



General Certificate of Secondary Education  
2015–2016

Centre Number

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Candidate Number

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## Science: Single Award

Unit 3 (Physics)

Higher Tier



[GSS32]

\*GSS32\*

**WEDNESDAY 25 MAY 2016, AFTERNOON**

### TIME

1 hour 15 minutes.

### 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 blue or black ink only. **Do not write with a gel pen.**

Answer **all ten** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

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

10160.06RR



\*28GSS3201\*

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



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

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[1]

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

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[2]



(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'.

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[1]

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

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[1]

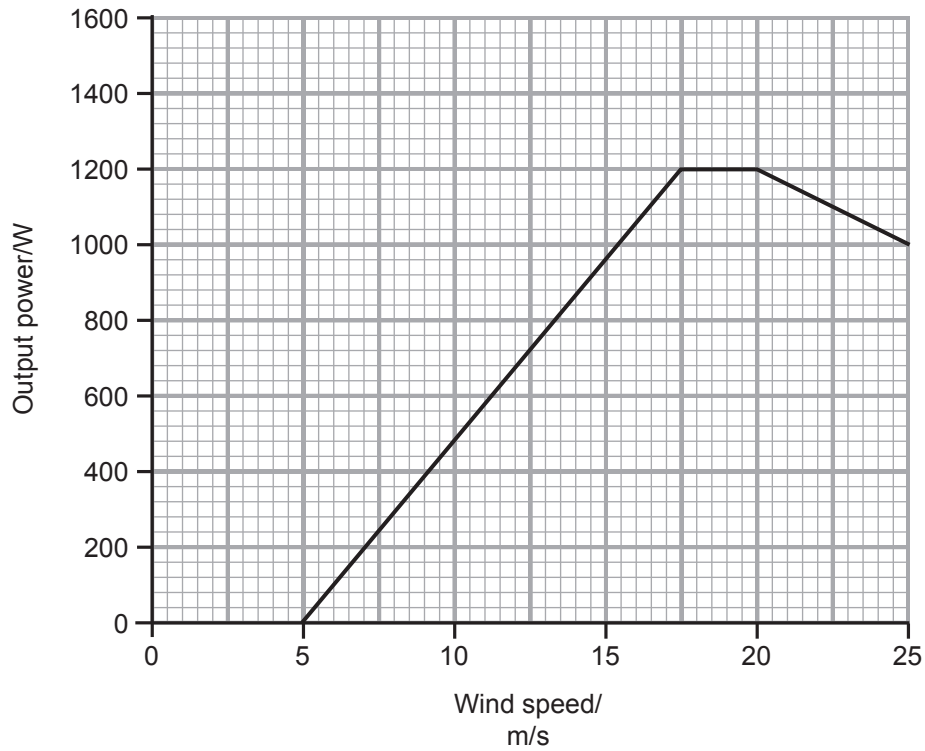
(iii) Calculate the **stopping** distance for a car with a driver and three passengers travelling at 30 km/h.

Answer \_\_\_\_\_ m [1]

[Turn over



- 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.

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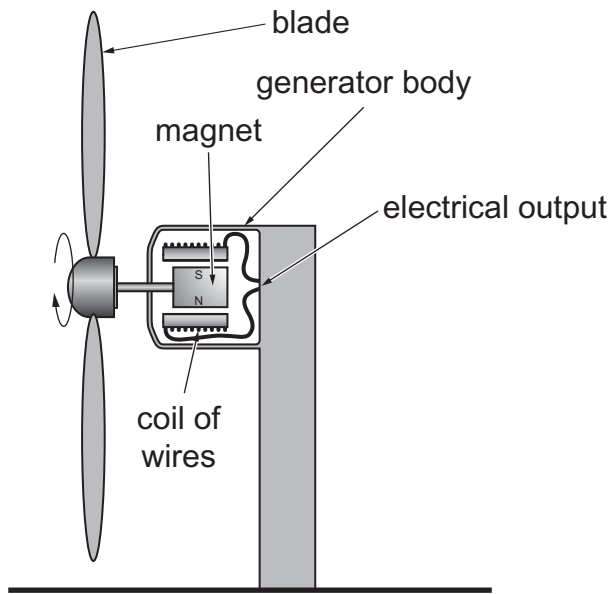
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[2]



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



© Principal Examiner

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

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[2]

(b) Give **one** environmental advantage and **one** environmental disadvantage of using wind turbines.

Advantage \_\_\_\_\_

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Disadvantage \_\_\_\_\_

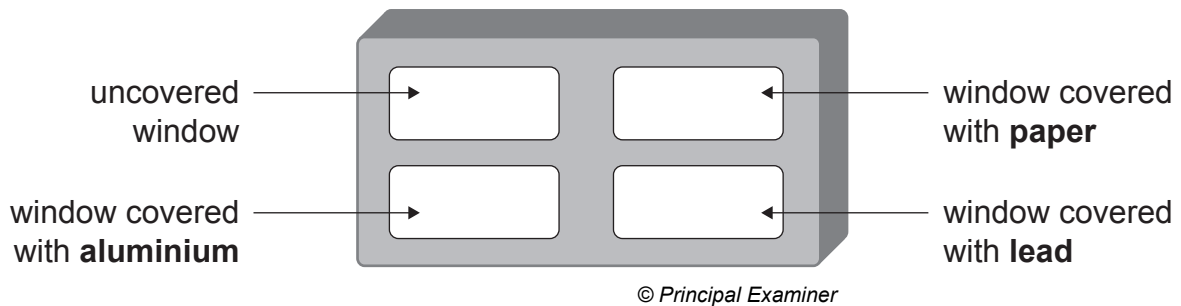
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[2]

[Turn over



- 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]

- (ii) How many windows will change from brown to white when exposed to **beta** radiation?

Answer \_\_\_\_\_ [1]

- (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]



(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.

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[2]

[Turn over







**(b)** The Universe consists of millions of galaxies.

**(i)** What is a 'galaxy'?

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[1]

**(ii)** Name the galaxy that includes planet Earth.

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[1]

[Turn over

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\*28GSS3209\*

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

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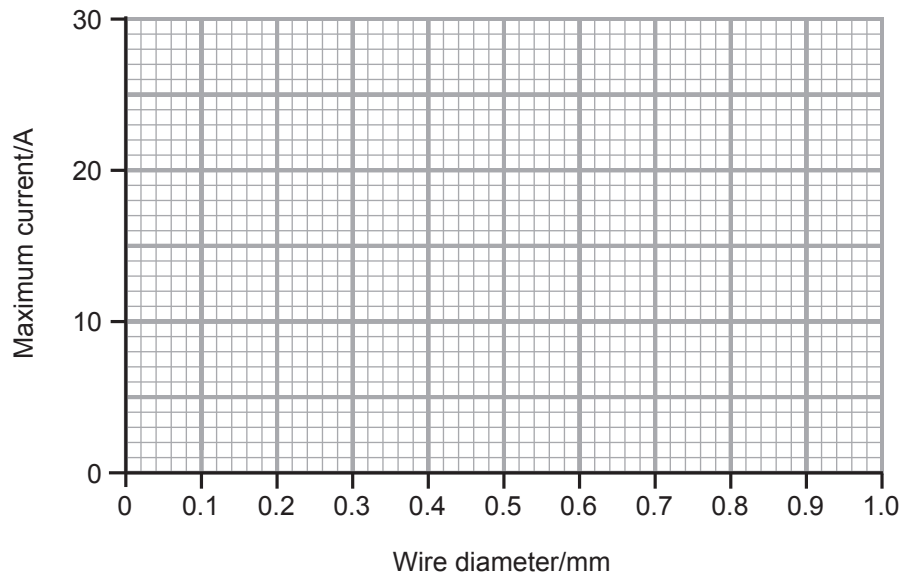
[3]

- (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]

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

Answer \_\_\_\_\_ A [1]

(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.)

Answer \_\_\_\_\_ W [2]

[Turn over



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



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Suggest **one** reason why RCCBs have replaced fuses in consumer units.

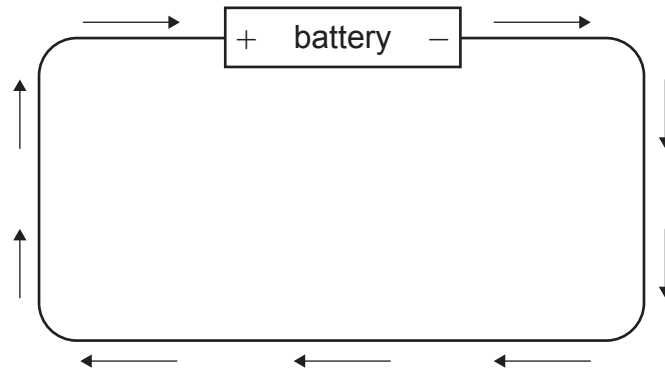
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[1]



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 conventional current flows in a circuit.

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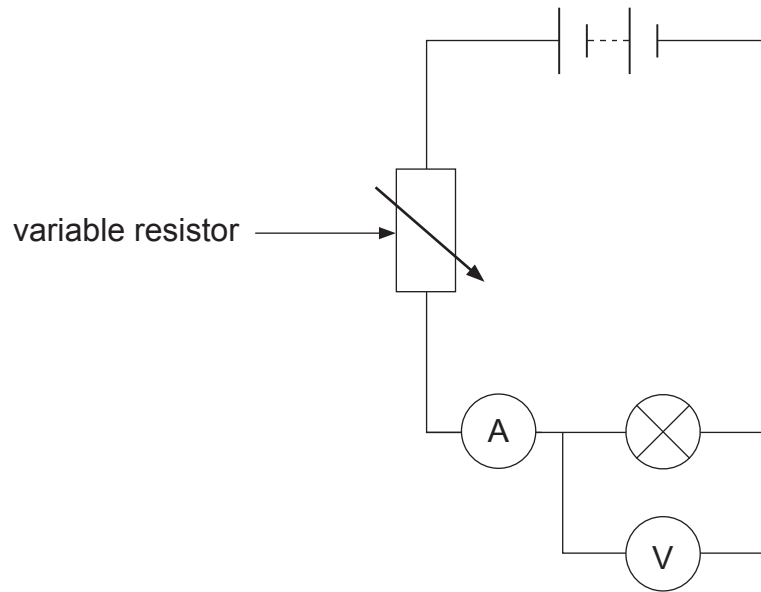
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[2]

[Turn over



- (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.

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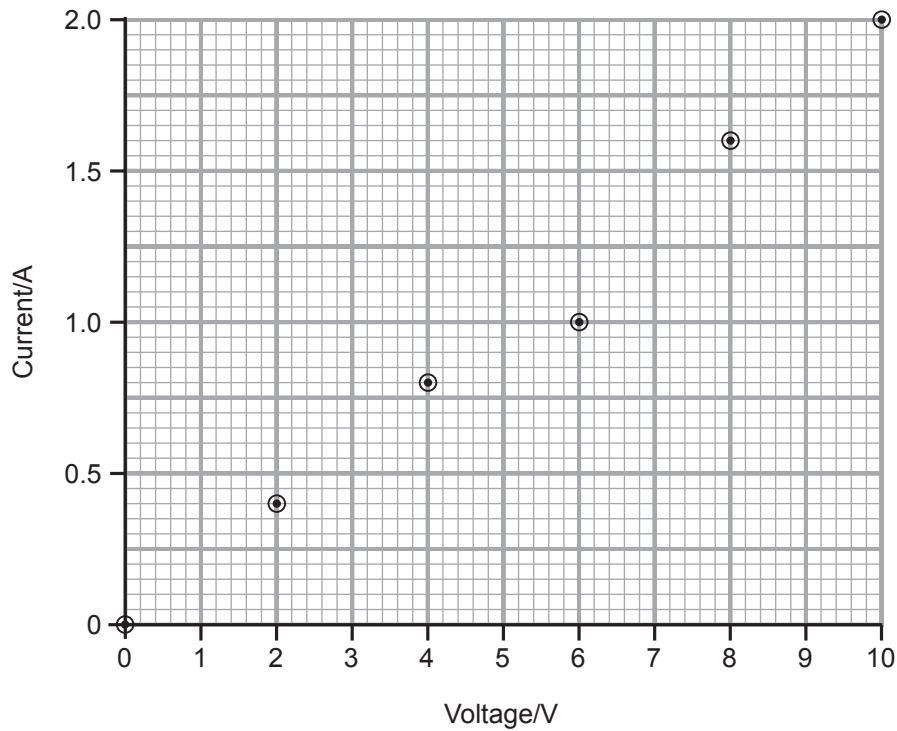
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[2]



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]

(iii) State the conclusion that can be drawn from this investigation.

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[1]

(iv) Use the graph and the equation:

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

to calculate the resistance when the voltage is 8 V.

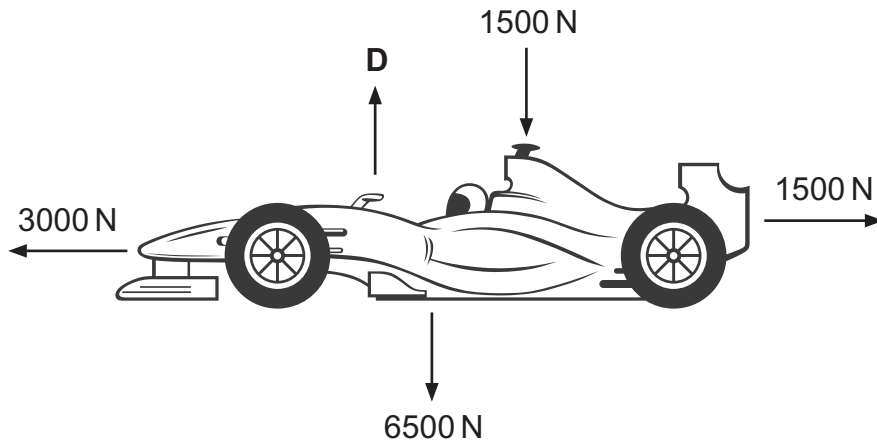
(Show your working out.)

Answer \_\_\_\_\_ ohms [2]

[Turn over



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



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

(Show your working out.)

Answer \_\_\_\_\_ N [2]

(ii) Explain fully, in terms of the horizontal force, the motion of this car.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]





- (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.

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[2]

- (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.

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[2]

[Turn over



- 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.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_ [2]

- (ii) Describe **two** differences between these methods.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_ [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.

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[2]

(c) The photograph below shows a microwave oven.



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Explain fully how microwave ovens heat food.

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[2]

[Turn over



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

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

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

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[2]





- 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 ( $\times 1000$ )			
		Petrol	Diesel	Modern Hybrid	Rechargeable electric (battery)
Year	Fuel type				
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

Source: Principal Examiner



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

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

Answer \_\_\_\_\_ % [1]

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

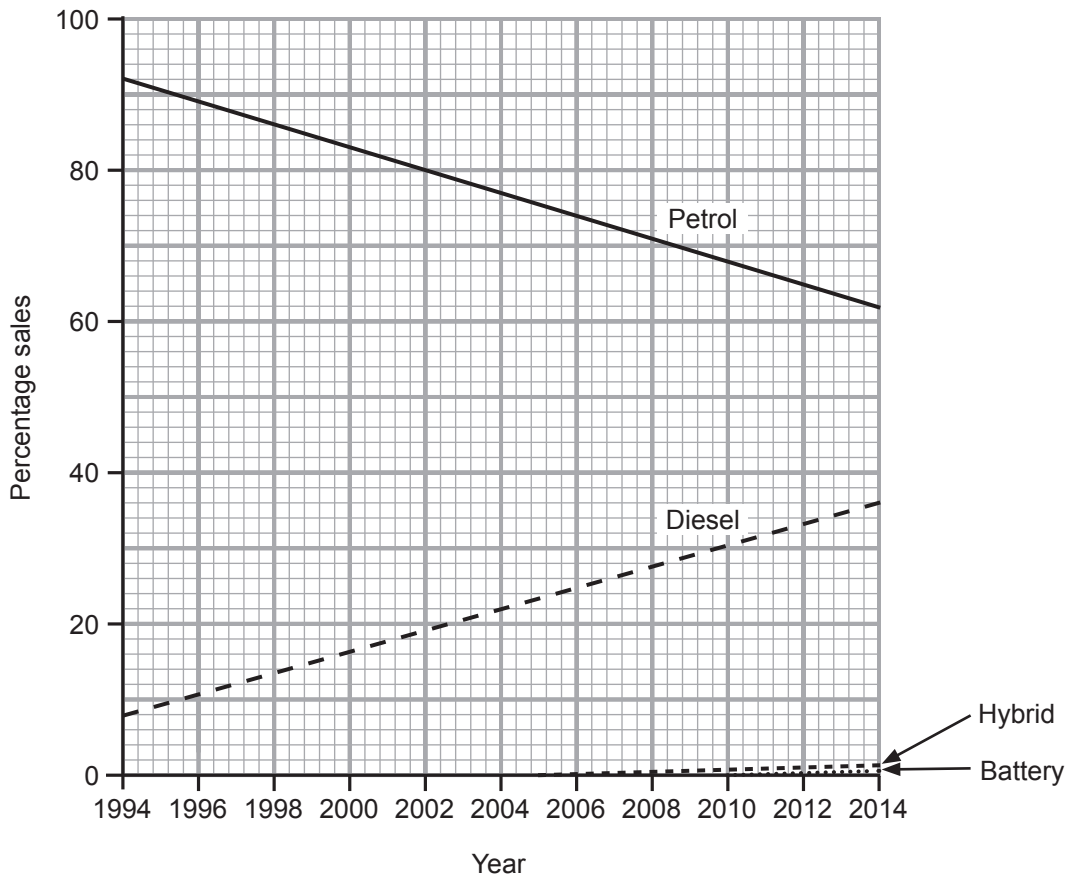
Answer \_\_\_\_\_ [1]

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

\_\_\_\_\_  
\_\_\_\_\_ [1]



(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.

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[3]

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Question Number	Marks
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Examiner Number

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