



General Certificate of Secondary Education
2019–2020

Centre Number

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Candidate Number

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Single Award Science: Physics

Unit 3
Higher Tier



[GSA32]

GSA32

FRIDAY 8 NOVEMBER 2019, 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 nine** 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)**.



- 1 (a) The table below gives some information about the first five planets in our Solar System. The planets are in order of increasing distance from the Sun.

Planet	Average surface temperature/°C	Orbital time/ years	Length of day	Orbital speed/ million km/year
Mercury	350	0.2	0.16 years	1560
Venus	480	0.6	0.67 years	1100
Earth	22	1.0	24 hr	945
Mars	−23	1.9	24 hr 37 min	754
Jupiter	−150	12.0	9 hr 50 min	413

Use information from the table to answer parts (i) and (ii) below.

- (i) Give **one** factor that **increases** as the distance from the Sun increases.

_____ [1]

- (ii) Give **one** factor that **decreases** as the distance from the Sun increases.

_____ [1]

- (b) There are eight planets in our Solar System. Name the planet that is farthest from the Sun.

_____ [1]

- (c) Name the force that keeps the planets in orbit around the Sun.

_____ [1]



(d) An object that orbits the Earth is called a satellite. Many are artificial because they have been put into orbit by humans.

(i) State **one** use of artificial satellites.

_____ [1]

(ii) Name the Earth's only **natural** satellite.

_____ [1]

[Turn over



- 2 The photograph below shows a toy designed for a pet dog.

Image removed due to copyright

- (a) The toy produces ultrasound that only the dog can hear.
What is meant by the term **ultrasound**?

[2]

- (b) Sound waves are longitudinal waves.

- (i) Describe the movement of the particles in a longitudinal wave.

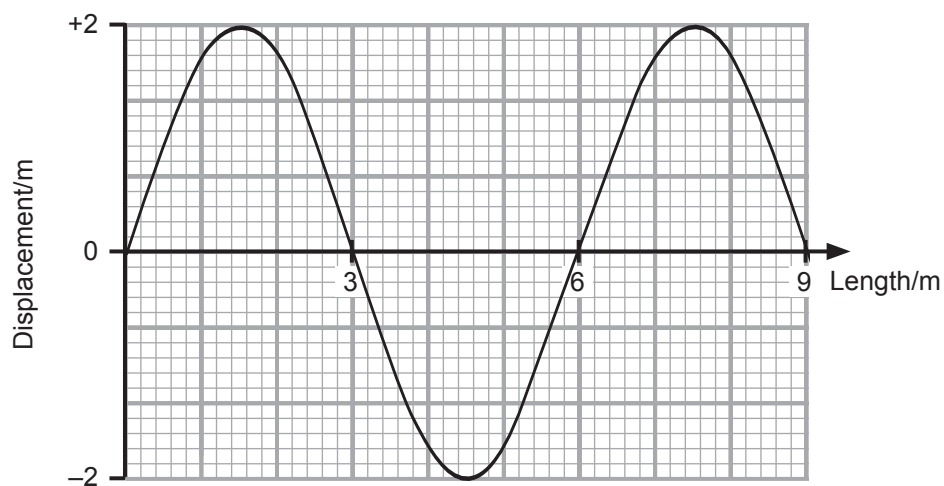
[2]



(ii) Light is an example of another type of wave. Name this other **type** of wave.

_____ [1]

(c) The diagram below represents a water wave.



(i) What is the amplitude of this wave?

_____ m [1]

(ii) What is the wavelength of this wave?

_____ m [1]

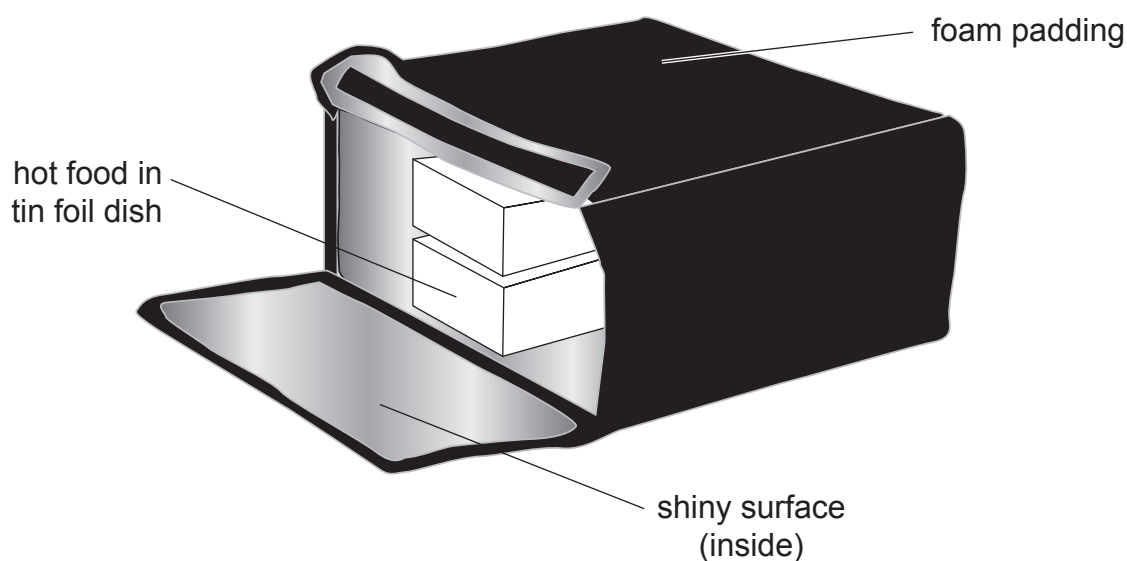
(d) Complete the following sentence.

All waves transfer _____ from one point to another. [1]

[Turn over



- 3 (a) The diagram below shows a food delivery bag. It is designed to keep food warm.



Source: Principal Examiner

Explain how this type of bag is designed to keep food warm.

Your answer should include:

- the names of the 3 methods of heat transfer;
- a description of each method of heat transfer; and
- how the different parts of the bag help prevent heat loss.

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





[6]

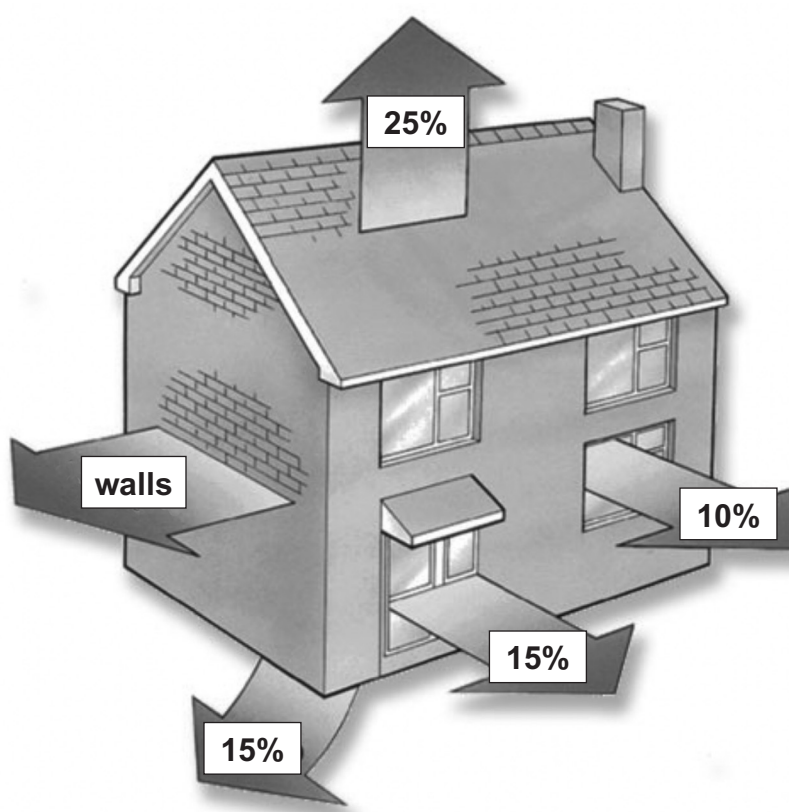
[Turn over

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(b) The diagram below shows how heat is lost from a house.



Source: Principal Examiner

(i) Calculate the percentage of heat that is lost through the walls.

_____ % [1]

(ii) Give **one** way that heat loss through the walls can be reduced.

_____ [1]





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(Questions continue overleaf)



- 4 (a) The table below shows how the percentage of people using seat belts changed from 2013 to 2017 in four types of vehicles.

Type	2013	2014	2015	2016	2017
SUVs	86.1	87.8	90.6	92.4	90.9
Vans	86.7	88.1	90.7	90.4	93.4
Cars	85.1	85.7	89.3	90.2	90.4
Trucks	71.3	71.9	78.1	76.6	81.5

- (i) In which type of vehicle has there been the biggest increase in seat belt use from 2013 to 2017?

_____ [1]

- (ii) From this information Helen concludes that:
“*The use of seat belts has increased every year in all types of vehicle.*”
Give one reason why this conclusion is **incorrect**.

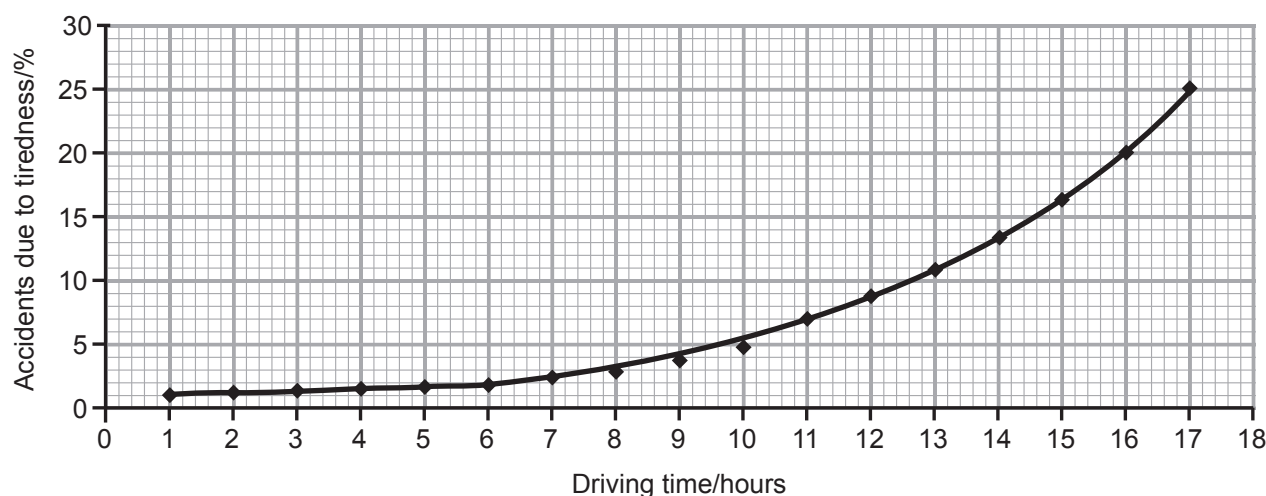
_____ [1]

- (iii) Seat belts are fitted as a safety feature. Name **one** other safety feature found in vehicles.

_____ [1]



- (b) The graph below shows how the percentage of accidents due to tiredness changes with the length of time a person is driving.



Source: Principal Examiner

- (i) State fully the trend shown by the information in this graph.

[2]

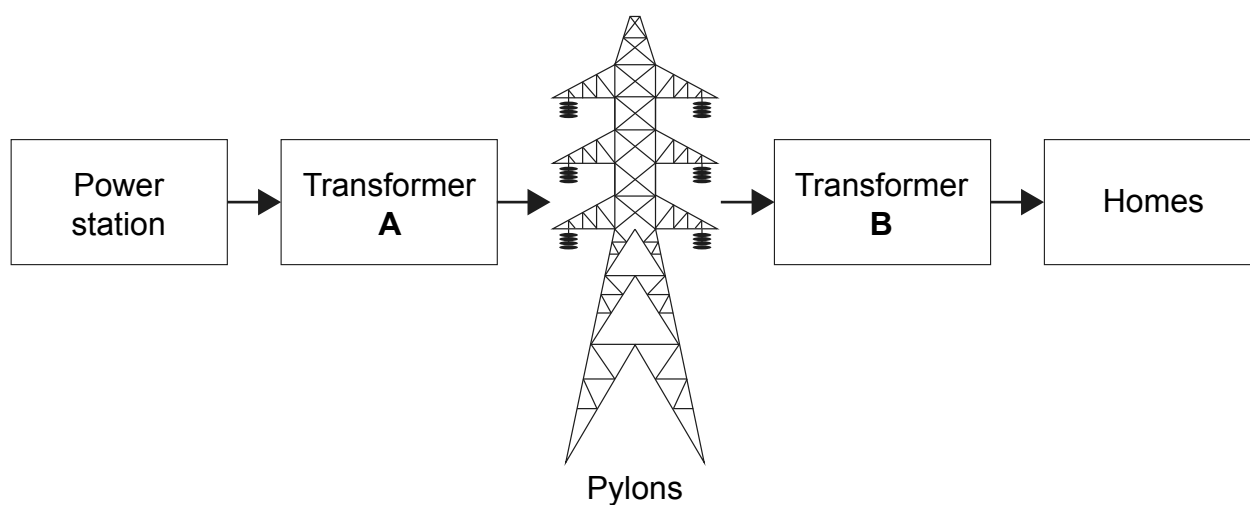
- (ii) What effect, if any, does tiredness have on thinking, braking and stopping distance?

[2]

[Turn over



- 5 (a) The diagram below shows how electricity is carried from the power station to all our homes.



Source: Principal Examiner

The electricity companies want to deliver this electricity across the country with as little energy loss as possible.

- (i) What type of transformer is **A**?

_____ [1]

- (ii) Explain fully how transformer **A** reduces the amount of energy lost.

_____ [2]



- (b) Most of the electrical energy supplied to our homes is used by appliances. Some of these appliances, like the fridge-freezer, must stay on all the time.

Use the equation:

$$\text{energy (kWh)} = \text{power (kW)} \times \text{time (hr)}$$

to calculate the cost of running a 150 W fridge-freezer for 1 day.
Each unit of electricity costs 21 p.

(Show your working out.)

_____ p [3]



- 6 The diagram below shows a car of mass 600 kg moving along a straight level road and some of the forces acting on it.



Source: Principal Examiner

- (a) What name is given to the force labelled **X** in the diagram?

_____ [1]

- (b) Use the equation:

$$\text{force} = \text{mass} \times \text{acceleration}$$

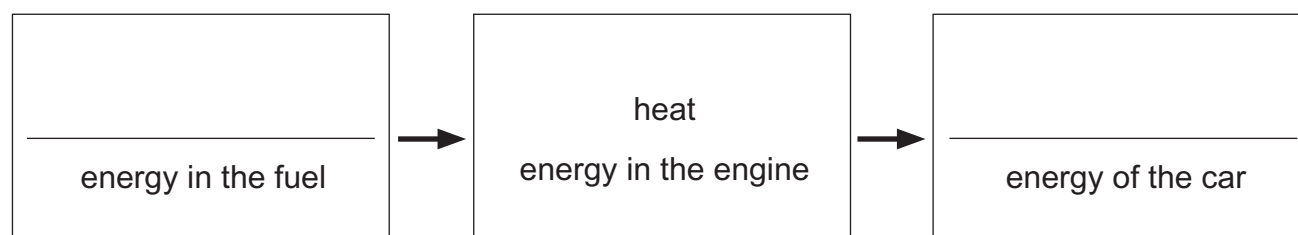
to calculate the acceleration of this car. Give your answer to 2 decimal places.

(Show your working out.)

_____ m/s² [3]



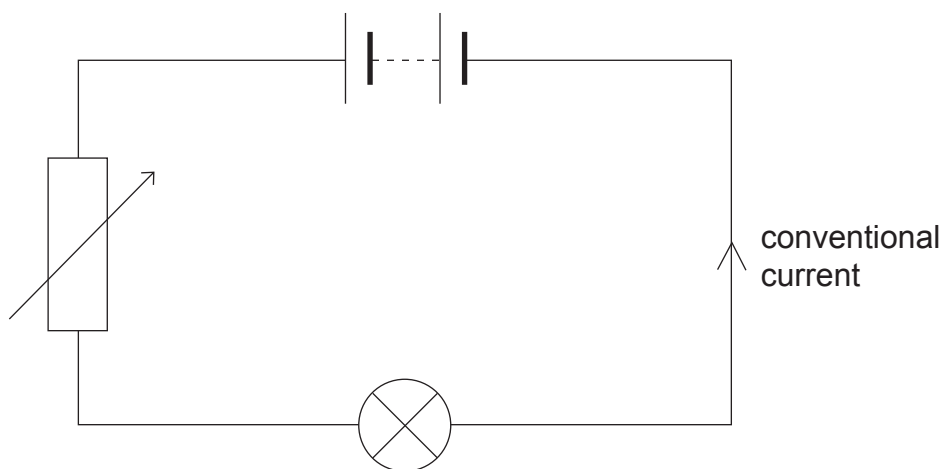
(c) Complete the energy transfer diagram below for the moving car.



[2]



- 7 The circuit below shows a variable resistor (dimmer switch) being used to control the brightness of a bulb.



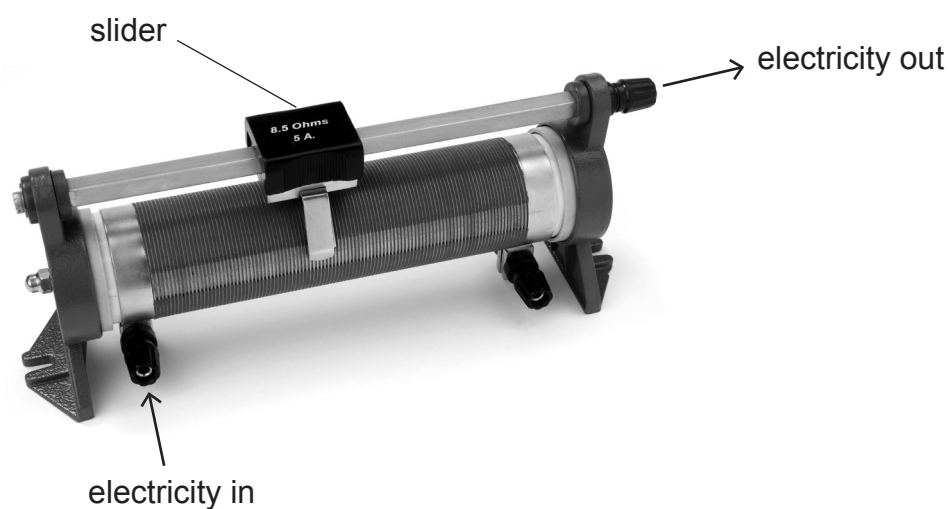
Source: Principal Examiner

- (a) Explain fully why electrons flow in the opposite direction to conventional current flow in a circuit.

[2]



The photograph below shows a variable resistor.



Source: © Trevor Clifford Photography / Science Photo Library

- (b) Explain fully how moving the slider on the variable resistor to the right will make the bulb in the circuit dimmer.

[3]

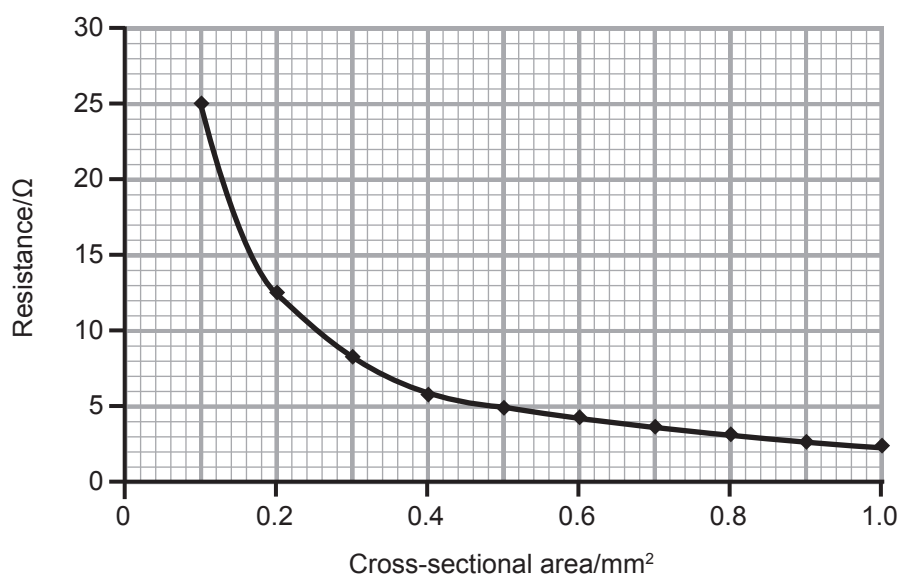
- (c) Apart from a dimmer switch, give **one** other use of a variable resistor.

[1]

[Turn over



The graph below shows how the cross-sectional area of a wire affects its resistance.



(d) Predict the resistance of a wire with cross-sectional area of 1.2 mm².

_____ Ω [1]



- 8 The table below shows how the efficiency of diesel and biodiesel engines is affected by adding rapeseed oil.

Rapeseed oil added/%	Diesel efficiency/%	Biodiesel efficiency/%
0	24.16	25.05
10	23.76	25.28
30	23.73	25.32
50	24.20	25.74

- (a) Describe fully the effect of increasing the percentage of rapeseed oil on diesel and biodiesel engine efficiency.

Diesel _____

Biodiesel _____
_____ [2]

- (b) From the table name the substitute and the extender.

Substitute _____

Extender _____ [2]

- (c) Suggest **one** benefit of a more efficient engine.

_____ [1]

[Turn over



- 9 CT scanners take multiple X-ray images which are processed by a computer to make one image.
The photographs below show an X-ray image and a CT scan of the chest area.



X-ray



CT scan

Source: © PR Michel Brauner, ISM / Science Photo Library
© Du Cane Medical Imaging Ltd / Science Photo Library

The table below gives the radiation dose received from having an X-ray or a CT scan carried out on various parts of the body.

Procedure	Radiation dose/mSv
X-ray of head	0.10
X-ray of chest	0.02
X-ray of abdomen	0.70
CT scan of head	2.00
CT scan of chest	8.00
CT scan of abdomen	9.80



- (a) Suggest **one** advantage and **one** disadvantage of having a CT scan rather than an X-ray.

Advantage _____

Disadvantage _____

_____ [2]

- (b) The lowest level of radiation that is linked to an increased risk of cancer is 100 mSv per year.

- (i) What is the maximum number of CT abdomen scans a person can have in one year without increasing their risk of cancer?

_____ [1]

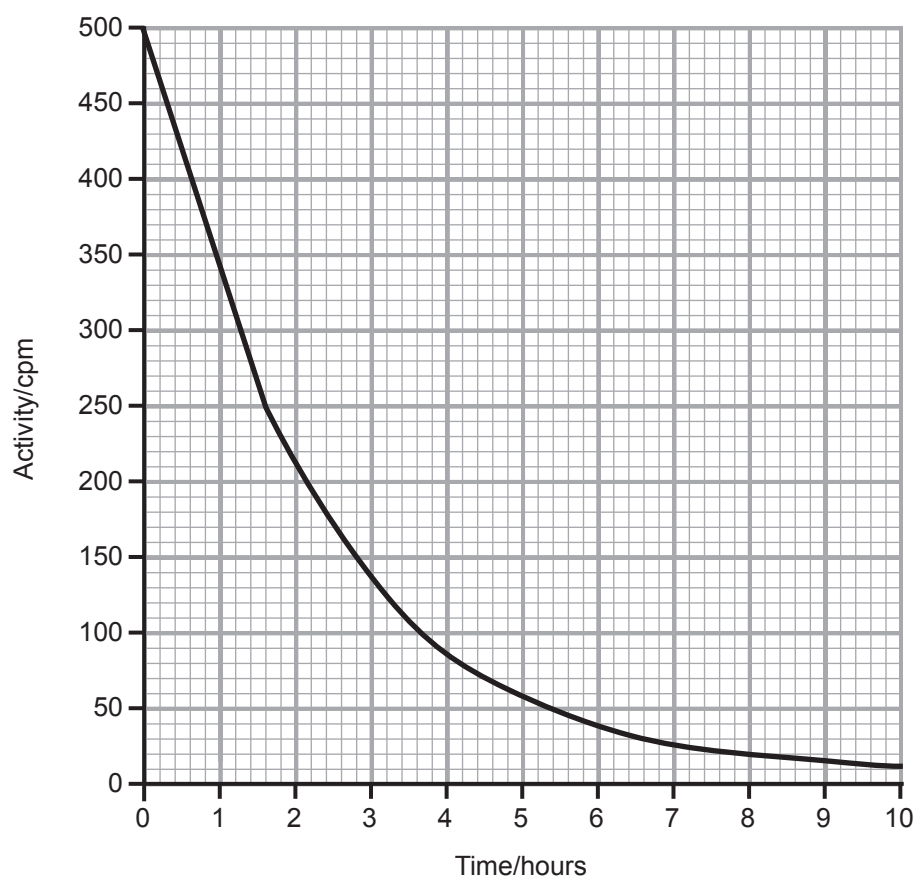
- (ii) A radiographer will perform thousands of X-rays and CT scans each year. Suggest how they protect themselves from an increased risk of cancer.

_____ [1]

[Turn over



- (c) The graph below shows the activity of a radioactive tracer over ten hours. This can be used to find its half-life.



- (i) What is meant by the term **half-life**?

_____ [1]

- (ii) Use the graph to find the half-life of this tracer.

_____ hours [1]



- (iii) This tracer can be used to follow the flow of blood around the body. Why is it important that this tracer has a short half-life?

[1]

THIS IS THE END OF THE QUESTION PAPER



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For Examiner's use only	
Question Number	Marks
1	
2	
3	
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Total Marks	
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Examiner Number

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