Cambridge IGCSE

**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

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| CANDIDATE NAME | | | | | | | | | |
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*8414511595*

**PHYSICS** **0625/31**

Paper 3 Theory (Core) **October/November 2017**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s$^2$).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **19** printed pages and **1** blank page.


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**1** A student clamps a metre rule to the end of a bench, as shown in Fig. 1.1. He attaches a mass to the end of the rule.

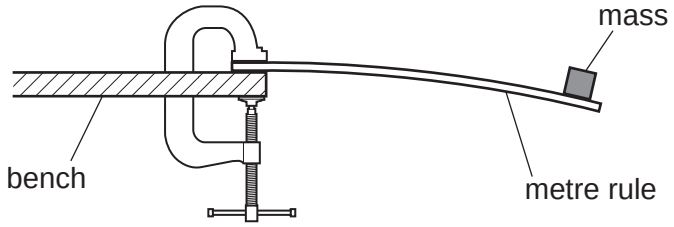



**Fig. 1.1**

The student displaces the end of the rule by a small distance. The rule oscillates up and down. The student measures the time for ten complete oscillations.

**(a)** State the name of a measuring device for timing the oscillations.

..... [1]

**(b)** State a reason why the student measures the time for ten oscillations, rather than for one.

..... [1]

**(c)** The student repeats the procedure. His results are shown in the table.

| results | time for ten complete oscillations / seconds |
|---|---|
| 1st | 3.93 |
| 2nd | 4.07 |
| 3rd | 3.55 |
| 4th | 3.99 |

**(i)** One of the results is incorrect. On the table, draw a ring around the incorrect result. [1]

**(ii)** Calculate the average value for the time for ten complete oscillations.

average time = ..... s [2]

**(iii)** Determine the time for one complete oscillation. State your answer to two significant figures.

time = ..... s [1]

[Total: 6]

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**2** Fig. 2.1 shows a river flowing through a village. There are two bridges across the river.

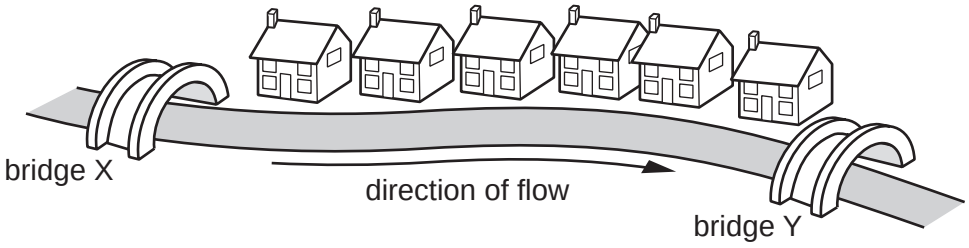



**Fig. 2.1**

Two students plan to measure the speed of a stick as it floats on the river between bridge X and bridge Y.

**(a)** The students plan to drop a stick into the middle of the river from bridge X. The stick moves with the water between bridge X and bridge Y.

Describe how the students can determine the average speed of the stick.

.....

.....

.....

.....

.....

.....

.....

..... [4]

**(b)** The stick moves with constant speed.
One statement correctly describes the horizontal forces acting on the stick.

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

- ☐ Only a forward force acts.
- ☐ The forward force and the backward force are equal.
- ☐ The forward force is greater than the backward force.
- ☐ The backward force is greater than the forward force.

[1]

[Total: 5]

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**3** Fig 3.1 shows a warning marker floating on the surface of a lake.

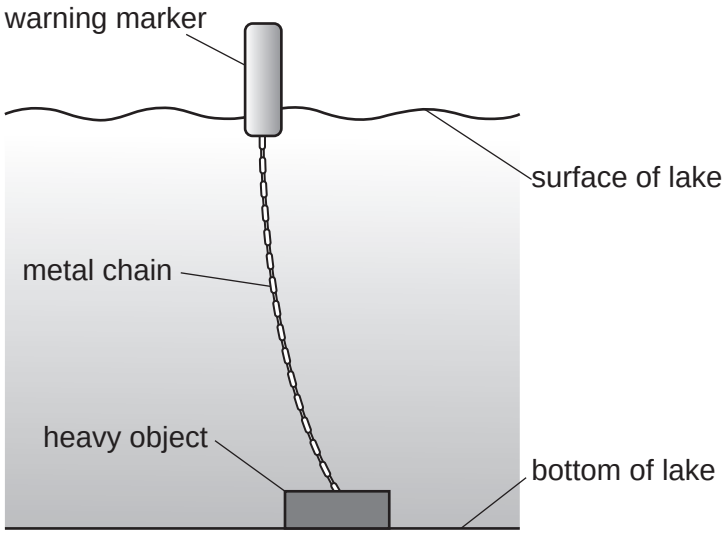



**Fig. 3.1**

The marker is attached by a metal chain to a heavy object on the bottom of the lake.

**(a)** Fig. 3.2 shows the forces acting on the marker at one moment in time.

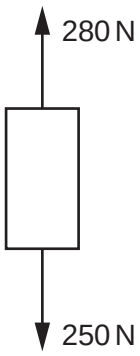



**Fig. 3.2**

Calculate the resultant force on the marker.

resultant force = ..... N

direction = .....

[2]

**(b)** Fig. 3.3 shows part of the metal chain. It is made from small metal loops.

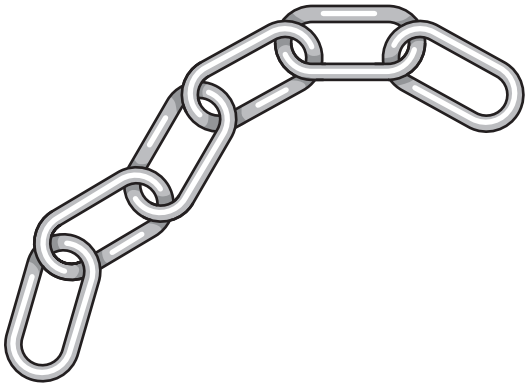


**Fig. 3.3**

A damaged loop is removed from the chain. Describe a method to determine the density of the metal from which the loops are made.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 7]

**4** Fig. 4.1 shows two methods for generating electricity using renewable sources.

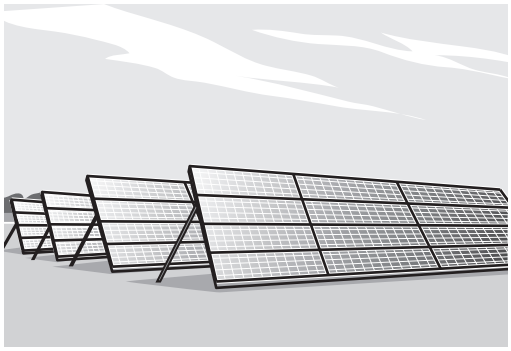


**Fig. 4.1a**

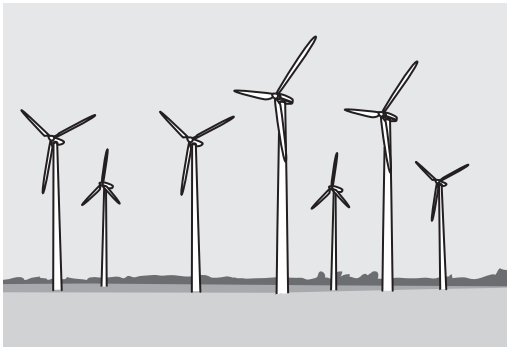


**Fig. 4.1b**

**Fig. 4.1**

**(a)** Name the energy source for each method.

In Fig. 4.1a, the energy source is .....

In Fig. 4.1b, the energy source is .....
[2]

**(b)** **(i)** State **two** advantages of using renewable sources for generating electricity compared to using a coal-fired power station.

1. .....

.....

2. .....

..... [2]

**(ii)** State **one** disadvantage of using renewable sources for generating electricity compared to using a coal-fired power station.

.....

..... [1]

[Total: 5]

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**5** Complete the sentences. Choose from the words in the box.

| solid | liquid | gas |
|---|---|---|

The words may be used once, more than once or not at all.

**(a)** The atoms are usually arranged in regular patterns in a ..... . [1]

**(b)** The state of matter with the lowest density is a ..... . [1]

**(c)** Evaporation takes place when the most energetic molecules leave the surface of a ..... . [1]

**(d)** A small force can change the volume of a ..... . [1]

[Total: 4]

**6** **(a)** Fig. 6.1 shows a ray of light inside a semi-circular glass block.

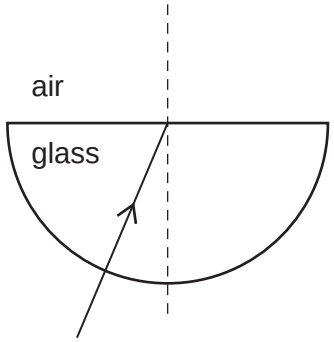



**Fig. 6.1**

The angle of incidence at the straight surface is **less** than the critical angle for the glass.

On Fig. 6.1, continue the path of the ray. [2]

**(b)** Fig. 6.2 shows another ray of light inside a semi-circular glass block.

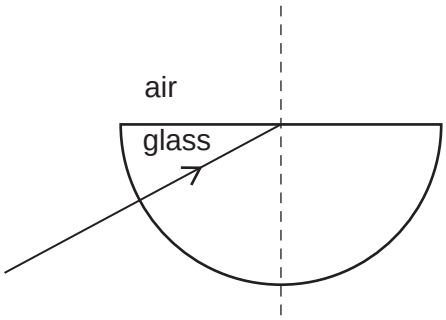



**Fig. 6.2**

The angle of incidence at the straight surface is **greater** than the critical angle for the glass.

**(i)** On Fig. 6.2, continue the path of the ray. [2]

**(ii)** State the term used to describe what happens to the light when it strikes the straight surface in Fig. 6.2.

..... [1]

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**(c)** A wave on the surface of water approaches a barrier. There is a small gap in the barrier, as shown in Fig. 6.3.

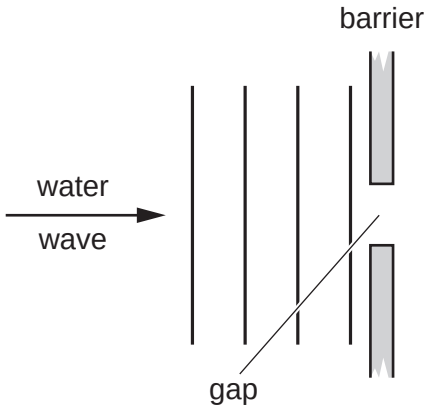



**Fig. 6.3**

On Fig. 6.3, draw **three** wavefronts that have passed through the gap. [2]

[Total: 7]

**7** **(a)** Fig. 7.1 shows a man listening to a radio.

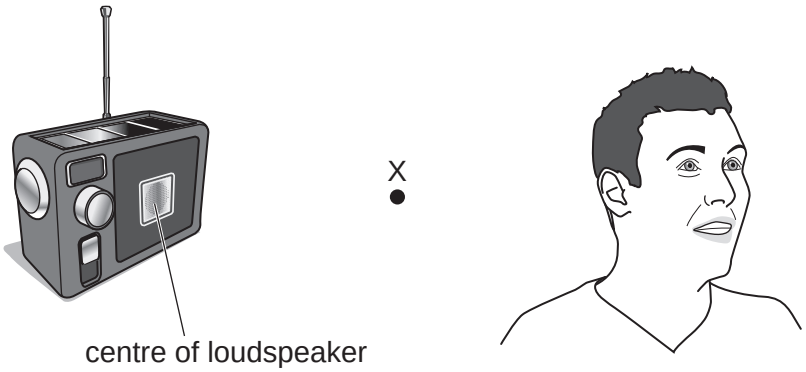



**Fig. 7.1**

**(i)** Sound from the radio makes an air particle at X vibrate.

On Fig. 7.1 draw two arrows on point X to show the directions of vibration of the air particle. [2]

**(ii)** Which of these terms correctly describes the sound wave?

Tick **one** box.

- ☐ transverse
- ☐ longitudinal
- ☐ electromagnetic [1]

**(iii)** Suggest a value for the frequency of the sound that the man can hear. State the unit.

frequency = ..... [2]

**(iv)** Explain why the man cannot hear ultrasound.

.....

..... [1]

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**(b)** Fig. 7.2 shows a distance-time graph for ultrasound travelling in sea-water.

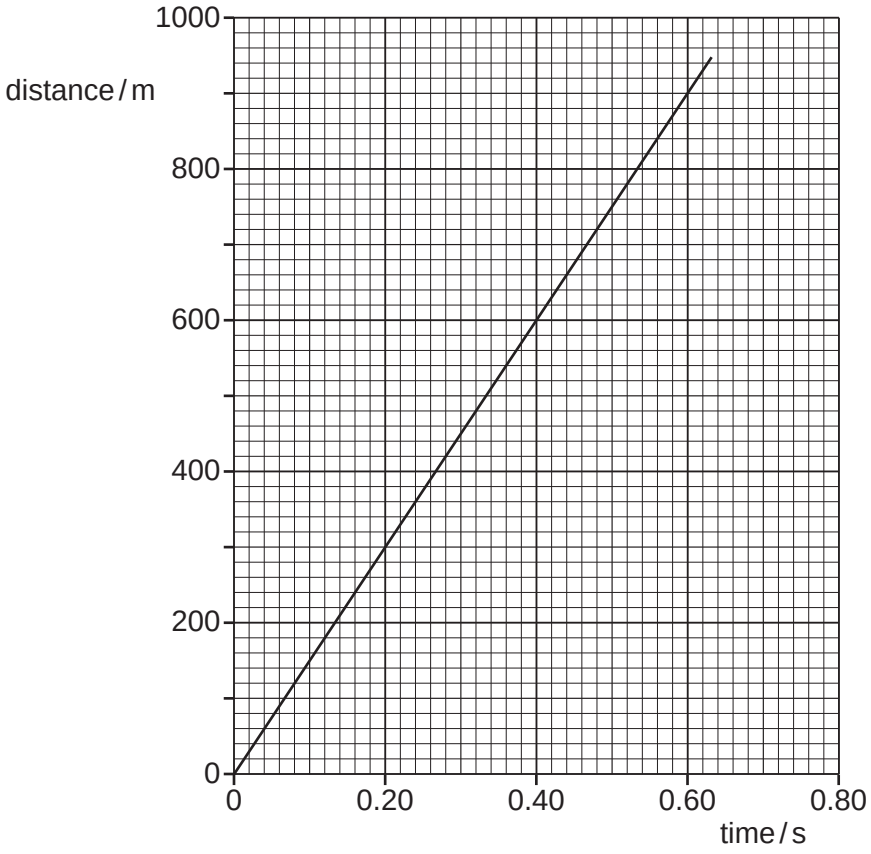



**Fig. 7.2**

**(i)** Use the graph to calculate the speed of ultrasound in sea-water.

speed = ..... m / s [2]

**(ii)** A scientist measures the depth of the sea by using ultrasound. She sends a pulse of ultrasound from the ship to the seabed. It reflects from the seabed as shown in Fig. 7.3.

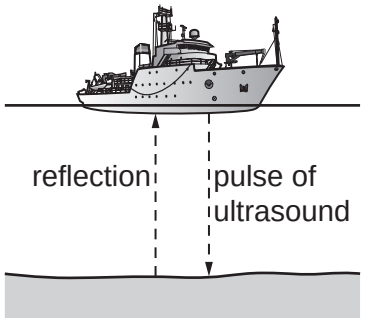



**Fig. 7.3**

The time taken between sending a pulse and receiving the echo is 0.60 s. Use the graph to determine the depth of the sea.

depth = ..... m [2]

[Total: 10]

**8** Fig. 8.1 shows a plotting compass and a bar magnet. The plotting compass consists of a small magnet in the shape of an arrow. The arrow can rotate freely on a pivot.

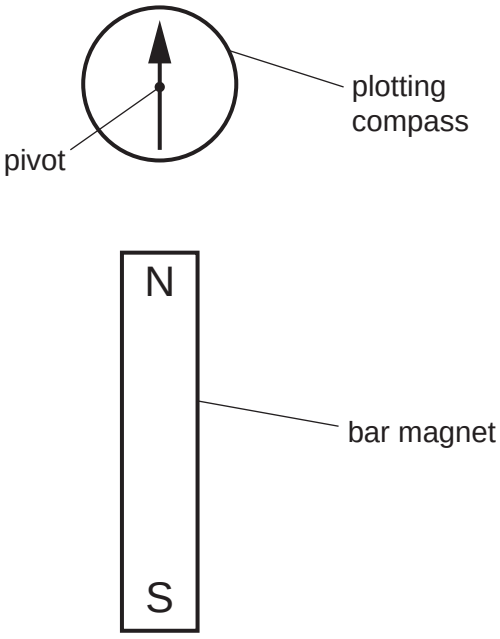



**Fig. 8.1**

**(a)** Describe how to use this apparatus to identify the magnetic field pattern of the bar magnet.

.....

.....

.....

.....

.....

..... [3]

**(b)** Fig. 8.2 shows a bar magnet.




**Fig. 8.2**

On Fig. 8.2 draw the magnetic field pattern around the bar magnet. Use arrows to show the direction of the field. [3]

[Total: 6]

**9** A student investigates how the resistance of a thermistor changes with temperature.
Fig. 9.1 shows part of the circuit the student uses.

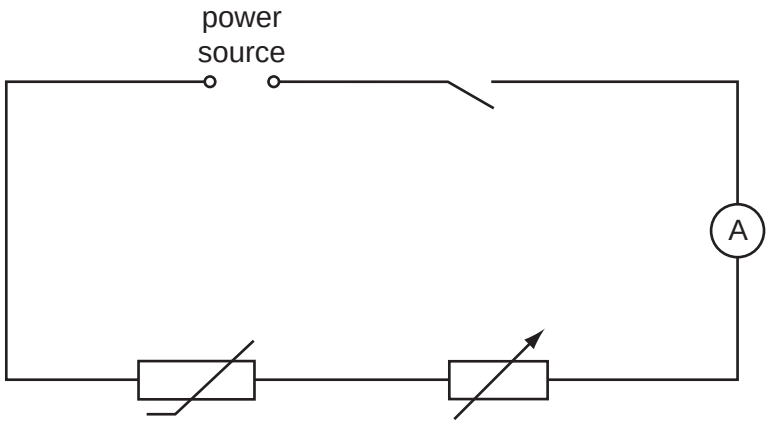



**Fig. 9.1**

**(a)** **(i)** On Fig. 9.1, label the thermistor. [1]

**(ii)** The student measures the potential difference (p.d.) across the thermistor.
On Fig. 9.1, draw a voltmeter symbol, correctly connected, to measure this potential difference. [2]

**(b)** The student varies the temperature of the thermistor and measures the current in it.
Some of the results are shown in the table.

| temperature of thermistor / °C | 20 | 40 | 60 | 80 |
|---|---|---|---|---|
| current in thermistor / A | 0.005 | 0.010 | 0.040 | |

**(i)** The potential difference across the thermistor is 6.0 V.

Calculate the resistance of the thermistor when its temperature is 40 °C.

resistance = ..... Ω [3]

**(ii)** Describe and explain what happens to the current in the thermistor as the temperature of the thermistor rises.

.....

.....

..... [2]

**(iii)** Suggest a value for the current in the thermistor at 80 °C.

.....A [1]

**(c)** At a different temperature, the resistance of the thermistor is 300 Ω and the resistance of the variable resistor is 400 Ω.

Calculate the value of their combined resistance.

combined resistance = ..... Ω [1]

[Total: 10]

**10 (a)** A student investigates electromagnetic induction.

Fig. 10.1 shows the arrangement she uses.

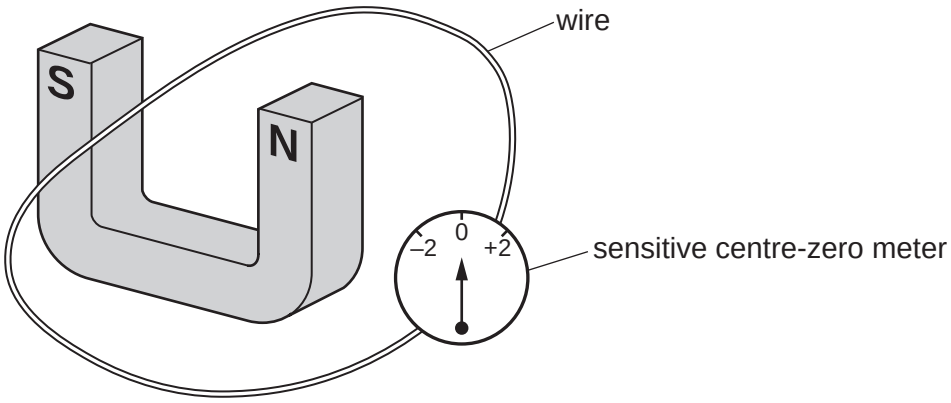
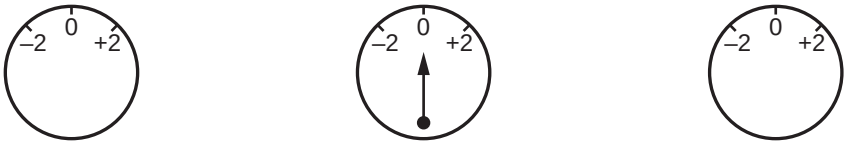



**Fig. 10.1**

When the student holds the wire stationary, as shown in Fig. 10.1, the reading on the meter is zero.
She moves the wire down between the poles of the magnet. Then she holds it stationary and then moves it up.

**(i)** The meter measures the size and direction of the induced electromotive force (e.m.f.). On Fig. 10.2, draw the position of the pointer on the meter at each stage.

One has been done for you.




wire moving down  wire stationary  wire moving up

[2]

**Fig. 10.2**

**(ii)** Describe how the student could increase the size of the induced electromotive force (e.m.f.).

.....

.....

..... [2]

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**(b)** A transformer is used near a power station.
There are 60 turns on the input coil and 660 turns on the output coil.
The input voltage is 25 000 V.

Calculate the output voltage.

output voltage = ..... V [3]

**(c)** State **two** advantages of high-voltage transmission of electrical energy.

1. .....

2. ..... [2]

[Total: 9]

**11** A nucleus of polonium-210 can be represented as $^{210}_{84}Po$.

**(a)** **(i)** State the number of protons in a nucleus of polonium-210 ..... [1]

**(ii)** State the number of neutrons in a nucleus of polonium-210 ..... [1]

**(iii)** State the number of electrons in a neutral atom of polonium-210 ..... [1]

**(b)** Polonium-210 is radioactive. When polonium-210 decays it emits alpha radiation.

Name two other types of radiation emitted when radioactive elements decay.

..... and ..... [1]

**(c)** Polonium-210 has a half-life of 138 days.

A sample of polonium-210 has a mass of 0.4 g.

Calculate the time for the sample to decay until only 0.1 g of polonium-210 remains.

time = ..... days [3]

[Total: 7]

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**12** A scientist needs to reduce the risks when working with radioactive sources.

**(a)** Explain why radioactive sources can be dangerous.

.....

.....

..... [2]

**(b)** Describe how to reduce the risks when working with radioactive sources.

.....

.....

.....

..... [2]

[Total: 4]

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