



Rewarding Learning

General Certificate of Secondary Education
2023–2024

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3

Foundation Tier

MV18

[GSA31]

FRIDAY 23 FEBRUARY 2024, MORNING

Time

1 hour, plus your additional time allowance.

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 on blank pages.

Complete in black ink only.

Answer **all eleven** questions.

Information for Candidates

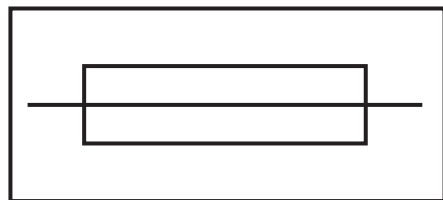
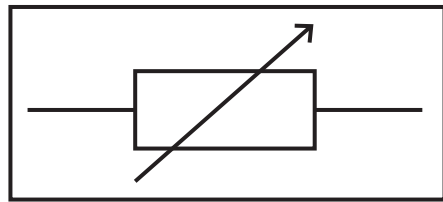
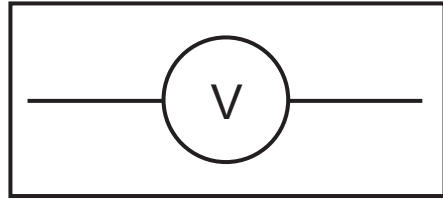
The total mark for this paper is 60.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **10**.

1 (a) Below are three electrical symbols. Use lines to match each symbol with its correct description. [2 marks]

Symbol



Description

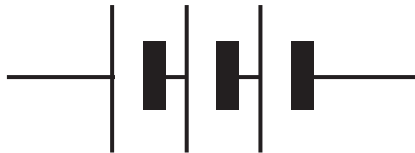
variable resistor

fuse

voltmeter

The diagram below shows cells in three different arrangements.

A



B



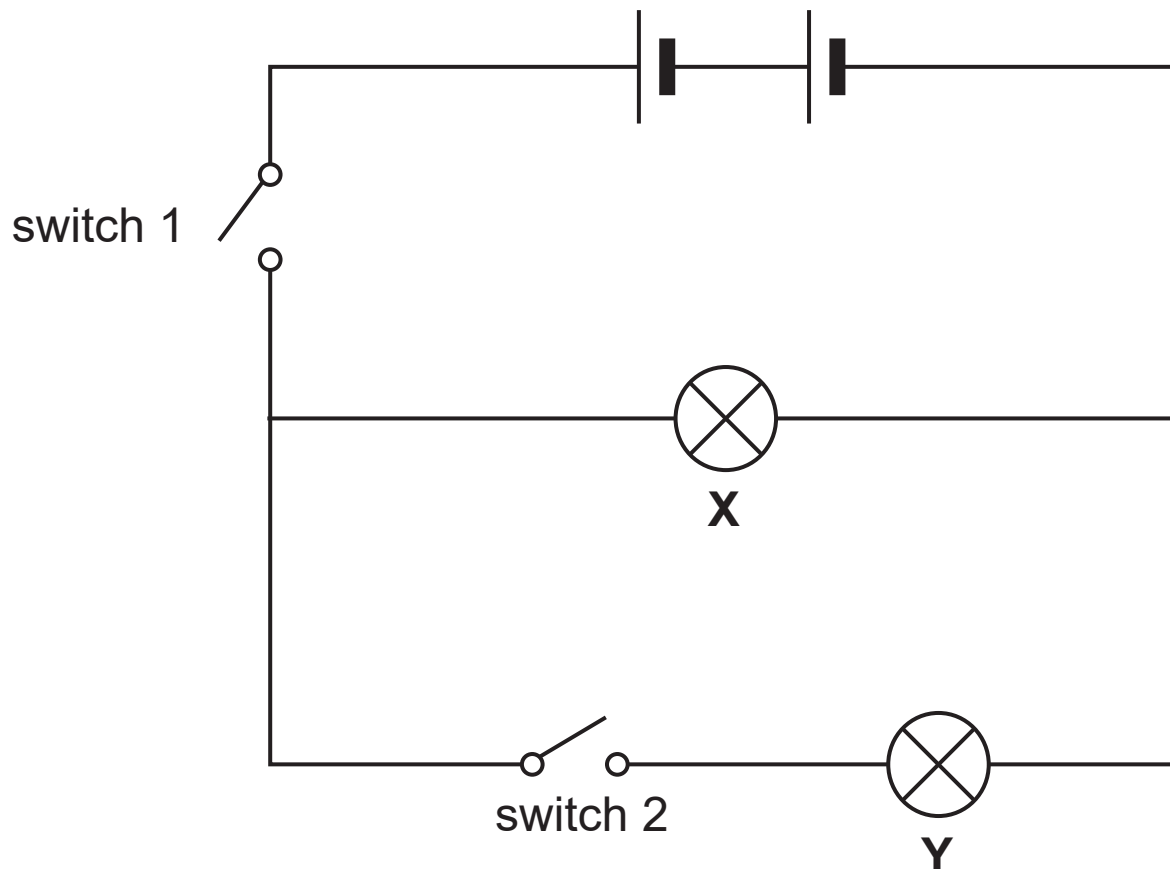
C



Each cell provides 1.5 volts.

(b) Which arrangement of cells **A**, **B** or **C** will provide 1.5 volts? [1 mark]

A student set up the following circuit.



(c) Complete the table below to show if the bulbs are lit or not lit for the switch positions given. [2 marks]

Use a tick (✓) to show if the bulb is lit and a cross (X) to show if it is not lit.

Switch 1	Switch 2	Bulb X	Bulb Y
open	closed		
closed	open		

- 2 Shown below are two objects which convert energy.
Complete the energy transfer diagram for each object.
[2 marks]

Choose from:

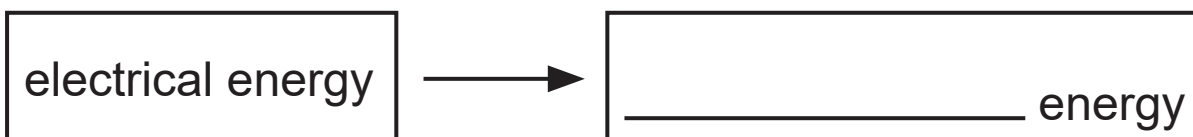
chemical
magnetic
sound
light



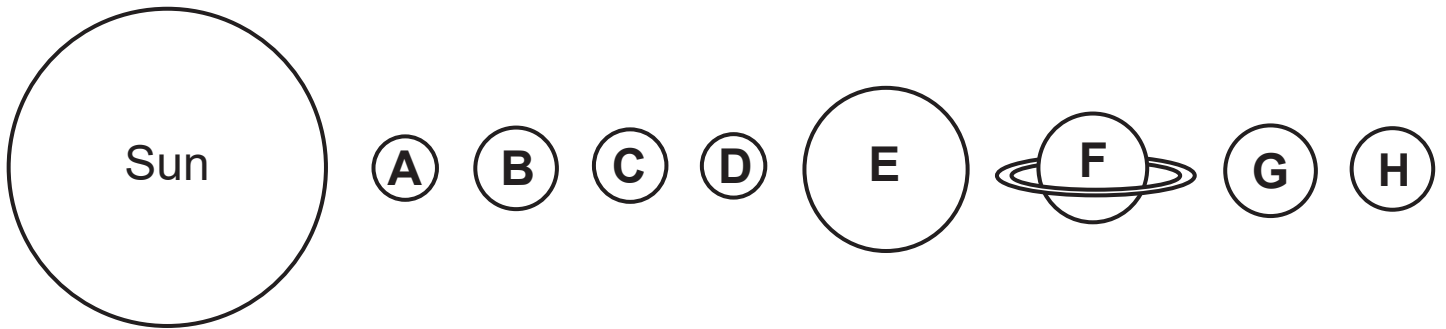
Burning match



Earphones



- 3 (a) The diagram below represents the Sun and its eight planets.



- (i) Name the planet labelled **A**. [1 mark]

- (ii) Suggest which planet **A**, **C**, **E** or **H** takes the longest time to orbit the Sun. [1 mark]

The table below gives information about four planets in our Solar System.

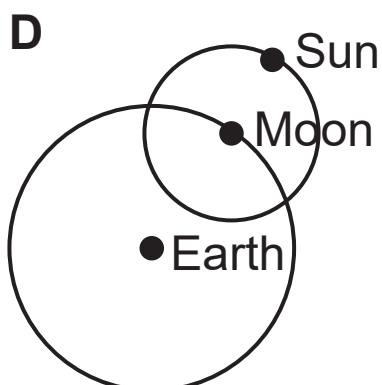
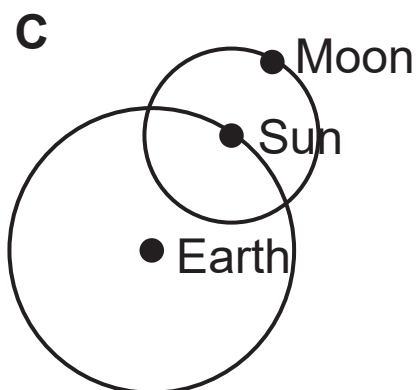
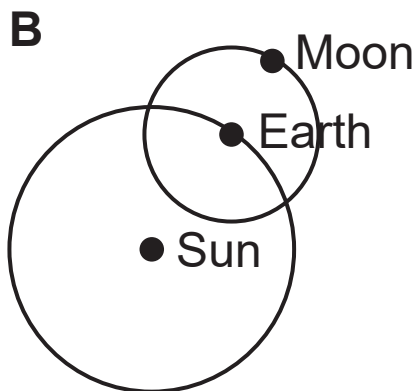
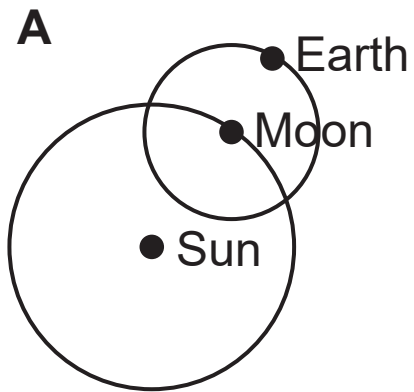
Planet	Diameter/ km	Gravity/ N/kg
Jupiter	142 800	26
Uranus	51 118	11
Neptune	49 528	12
Mars	6790	4

A student looked at this information and made the following suggestion.

“As the diameter of a planet increases, its gravity increases.”

(b) Use data from the table to explain why the student is **not** correct. [2 marks]

(c) Which diagram **A**, **B**, **C** or **D** shows how the Sun, the Earth and the Moon move in their orbits? [1 mark]

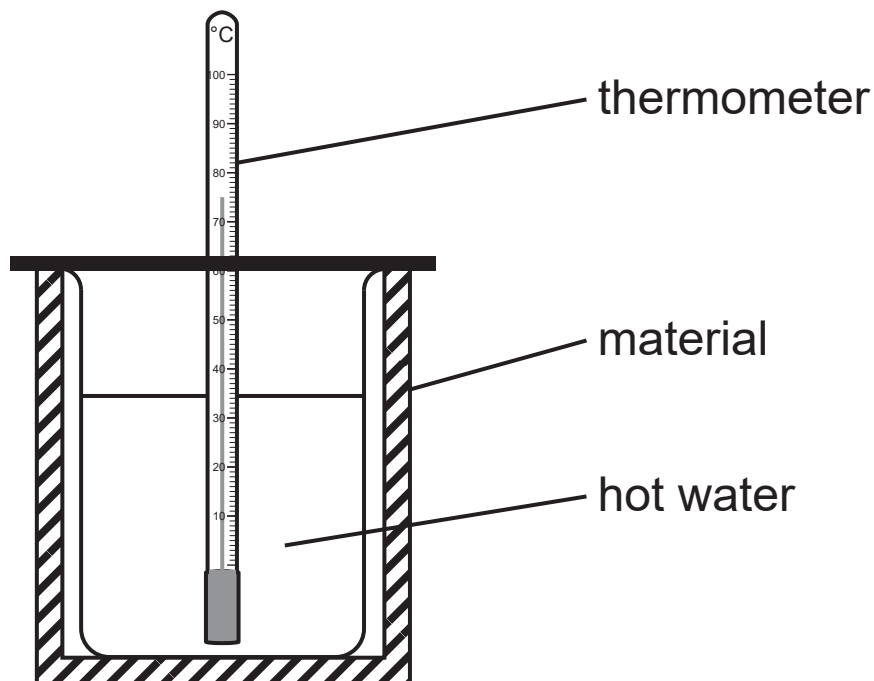


The photograph below shows craters on the Moon.



(d) Name the type of object which caused these craters.
[1 mark]

- 4 (a) Donna set up the apparatus below to investigate how different materials affected heat loss.



The results are shown below.

Material	Starting temperature/ $^{\circ}\text{C}$	Final temperature/ $^{\circ}\text{C}$	Change in temperature/ $^{\circ}\text{C}$
W	83	67	16
X	84	72	
Y	81	72	9
Z	83	70	13

- (i) Calculate the change in temperature for material X.
[1 mark]

_____ $^{\circ}\text{C}$

(ii) Which material **W**, **X**, **Y**, or **Z** is the best insulator?
[1 mark]

(iii) How could the results for this investigation be made more reliable? [1 mark]

(b) The table below gives four ways of insulating a house.

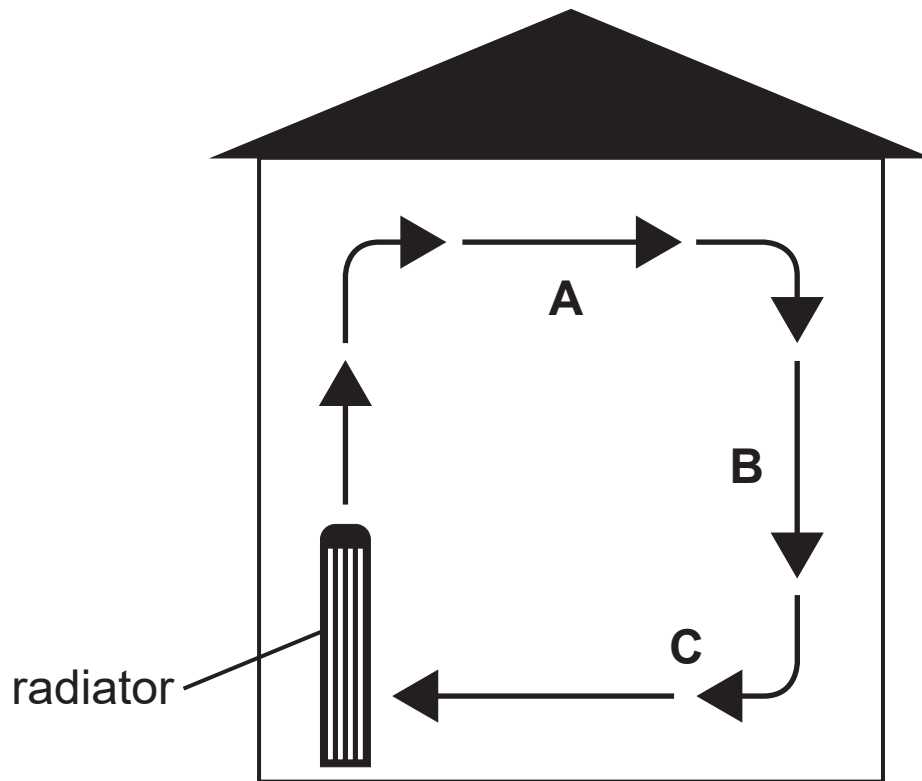
Insulation method	Set-up cost/£	Money saved per year/£
loft insulation	300	180
double glazing	5000	250
cavity wall insulation	500	125
draught excluders	15	45

(i) Which insulation method recovers the set-up cost in the shortest time? [1 mark]

(ii) Calculate the number of years it takes to recover the set-up cost for double glazing. [1 mark]

_____ years

- (c) The diagram below shows a room being heated. The arrows show the movement of air.



- (i) Name the method of heat transfer shown in the diagram. [1 mark]

Circle your answer.

convection

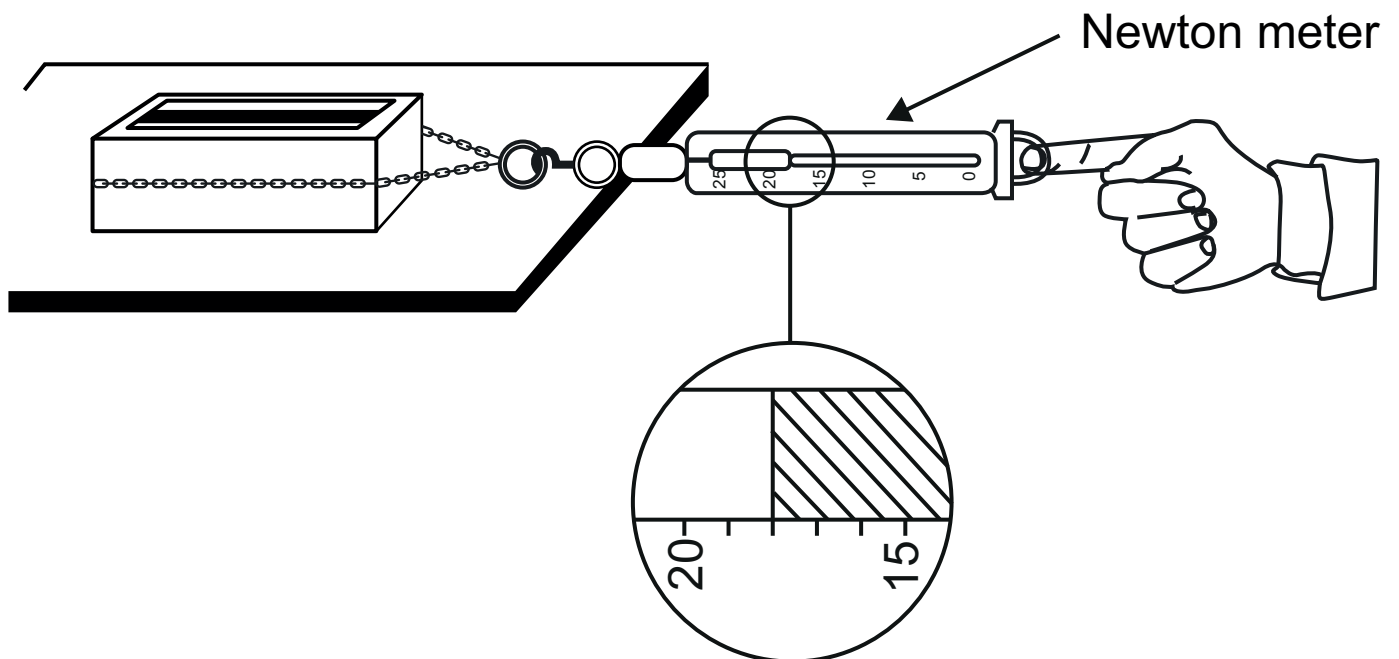
radiation

conduction

- (ii) Where in the room **A**, **B** or **C** is the air temperature **lowest**? [1 mark]

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(Questions continue overleaf)

- 5 George investigated friction by using a Newton meter to measure the force needed to pull a brick across different floor surfaces.



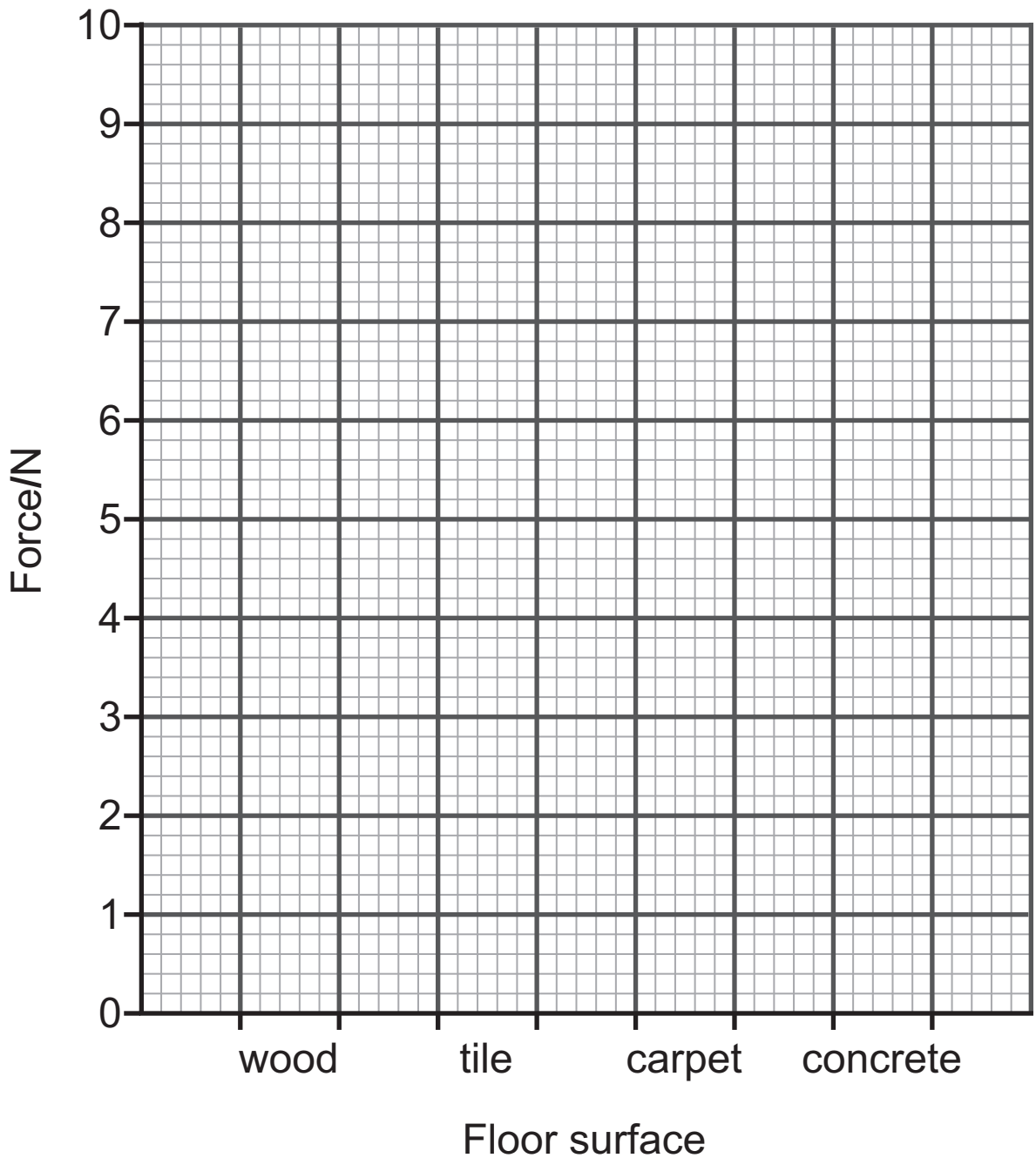
- (a) What is the reading on the Newton meter? [1 mark]

_____ N

- (b) The results for each surface are shown below.

Floor surface	Force/N
wood	4
tile	3
carpet	7
concrete	8

- (i) On the grid below draw a bar chart for these results.
[2 marks]

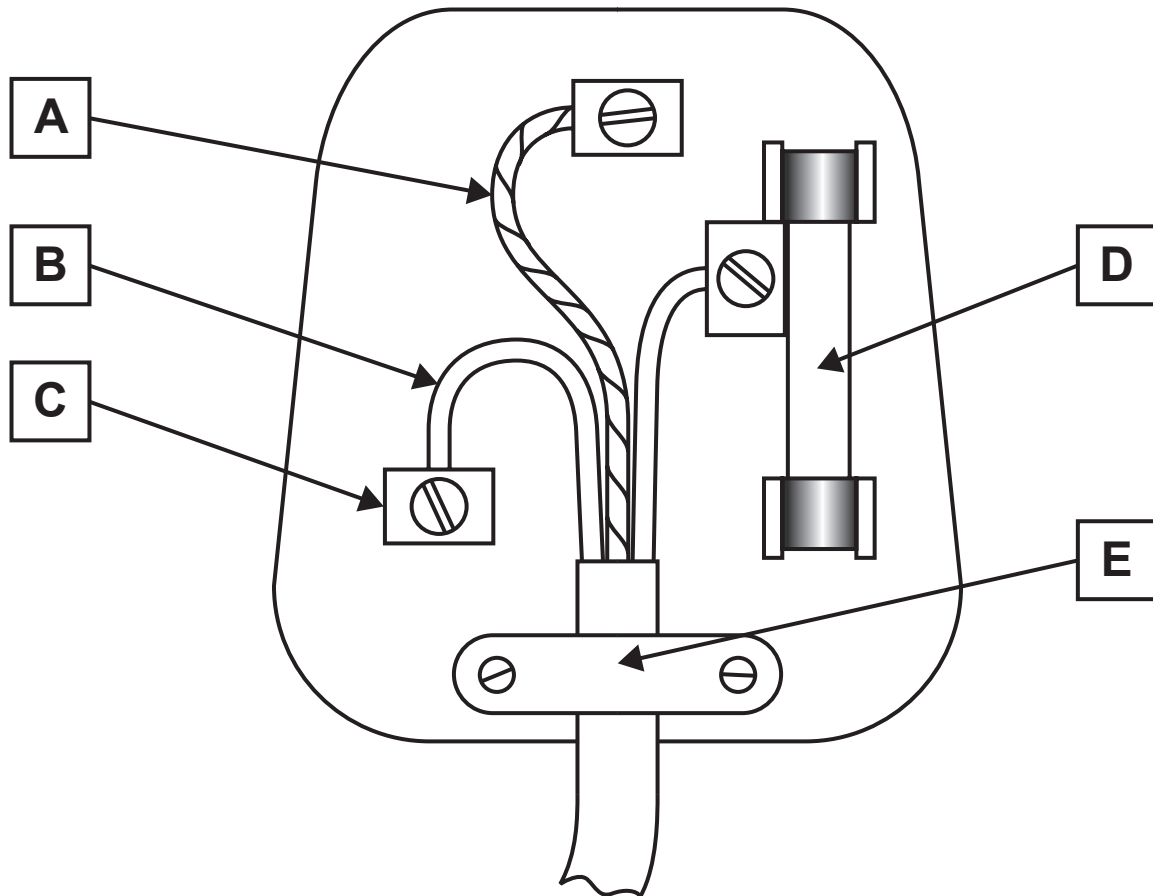


- (ii) Name the surface that produces the **most** friction.
[1 mark]

(c) Give **one** way to reduce friction on the tile floor surface.
[1 mark]

(d) Apart from kinetic energy, name **one** other form of energy produced as the brick is pulled across a floor surface. [1 mark]

- 6 The diagram below shows a three-pin plug used on a fridge.



(a) Which letter **A**, **B**, **C**, **D** or **E** shows the part of a plug that: [2 marks]

protects the fridge from high currents? _____

holds the wires securely in place? _____

(b) Shown below are the readings on a household electricity meter at the start and the end of a month.

Start of the month

0	9	2	7	8
---	---	---	---	---

End of the month

0	9	6	2	9
---	---	---	---	---

(i) Calculate the number of units of electricity that were used during this month. [1 mark]

_____ units

(ii) Use the equation:

$$\text{cost} = \text{units used} \times \text{cost per unit}$$

to calculate the cost of electricity which has been used during this month. [2 marks]

Each unit of electricity costs 20p.

Show your working out.

_____ p

7 (a) Shown below is part of the electromagnetic spectrum.

Gamma rays	X-rays		Visible light			Radio waves
------------	--------	--	---------------	--	--	-------------

(i) Complete the spectrum. [2 marks]

Choose from:

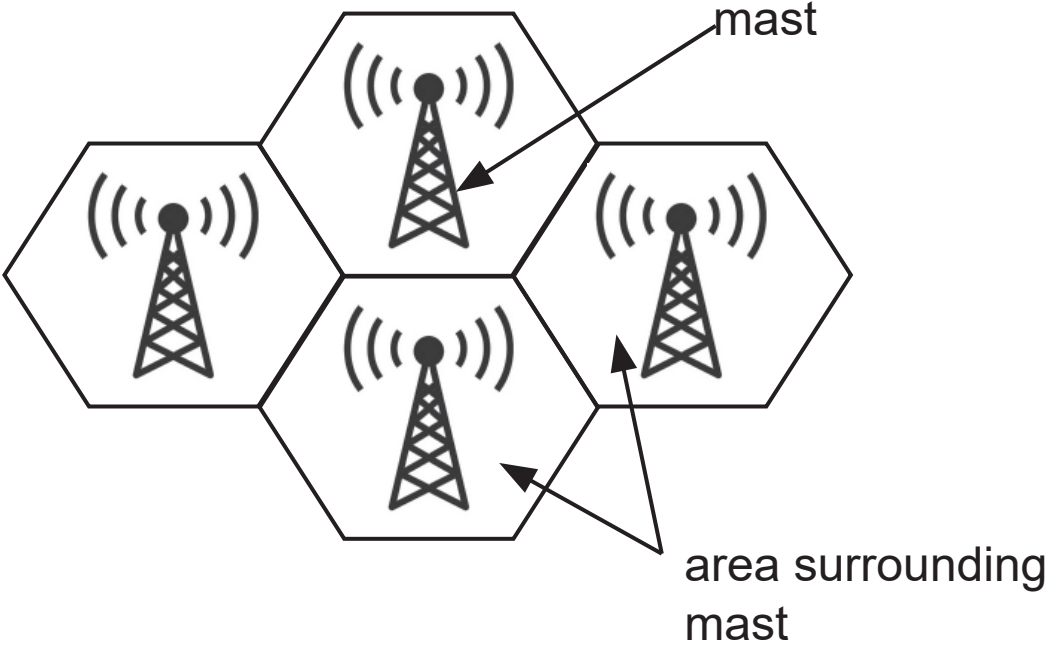
infrared

microwaves

ultraviolet

(ii) Give **one** property that is **different** for each of these waves. [1 mark]

The diagram below shows a mobile phone network that uses microwaves.



(b) What name is given to the area surrounding each mast?
[1 mark]

(c) Specific Absorption Rate (SAR) is a measurement of how much electromagnetic radiation is absorbed by body tissue when using a mobile phone. The table below gives the SAR level for four models of mobile phone.

Model	SAR/ W/kg
A	0.94
B	1.18
C	1.00
D	0.53

The higher the SAR value, the more radiation is absorbed. The maximum recommended level in the UK is 2 W/kg, but experts warn that children are **twice** as sensitive to radiation as adults.

Use this information to answer the following questions.

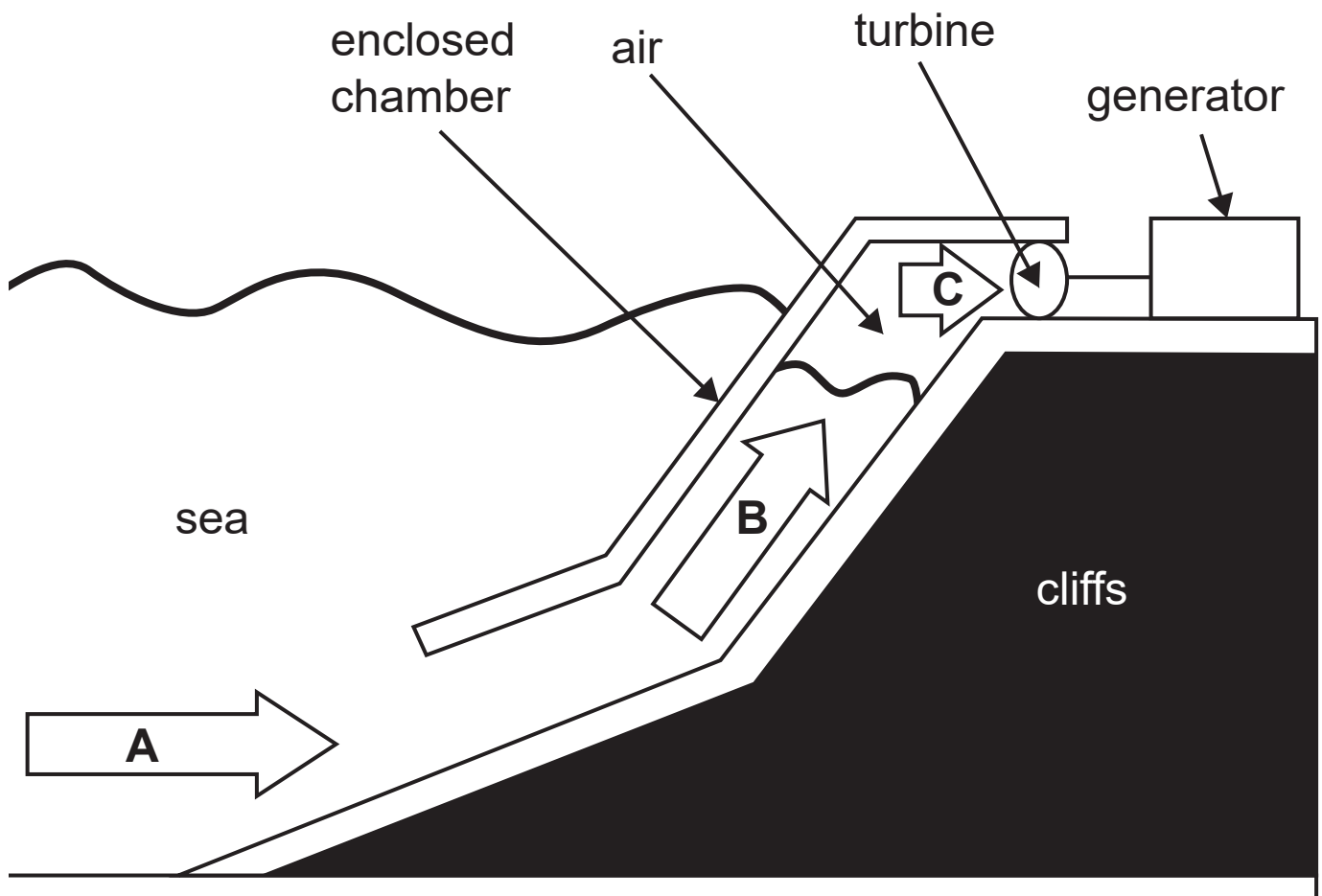
- (i) Which model **A**, **B**, **C** or **D** would be the safest to use? [1 mark]

- (ii) Which model **A**, **B**, **C** or **D** should **not** be used by children? Explain your answer. [2 marks]

8 (a) Waves are a source of renewable energy.

(i) What is meant by the term **renewable energy**?
[1 mark]

The diagram below shows a wave chamber used to generate electricity.

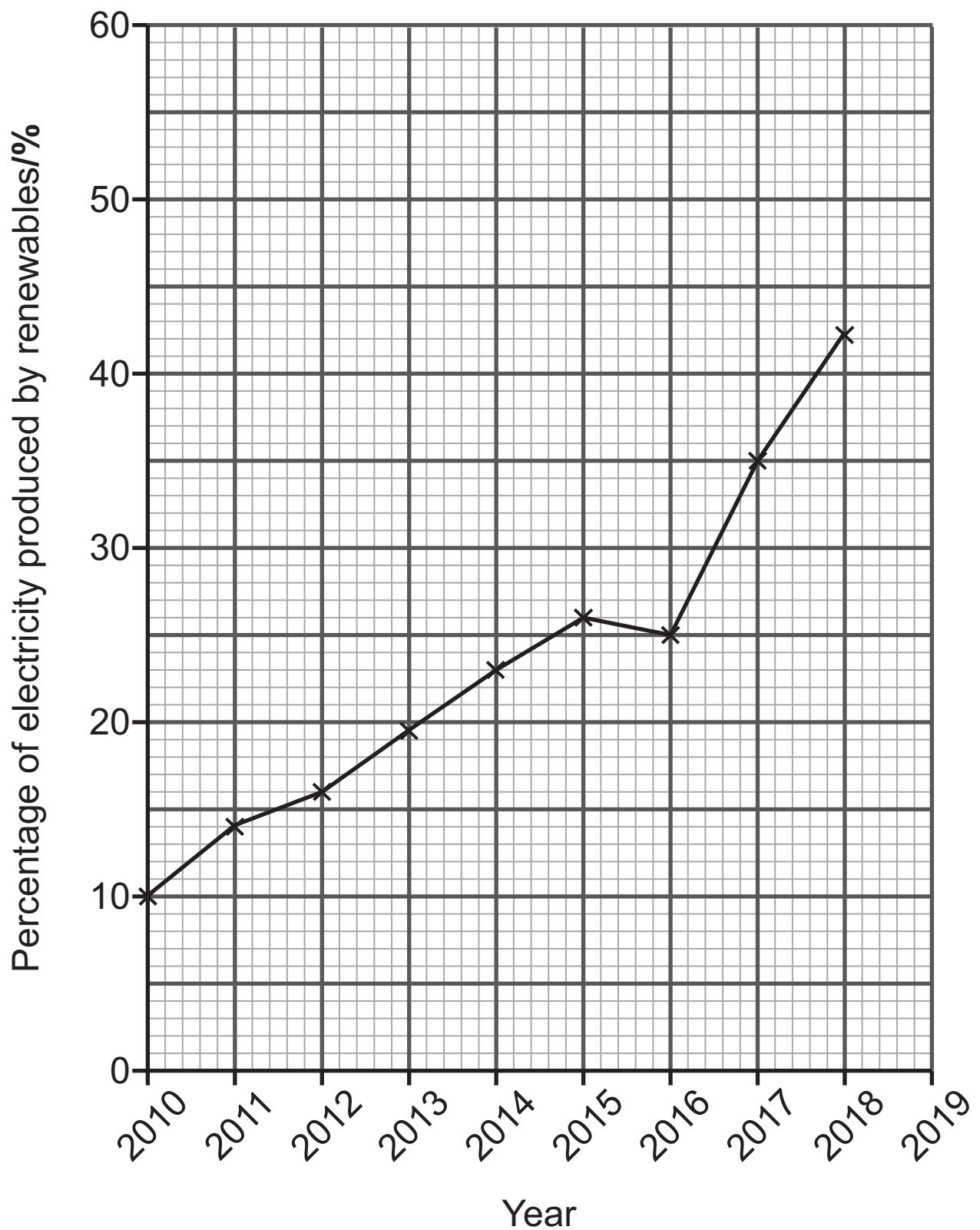


- A** waves push water up the chamber
- B** water pushes on air
- C** air forced through turbine

(ii) Explain how the **generator** produces electricity.
[2 marks]

(iii) Give **one** disadvantage of using wave chambers to generate electricity. [1 mark]

(b) The graph below shows the percentage of electricity generated in Northern Ireland using renewable sources from 2010 to 2018.



- (i) Use the graph to suggest the percentage of electricity generated from renewable sources in 2019. [1 mark]

_____ %

- (ii) Suggest **one** reason why the percentage of electricity produced by renewable sources has increased. [1 mark]

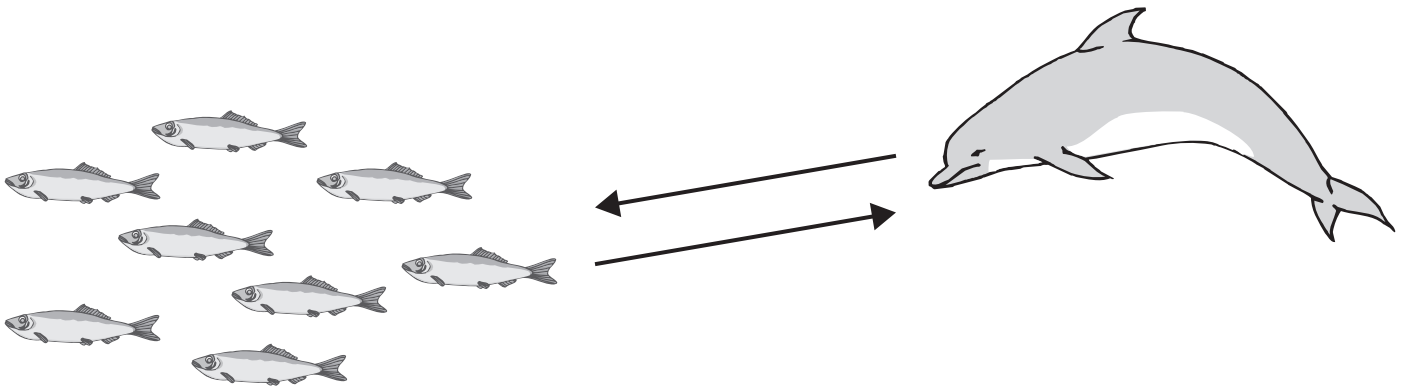
- 9 The table below shows the lowest and highest frequencies that can be heard by three types of dolphin.

Dolphin	Lowest frequency/ kHz	Highest frequency/ kHz
Bottlenose	0.1	150
Atlantic spotted	1.3	29
Striped	32.0	120

- (a) Name the type of dolphin which has the **smallest** frequency range. [1 mark]

- (b) What is the **highest** frequency that humans can hear? [1 mark]

The diagram below shows a dolphin hunting for fish.



Sound travels at 1500 m/s in water.

The dolphin sends out an ultrasound pulse and the echo returns 0.2 seconds later.

(c) Use the equation:

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

to calculate the distance of the fish from the dolphin.
[3 marks]

Show your working out.

_____ m

10 The table below shows blood alcohol levels and the number of car accidents, for different age groups.

	Blood alcohol level/ mg/100 ml			
	20	40	60	80
Age	Number of accidents			
under 20	16	36	60	100
20–30	12	28	49	76
over 30	10	23	38	56

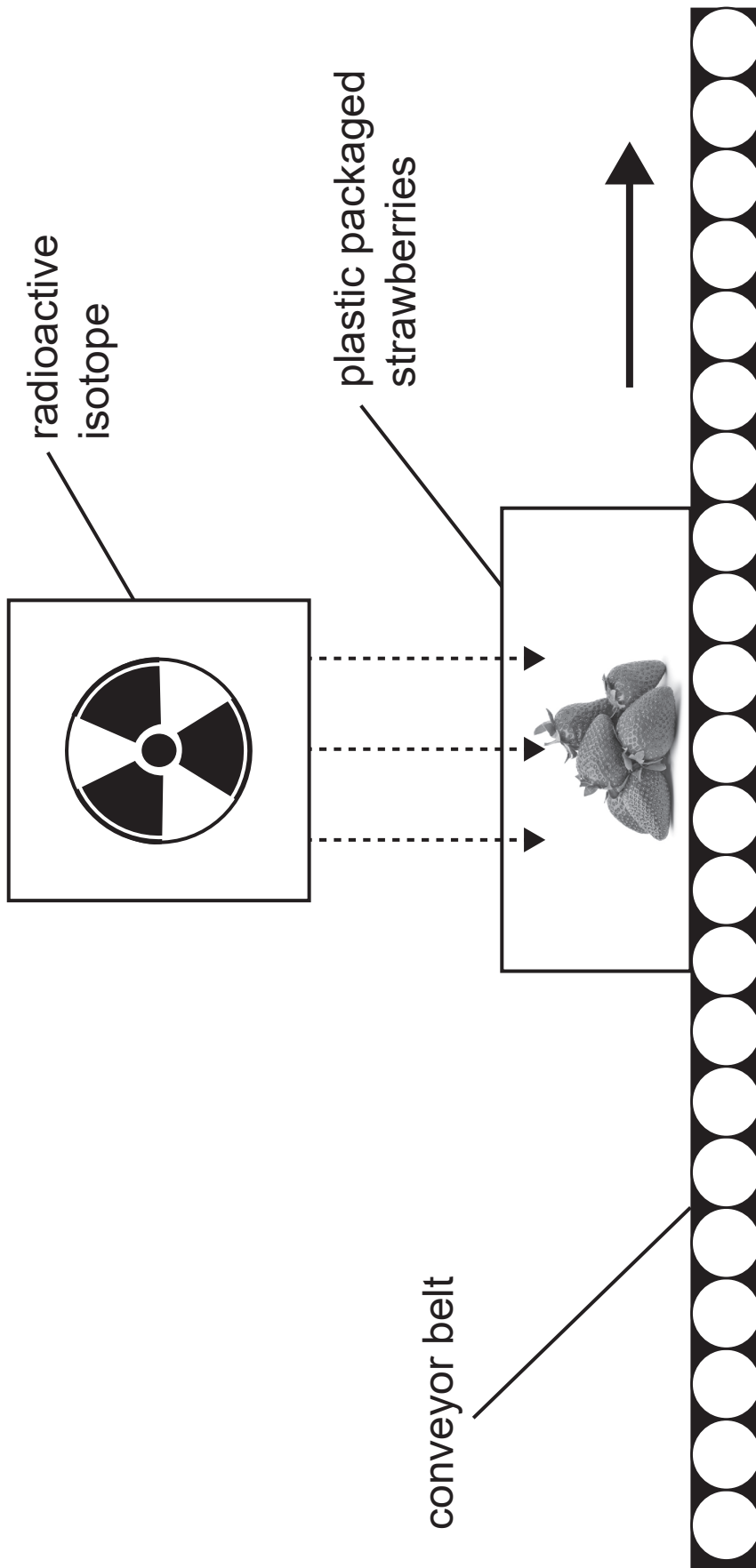
Use this information to describe the effect that alcohol has on the number of car accidents at different ages and explain this using your knowledge of how the brain reacts to alcohol. [6 marks]

Your answer should include:

- **two** conclusions from the information;
- the effect alcohol has on reaction time; and
- the effect alcohol has on thinking, braking and stopping distances.

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

11 The diagram below shows strawberries being irradiated by a radioactive isotope.



The table below gives some information about isotopes.

Radioactive isotope	Type of radiation emitted	Half-life
bismuth-83	beta	61 minutes
cobalt-60	gamma	5 years
polonium-210	alpha	138 days
radon-220	alpha	55 seconds
technetium-99	gamma	6 hours

- (a) Suggest which isotope would be the best for a food producer to use to irradiate a packet of fresh strawberries. Explain your answer. [3 marks]

Isotope _____

Explanation _____

- (b) Explain why some fruit producers irradiate strawberries. [2 marks]

This is the end of the question paper

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Question Number	Marks
1	
2	
3	
4	
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10	
11	
Total Marks	

Examiner Number

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