



Rewarding Learning

General Certificate of Secondary Education
2015–2016

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Science: Single Award

Unit 3 (Physics)

Higher Tier

MV18

[GSS32]

WEDNESDAY 25 MAY 2016, AFTERNOON

Time

1 hour 15 minutes, 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.

Complete in blue or black ink only.

Answer **all ten** questions.

Information for Candidates

The total mark for this paper is 75.

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

Questions **4(a)** and **9**.

1 (a) The advert below was used to discourage drink driving.



(i) Suggest how drink driving could lead to a person losing his or her job. [1 mark]

(ii) Describe and explain how alcohol affects a driver's thinking distance. [2 marks]

(b) The table below shows how the braking distance and the thinking distance may be affected by the number of people in a car at different speeds.

Speed/ km/h	Braking distance/m		Thinking distance/m	
	car and driver only	car, driver and three passengers	car and driver only	car, driver and three passengers
30	5	7	6	6
45	12	14	8	8
60	21	23	11	11

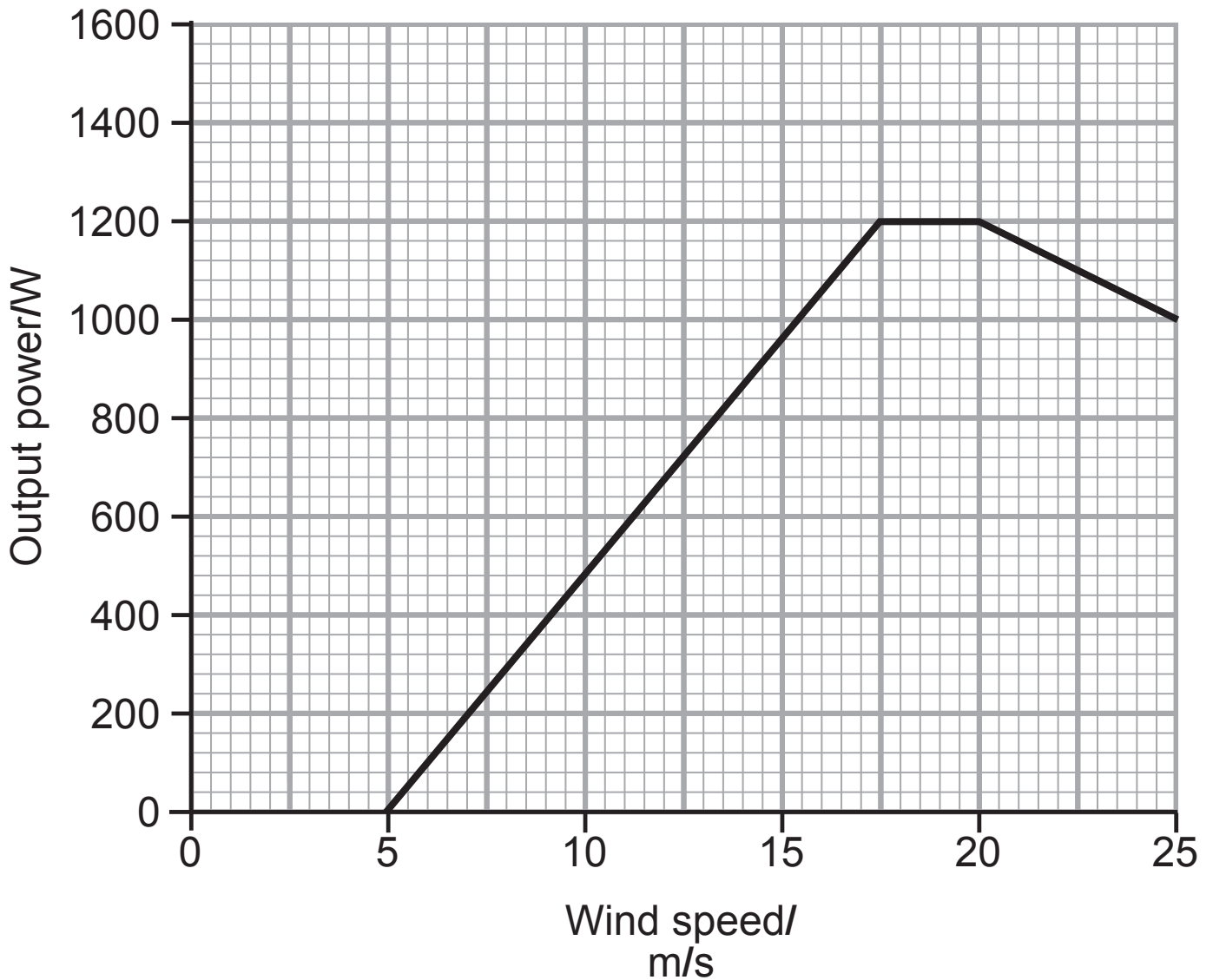
(i) Explain what is meant by the term 'braking distance'.
[1 mark]

(ii) In what way, if any, is braking distance affected by having passengers? [1 mark]

(iii) Calculate the **stopping** distance for a car with a driver and three passengers travelling at 30 km/h.
[1 mark]

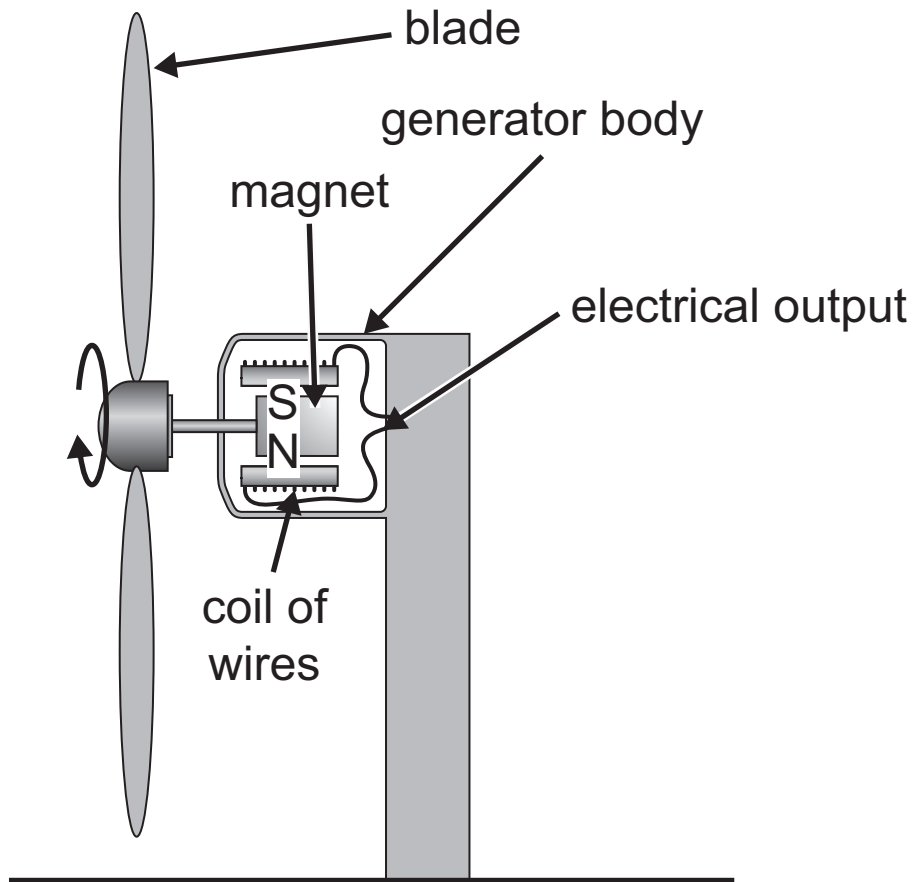
Answer _____ m

- 2 (a) The graph below shows the output power produced by a wind turbine at different wind speeds.



- (i) Describe fully the trend shown by the graph.
[2 marks]

The diagram below shows a cross section through a wind turbine.



(ii) Use the diagram and your knowledge to describe how electricity is produced by this turbine. [2 marks]

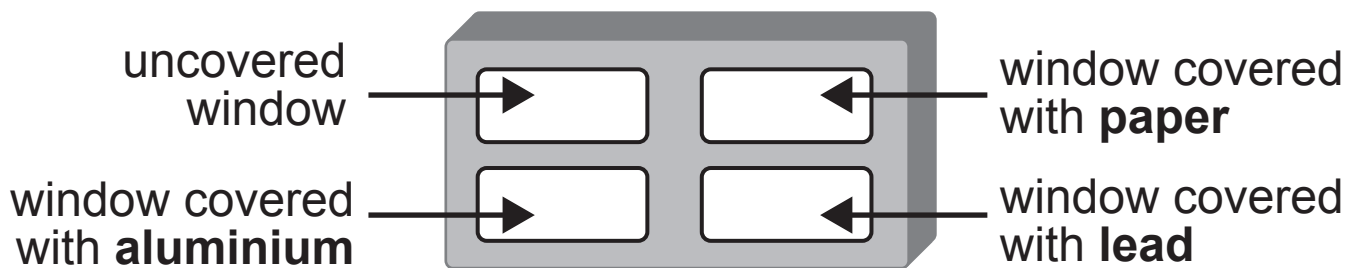
(b) Give **one** environmental advantage and **one** environmental disadvantage of using wind turbines. [2 marks]

Advantage _____

Disadvantage _____

3 (a) The diagram below shows a badge that is used to detect radiation.

The badge has four windows.



Behind each window there is a film that is sensitive to radiation. This film changes colour from brown to white when exposed to radiation.

(i) Suggest the function of the uncovered window.
[1 mark]

(ii) How many windows will change from brown to white when exposed to **beta** radiation? [1 mark]

Answer _____

(b) Surgical equipment can be treated with radiation before it is used in hospital operations.

Suggest why this is necessary, naming the type of radiation used. [3 marks]

(c) The table below shows the results of an investigation into the activity of a radioactive isotope.

Day	Activity/cpm
1	100
2	73
3	50
4	37
5	25
6	18
7	15
8	15
9	15
10	15

Describe fully the trend shown by this information.
[2 marks]

(b) The Universe consists of millions of galaxies.

(i) What is a 'galaxy'? [1 mark]

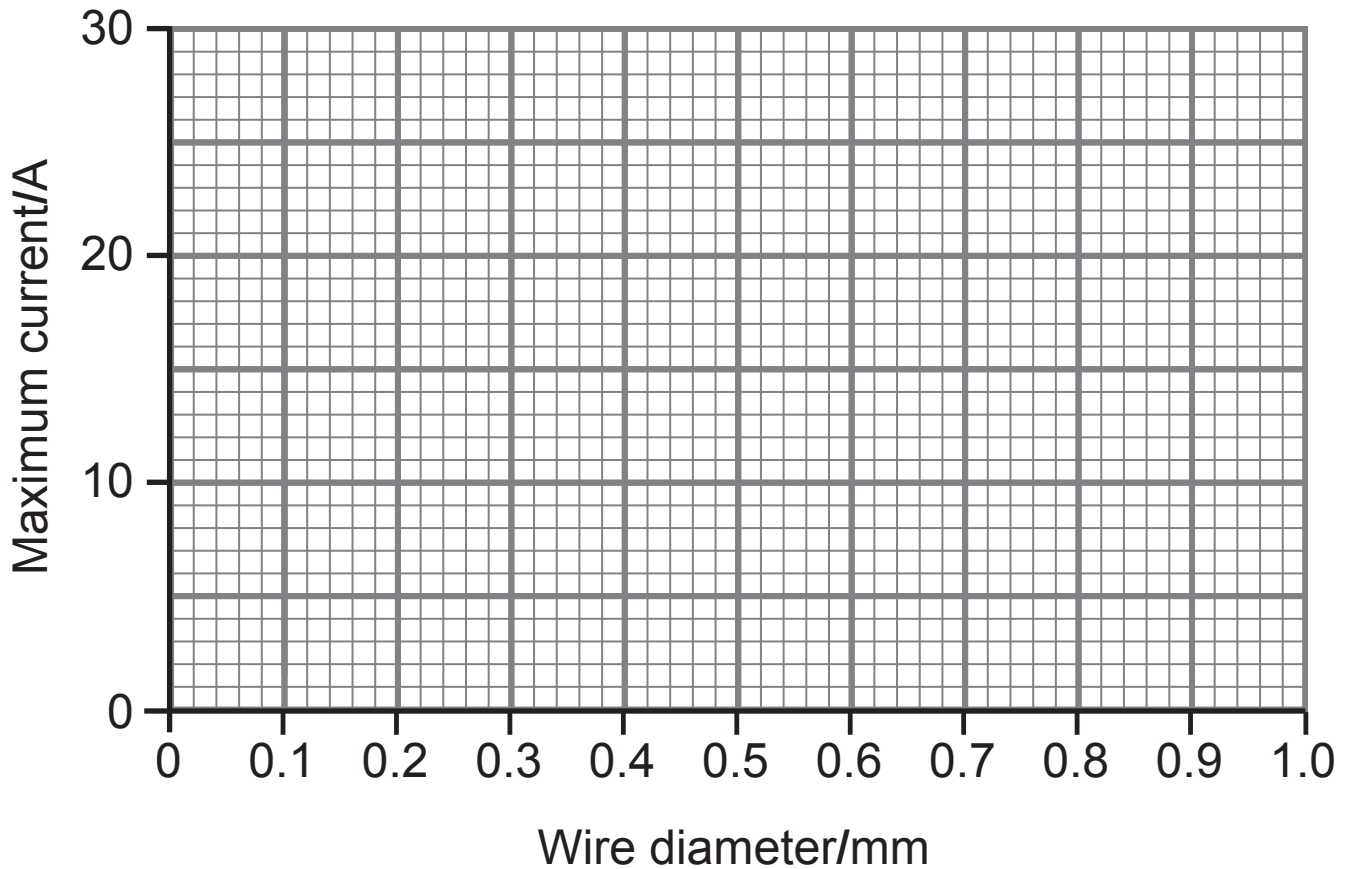
(ii) Name the galaxy that includes planet Earth.
[1 mark]

- 5 (a) Fuses are used in electrical circuits for safety.
Explain fully how a fuse works as a safety device.
[3 marks]

- (b) The table below shows the maximum recommended current allowed to flow through different diameters of wire.

Wire diameter/mm	Maximum current/A
0.20	5
0.35	10
0.50	15
0.65	20
0.80	25
0.95	30

- (i) On the grid below, plot and draw a line graph of these results. [3 marks]



- (ii) Use the graph to find the maximum current that a wire of diameter 0.4 mm should carry. [1 mark]

Answer _____ A

(iii) Use the information and the equation:

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

to calculate the maximum power of an appliance connected to the 240 V mains through a 0.2 mm diameter wire.

(Show your working out.) [2 marks]

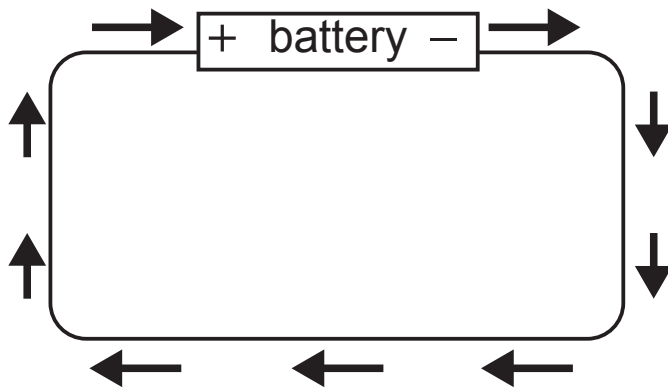
Answer _____ W

(c) The photograph below shows a consumer unit fitted with residual current circuit breakers (RCCBs).



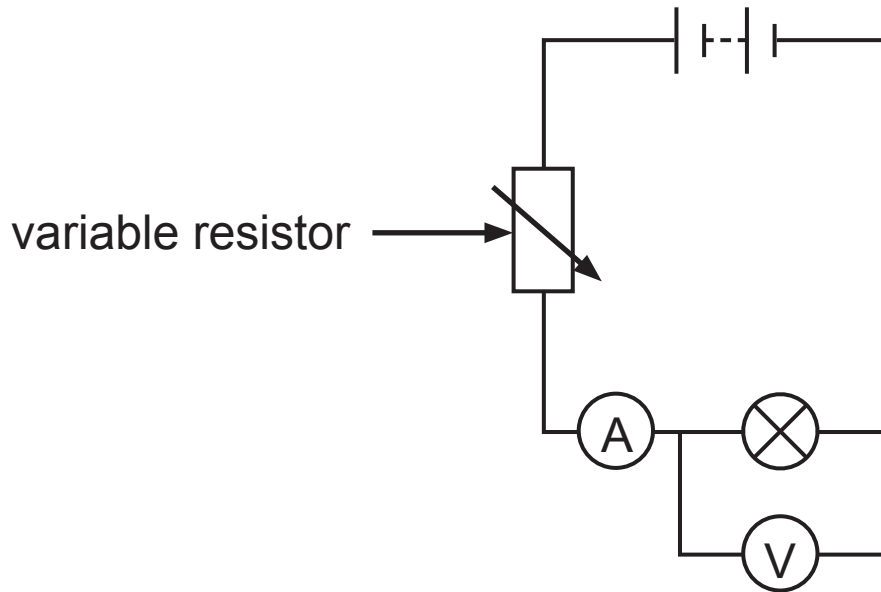
Suggest **one** reason why RCCBs have replaced fuses in consumer units. [1 mark]

- 6 (a) The diagram below shows the actual direction that electrons flow in a circuit.



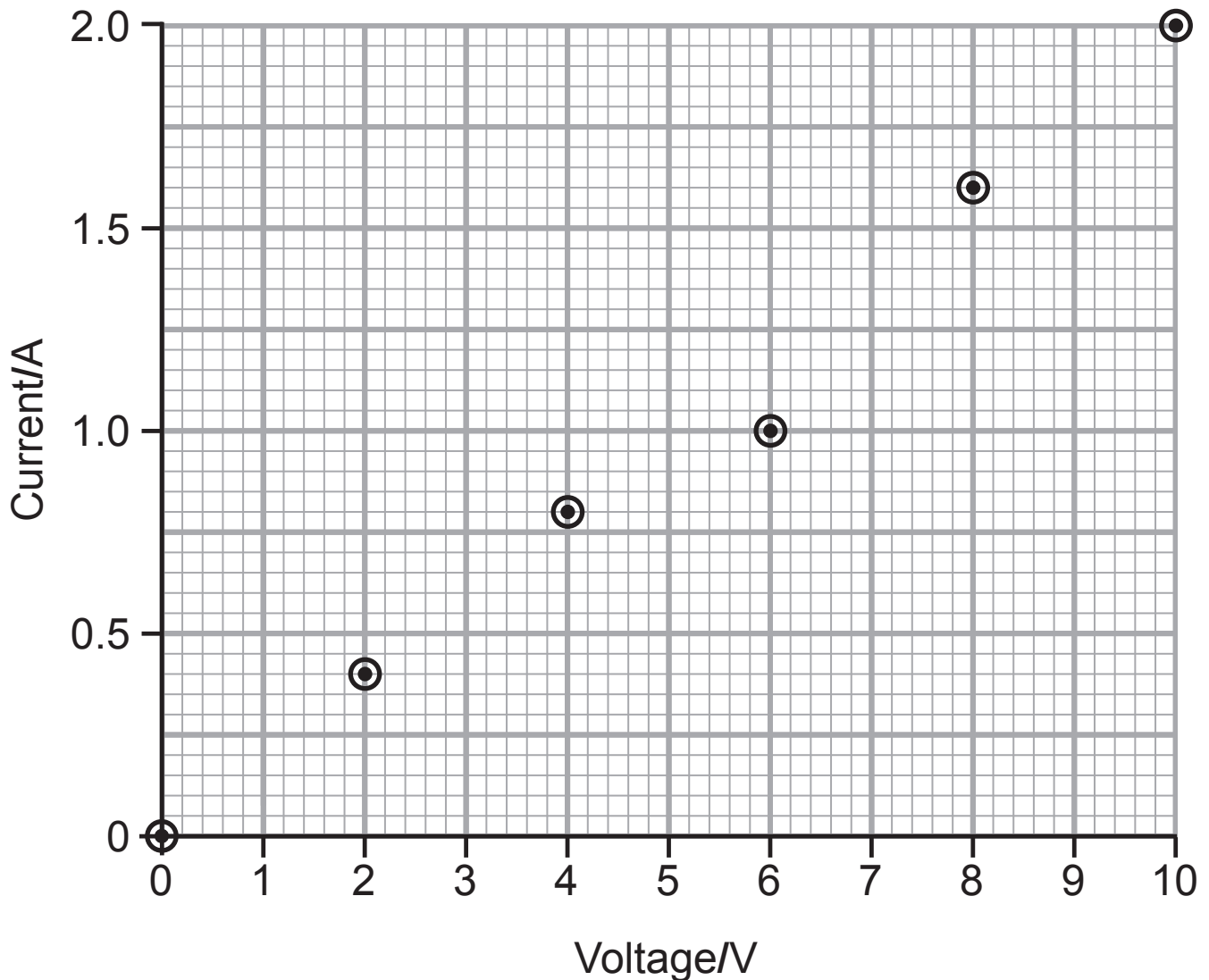
Use the diagram and your knowledge to explain fully how current flows in a circuit. [2 marks]

- (b) The circuit below was used to investigate the relationship between the current through a bulb and the voltage across it.



- (i) Describe fully how the variable resistor controls the current flowing in a circuit. [2 marks]

The graph below shows the results of the investigation but one of the points has been incorrectly plotted.



(ii) Draw a line of best fit on the graph. [1 mark]

(iii) State the conclusion that can be drawn from this investigation. [1 mark]

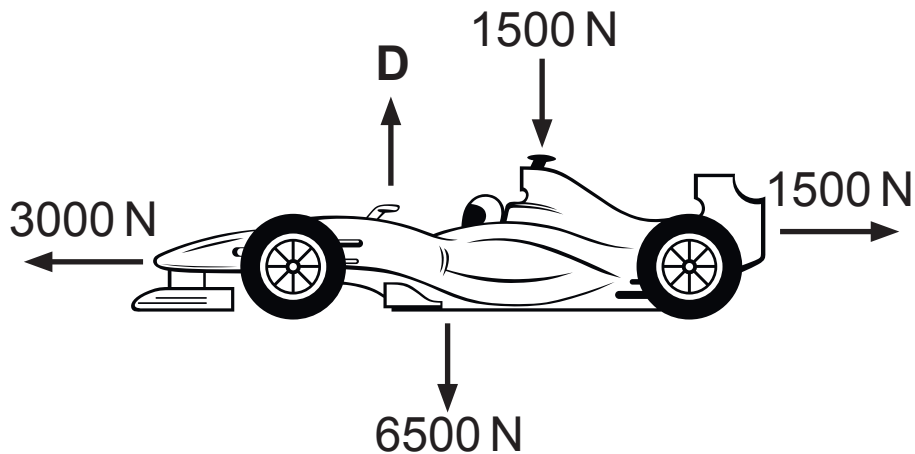
(iv) Use the graph on page 16 and the equation:

$$\text{voltage} = \text{current} \times \text{resistance}$$

to calculate the resistance when the voltage is 8 V.
(Show your working out.) [2 marks]

Answer _____ ohms

- 7 (a) The diagram below shows the forces acting on a car that is moving forward.



- (i) The vertical forces on this moving car are balanced. Calculate the size of the upward force labelled **D**.

(Show your working out.) [2 marks]

Answer _____ N

- (ii) Explain fully, in terms of the horizontal force, the motion of this car. [2 marks]

- (b) In a collision, the force exerted on a driver depends on how long it takes the **driver** to come to a complete stop **inside the car**.

The table below shows the times from a car hitting an object to the driver coming to a complete stop and the forces that are exerted.

Time to come to a complete stop/s	Force exerted on the driver/N
0.2	12 000
0.4	6000
0.6	4000
0.8	3000
1.0	1000

In a collision a driver without a seat belt will come to a complete stop in a shorter time than a driver wearing a seat belt.

- (i) Use the information to explain why wearing a seat belt is safer than not wearing one. [2 marks]

(ii) Another safety feature of a car is a crumple zone. Explain fully how a crumple zone acts as a safety feature in an accident. [2 marks]

BLANK PAGE

(Questions continue overleaf)

- 8 (a) Two ways to find the speed of sound are the echo method and the flash-bang method.

The steps given below are for the echo method.

- 1 find a wall to produce echoes
- 2 measure the distance to the wall
- 3 make a sound and start the stopwatch immediately
- 4 stop timing when echo is heard
- 5 record the time taken
- 6 repeat steps 3 to 5 twice more
- 7 calculate average time
- 8 divide average time by two
- 9 use the formula: $\text{speed} = \text{distance} \div \text{time}$

Using this information and your knowledge, answer the questions below.

- (i) Describe **two** similarities between the echo method and the flash-bang method. [2 marks]

1. _____

2. _____

- (ii) Describe **two** differences between these methods. [2 marks]

1. _____

2. _____

(b) Sound is a longitudinal wave but microwaves are an example of a transverse wave.
Describe a transverse wave in terms of particle movement. [2 marks]

(c) The photograph below shows a microwave oven.



Explain fully how microwave ovens heat food.
[2 marks]

(d) The table below gives information about the electromagnetic spectrum.

Wave type	Wavelength/m	Energy/eV
radio waves	10^3	1.24×10^{-9}
microwaves	10^{-2}	1.24×10^{-4}
infrared	10^{-5}	1.24×10^{-1}
visible light	10^{-7}	1.24×10^1
ultraviolet	10^{-8}	1.24×10^2
X-rays	10^{-10}	1.24×10^4
gamma rays	10^{-12}	1.24×10^6

Use the information above and your knowledge to explain fully why X-rays are more dangerous than microwaves. [2 marks]

- 9** Short sight is a common eye defect. Explain how and why short sight will affect someone's vision and how it is corrected.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms. [6 marks]

10 (a) The table below shows how the number of cars sold, in different fuel type groups, has changed over a twenty year period in the UK.

		Number of cars sold ($\times 1000$)			
Fuel type		Petrol	Diesel	Modern Hybrid	Rechargeable electric (battery)
Year					
1994		1920	147	0	0
1995		1950	189	0	0
1996		2005	218	0	0
1997		2040	244	0	0
1998		2060	269	0	0
1999		2103	293	0	0
2000		2123	315	0	0
2001		2164	346	0	0
2002		2184	391	0	0
2003		2180	440	0	0
2004		2195	501	0	0
2005		2180	560	0.8	0
2006		2147	608	1.6	0
2007		2126	666	3.2	0
2008		2090	716	4.7	0
2009		2049	764	6.1	0
2010		2008	820	8.2	0.15
2011		1950	876	10.2	0.26
2012		1916	939	12.5	0.41
2013		1870	1006	15.3	0.63
2014		1863	1073	18.8	1.62

Using **only** the information in the table on page 26, answer parts (i) and (ii) below.

- (i) Of all the cars sold in 1994, what was the percentage that were either petrol or diesel?
[1 mark]

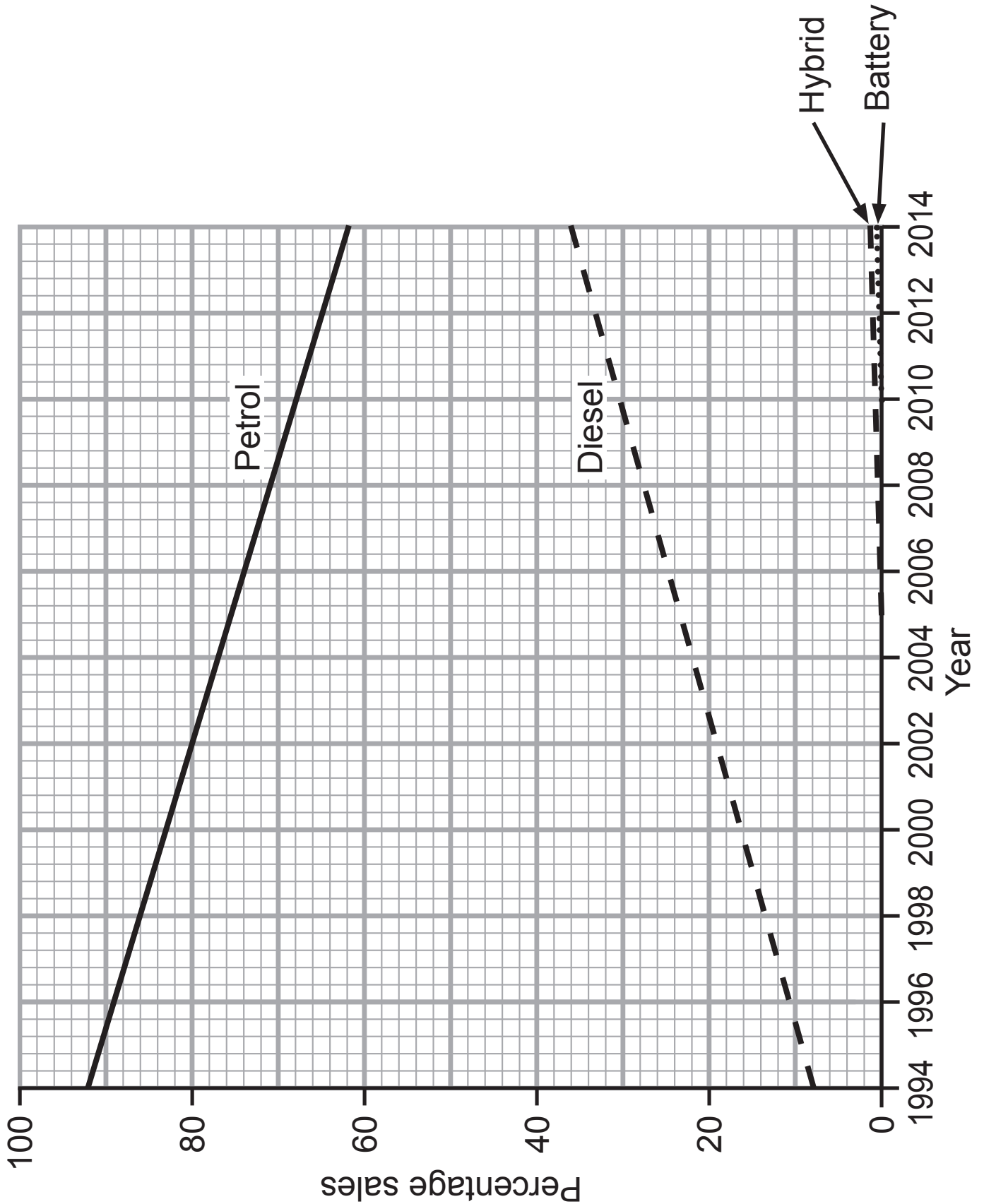
Answer _____ %

- (ii) In which year did the total percentage of cars sold, that were either petrol or diesel, start to fall?
[1 mark]

Answer _____

- (b) Suggest **one** reason why people may not want to use a rechargeable electric powered car. [1 mark]

(c) The graph below shows the trends in car sales using different fuel types over the same period.



Suggest which trend environmentalists would **not** like to see continue.

Explain your answer. [3 marks]

THIS IS THE END OF THE QUESTION PAPER

SOURCES

- Q1(a)© Crown Copyright. The THINK! Campaign is run by the Department for Transport. Contains public sector information licensed under the Open Government Licence v3.0.
- Q2© Principal Examiner
- Q3 © Principal Examiner
- Q5(c) © tentan / iStock / Thinkstock
- Q7(a)© Kreativ / iStock / Thinkstock
- Q8(c)© Pupsik23 / iStock / Thinkstock
- Q10(a) ...Source: Principal Examiner

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA
will be happy to rectify any omissions of acknowledgement in future if notified.