Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

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**.

10160.06**RR**

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

© Crown Copyright. The THINK! Campaign is run by the Department for Transport. Contains public sector information licensed under the Open Government Licence v3.0.

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

_____

_____ [1]

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

_____

_____

_____ [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'.

_____

_____ [1]

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

_____

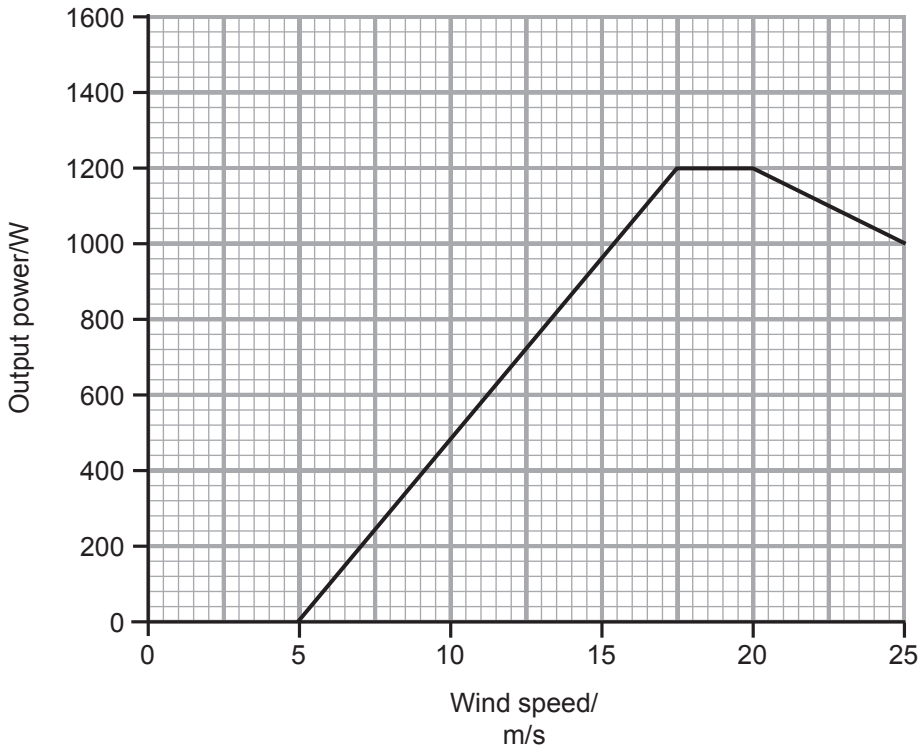
_____ [1]

(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.

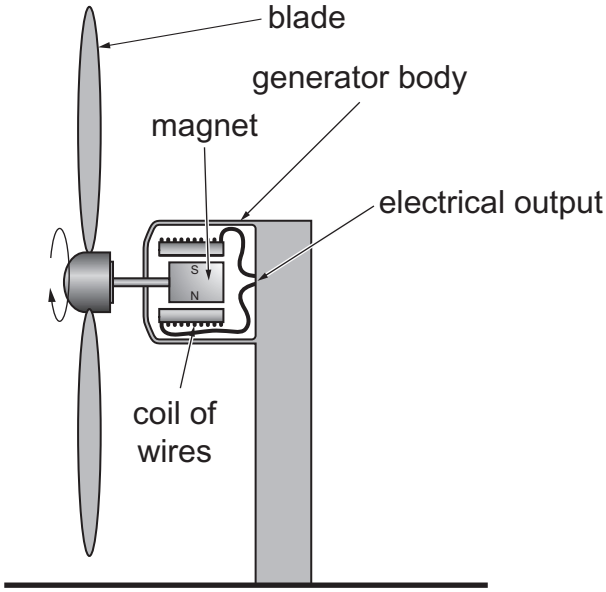
_____

_____

_____

_____ [2]

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]

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

Advantage _____

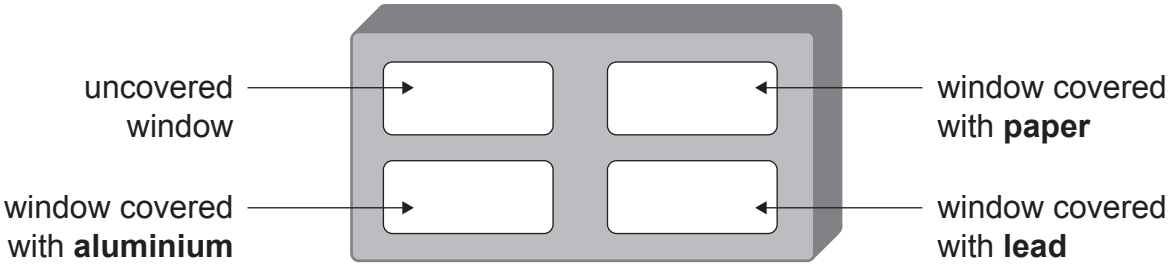
_____

Disadvantage _____

_____ [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.

_____

_____

_____ [2]

[Turn over

4 **(a)** Describe fully the present day model of the Solar System and explain how it differs from the earlier model.

Your answer should include:

- the name of each model
- **two** differences between these models
- the names and positions of **two** planets

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

[6]

(b) The Universe consists of millions of galaxies.

(i) What is a 'galaxy'?

_____

_____ [1]

(ii) Name the galaxy that includes planet Earth.

_____ [1]

[Turn over

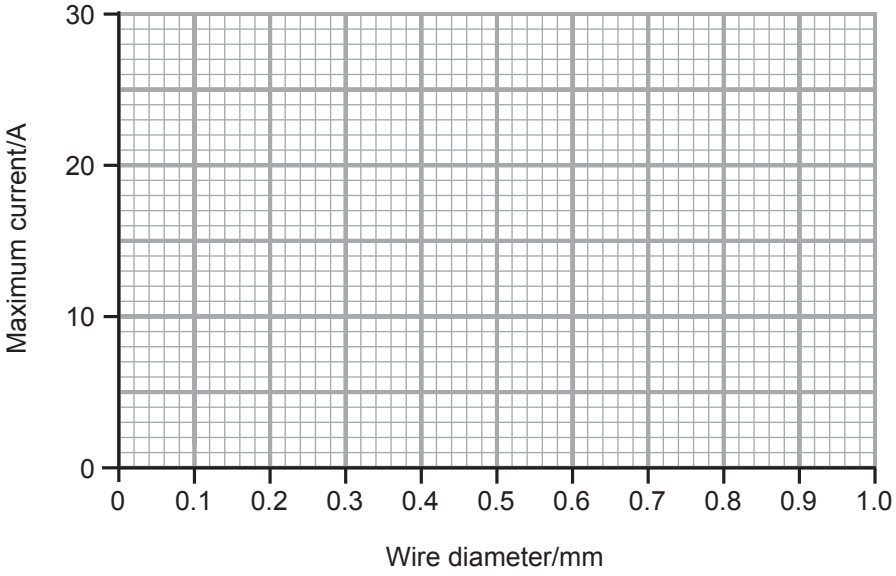
5 **(a)** Fuses are used in electrical circuits for safety.
Explain fully how a fuse works as a safety device.

[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:

power = voltage × 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).

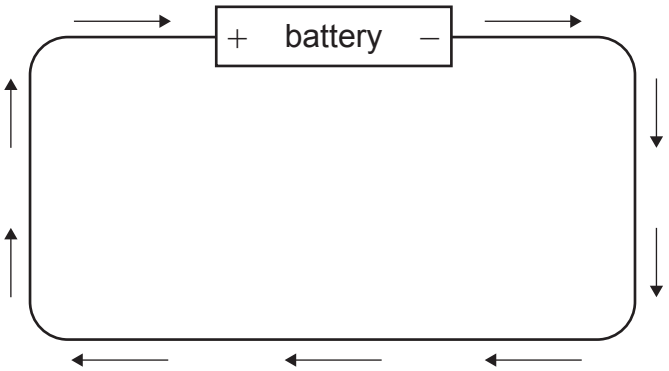
© tentan / iStock / Thinkstock

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

_____

_____ [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.

_____

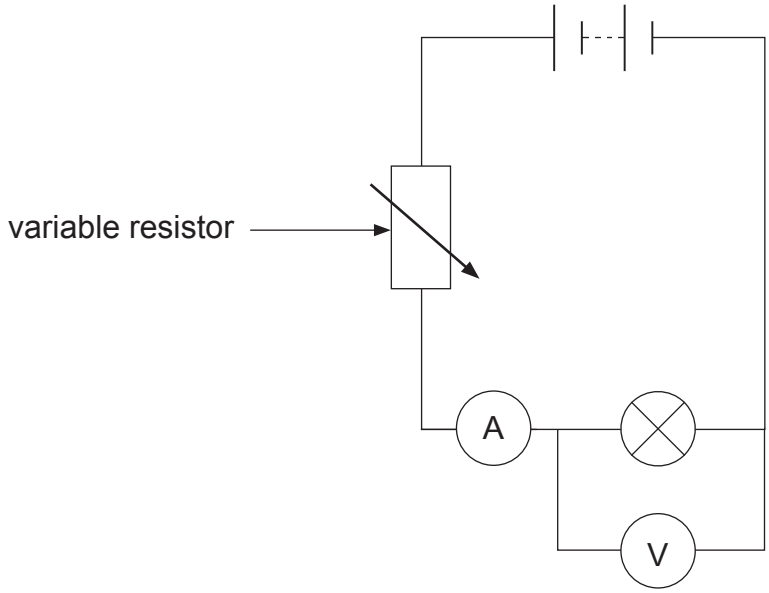
_____

_____

_____ [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.

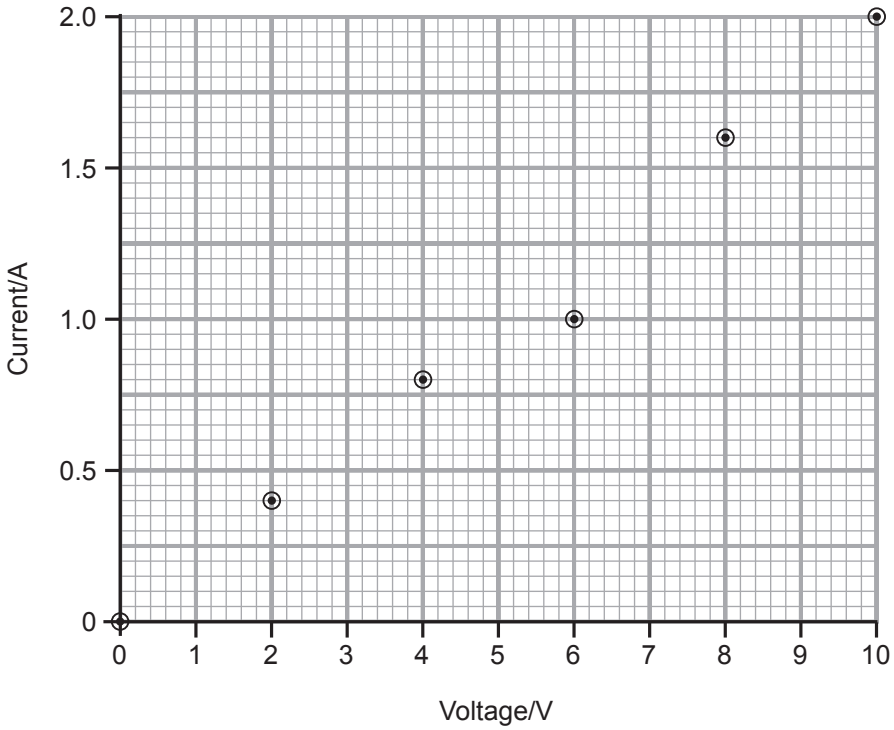
_____

_____

_____

_____ [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.

_____

_____ [1]

(iv) Use the graph and the equation:

voltage = current × resistance

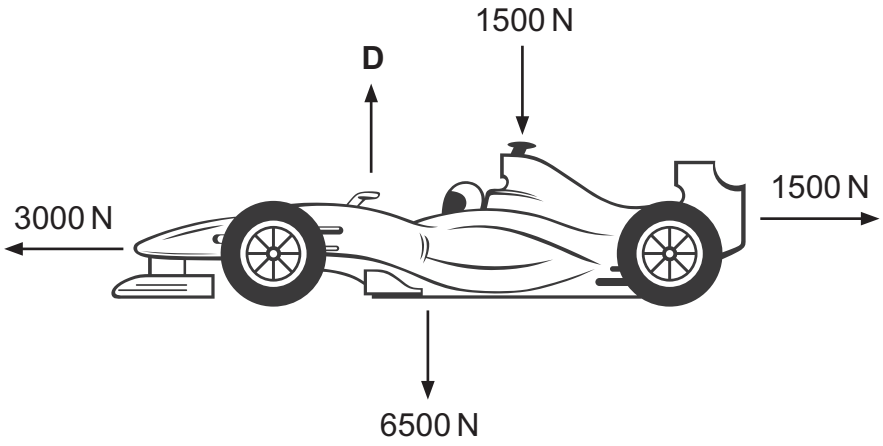
to calculate the resistance when the voltage is 8 V.

(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.



© Kreatiw / iStock / Thinkstock

(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.

[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.

[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: speed = distance ÷ 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.

_____

_____

_____

_____ [2]

(c) The photograph below shows a microwave oven.

© Pupsik23 / iStock / Thinkstock

Explain fully how microwave ovens heat food.

_____

_____

_____

_____ [2]

[Turn over

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

Wave type	Wavelength/m	Energy/eV
radio waves	10^{3}	1.24×10^{-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]

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]

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 (× 1000)			
Fuel type / Year	**Petrol**	**Diesel**	**Modern Hybrid**	**Rechargeable electric (battery)**
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]

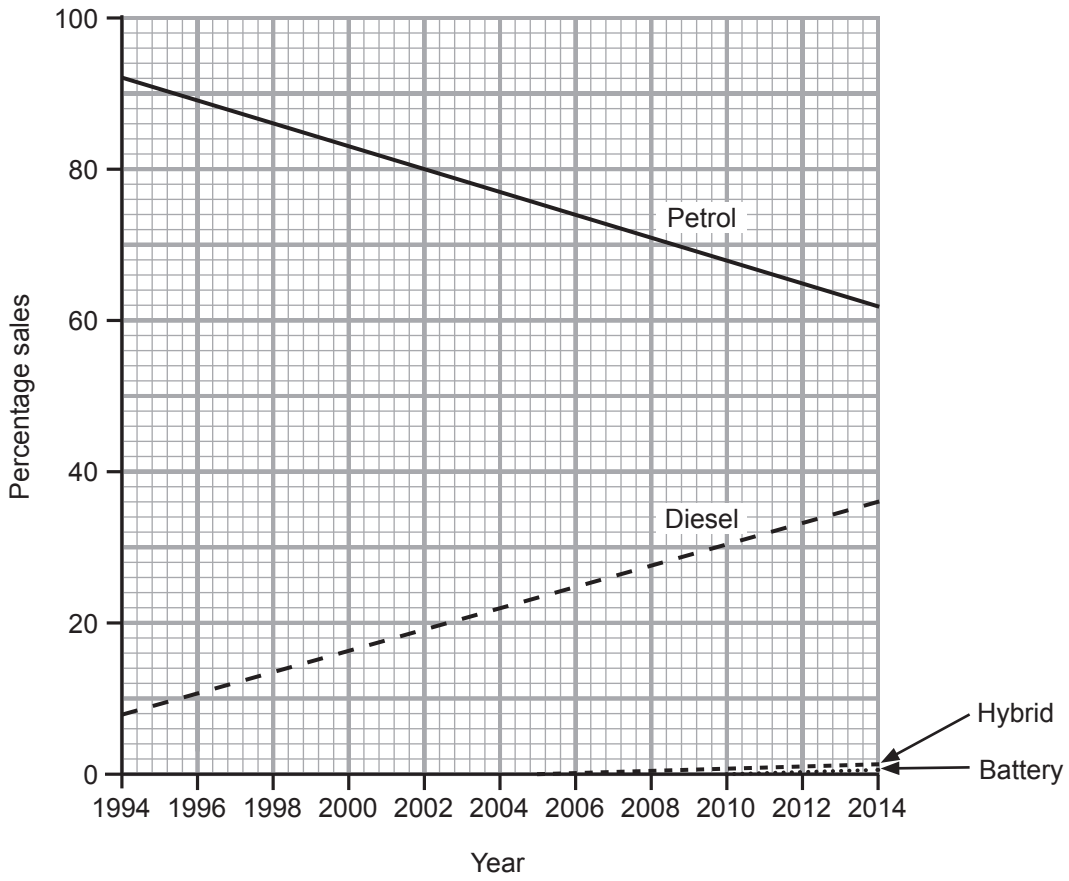
(b) Suggest **one** reason why people may not want to use a rechargeable electric powered car.

_____

_____ [1]

[Turn over

(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]

THIS IS THE END OF THE QUESTION PAPER

BLANK PAGE

DO NOT WRITE ON THIS PAGE

BLANK PAGE

DO NOT WRITE ON THIS PAGE

BLANK PAGE

DO NOT WRITE ON THIS PAGE

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