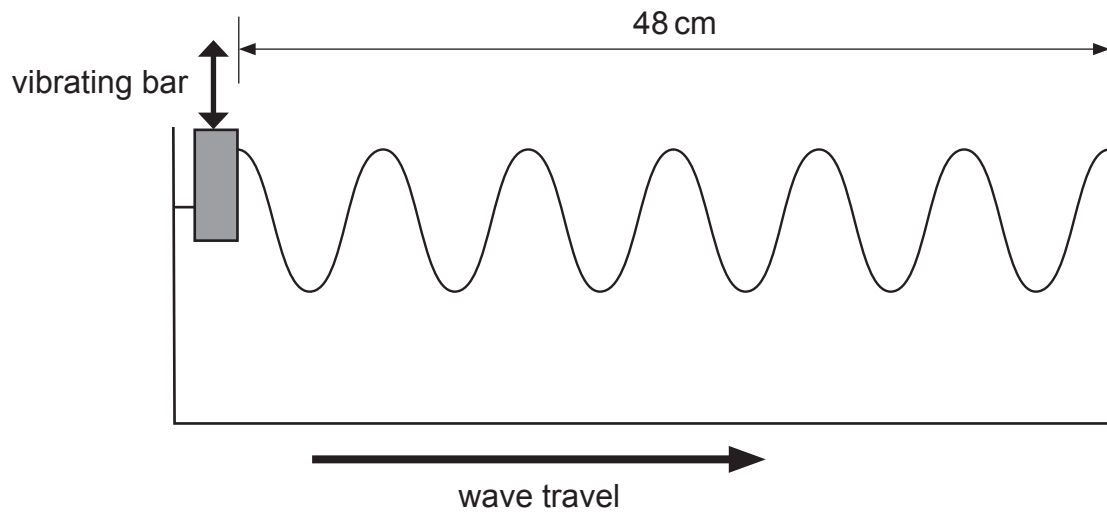**(b)** Name the type of EM radiation used to transmit mobile phone signals.

_____ [1]

(c) When mobile phone signals are transmitted they will be sent from mast to mast. What name is given to the area around a mast?

_____ [1]

[Turn over

5 **(a)** The diagram below shows waves being made in a tray of water by a vibrating bar. The bar vibrates with a frequency of 5 Hz.

48 cm

vibrating bar

wave travel

Source: Principal Examiner

(i) Name the type of wave produced in the tray of water. Explain your answer in terms of particle movement.

_____

_____

_____

_____ [3]

(ii) Use the diagram to calculate the wavelength of these water waves.

(Show your working out.)

_____ cm [2]

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(iii) Use the equation:
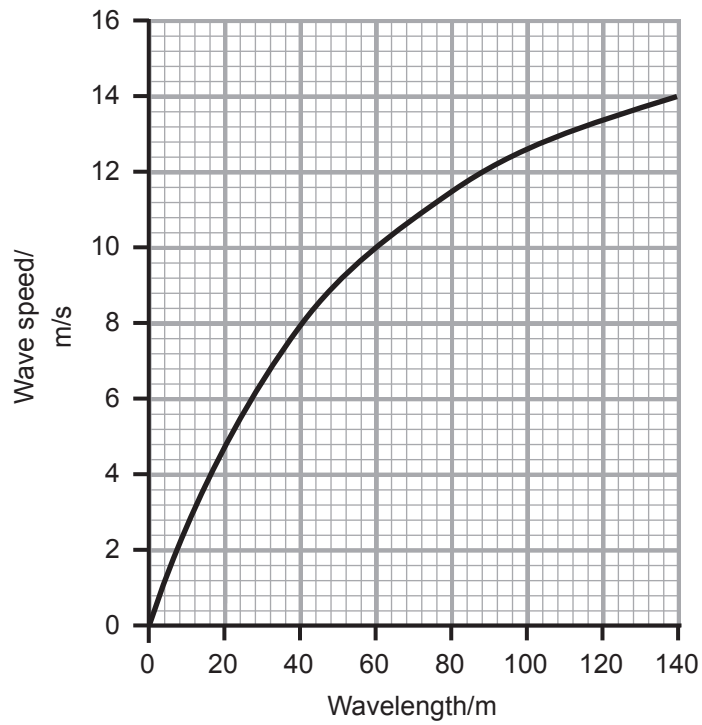
wave speed = frequency × wavelength

to calculate the speed of these water waves.

(Show your working out.)

_____ cm/s   [2]

The graph below shows how the speed of deep ocean waves depends on the wavelength.
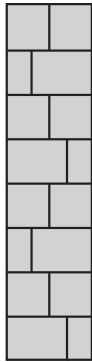

(b) State the conclusion that can be made from this graph.

_____

_____ [1]

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A car's parking sensors use ultrasound to find its distance from an obstacle.

Source: Principal Examiner

(c) What is meant by the term **ultrasound**?

_____

_____

_____ [2]

6 **(a)** The diagram below shows two identical solid cylinders placed equal distances from a Bunsen burner. One cylinder has a black surface and the other has a shiny surface.

thermometer

Bunsen burner

black surface
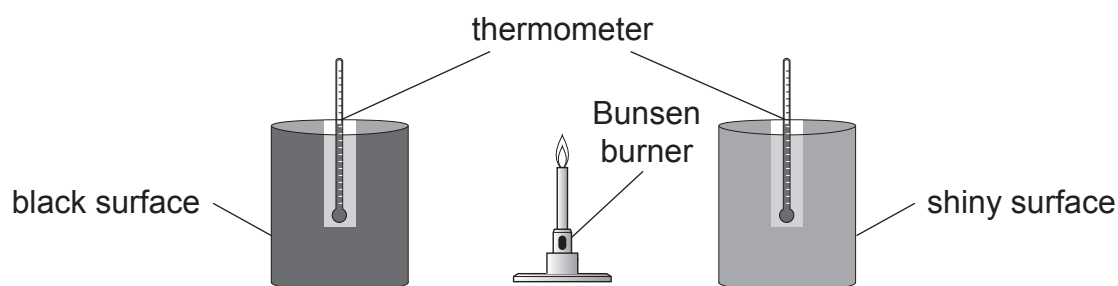
shiny surface

Source: Principal Examiner

The Bunsen burner was lit and the temperature of each cylinder was recorded. The results are given in the table below.

Time/mins	Temperature/°C	
	Black surface	**Shiny surface**
0	22	22
1	24	23
2	26	24
3	28	25
4	30	26
5	32	27
6	34	28
7	36	29
8	38	29
9	38	29
10	36	29

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(i) Describe fully the trend for the shiny surface.

_____

_____

_____ [2]

(ii) Why does the cylinder with the black surface heat up faster than the one with the shiny surface?

_____

_____ [1]

(iii) Describe fully how heat will transfer through the air **above** the Bunsen burner.

_____

_____

_____

_____ [3]

The table below gives the thermal (heat) conductivity of some materials that could be used to make the cylinders in this investigation.

Material	Thermal conductivity/W/m°C	Relative cost
Aluminium	250.00	high
Wood	0.13	medium
Copper	401.00	high
Silver	429.00	very high
Glass	1.05	medium

(b) Use this information and your knowledge to name the material these cylinders should be made from. Explain fully your choice.

_____

_____

_____

_____ [2]

(c) Complete the following sentence.

Glass has a low thermal conductivity because it does

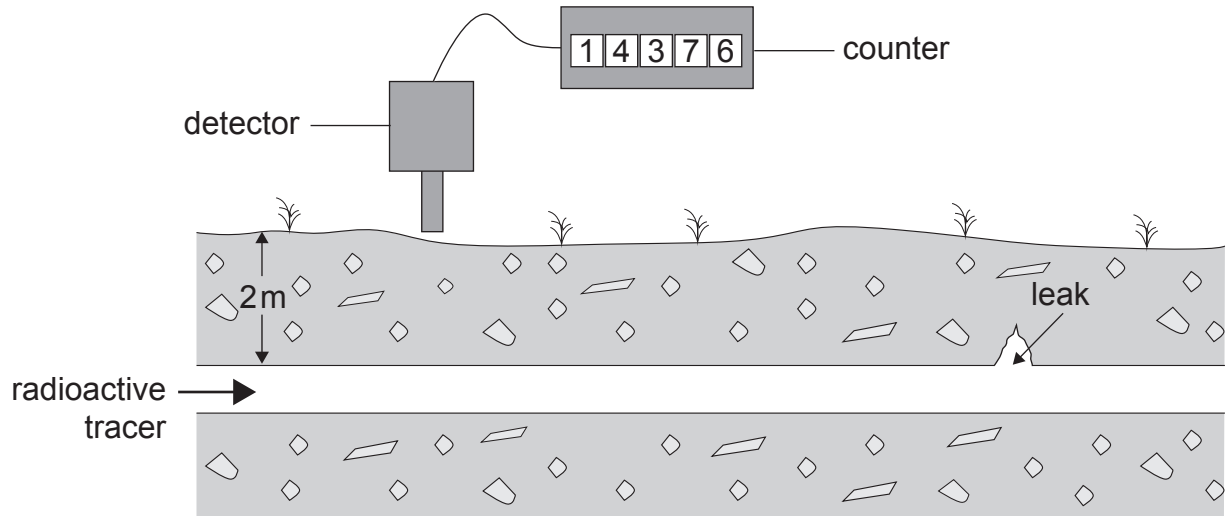not have _____. [1]

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(Questions continue overleaf)

7 **(a)** The diagram below shows how a radioactive tracer can be used to detect leaks in underground pipes.

Source: Principal Examiner

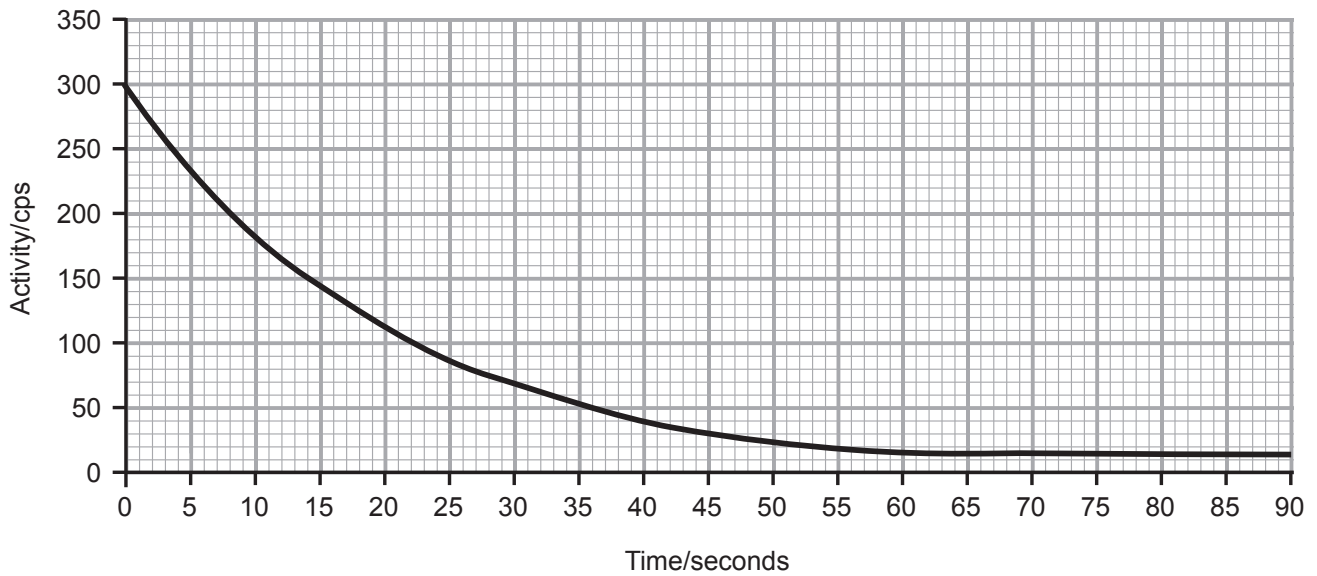**(i)** Name the type of radiation that should be used as the tracer. Explain why.

_____

_____

_____ [2]

(ii) How will the detector show the position of the leak?

_____

_____ [1]

(b) The graph below shows how the activity of a radioactive source changes with time.

(i) Use the graph to find the half-life of this source.

_____ seconds [1]

(ii) The tracer is added at a distance of 1 km from the leak. Suggest why this source should not be used as a tracer to detect leaks as shown in part **(a)**. Explain your answer.

_____

_____

_____ [2]

(iii) Use the graph to suggest a value for background radiation.

_____ cps [1]

[Turn over

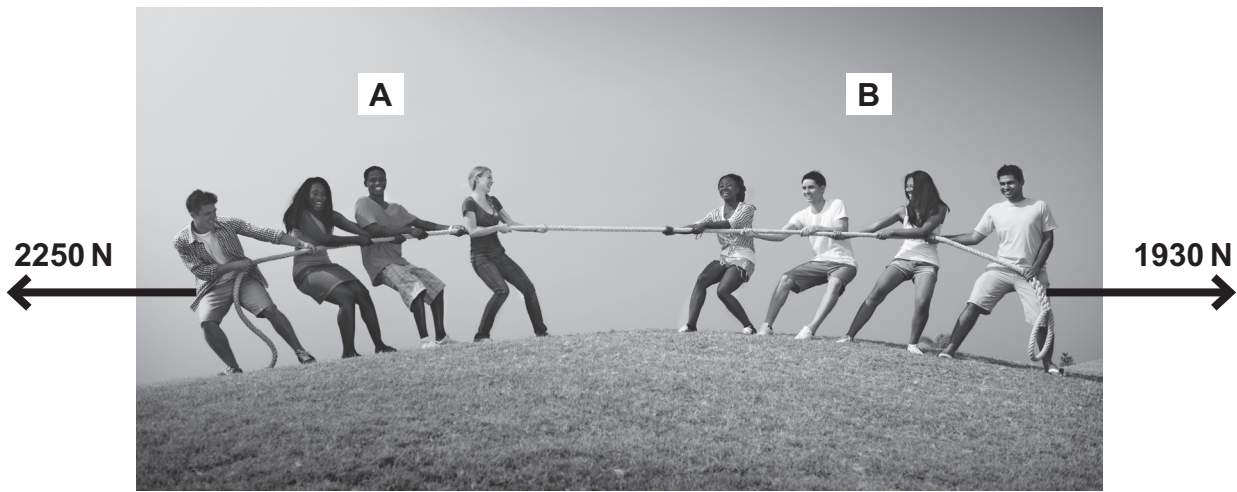**(c)** Explain fully why some elements are radioactive.

_____

_____

_____ [2]

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(Questions continue overleaf)

8 The photograph below shows a tug of war between eight people with a total mass of 540 kg.

2250 N

1930 N

© Getty Images

(a) Explain fully, in terms of forces, what will happen during this tug of war.

_____

_____

_____

_____ [3]

(b) (i) Use the equation:

force = mass × acceleration

to calculate the acceleration produced during this tug of war. Give your answer to 2 decimal places.

(Show your working out.)

_____ [3]

(ii) Give the unit of acceleration.

_____ [1]

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