

New  
Specification



Centre Number

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| 71 |  |
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Candidate Number

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General Certificate of Secondary Education  
2012–2013

## Science: Single Award

Unit 3 (Physics)

Higher Tier

[GSS32]



WEDNESDAY 14 NOVEMBER 2012, 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.

Write your answers in the spaces provided in this question paper.  
Answer **all eight** 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 **3(a)** and **6(a)**.

For Examiner's  
use only

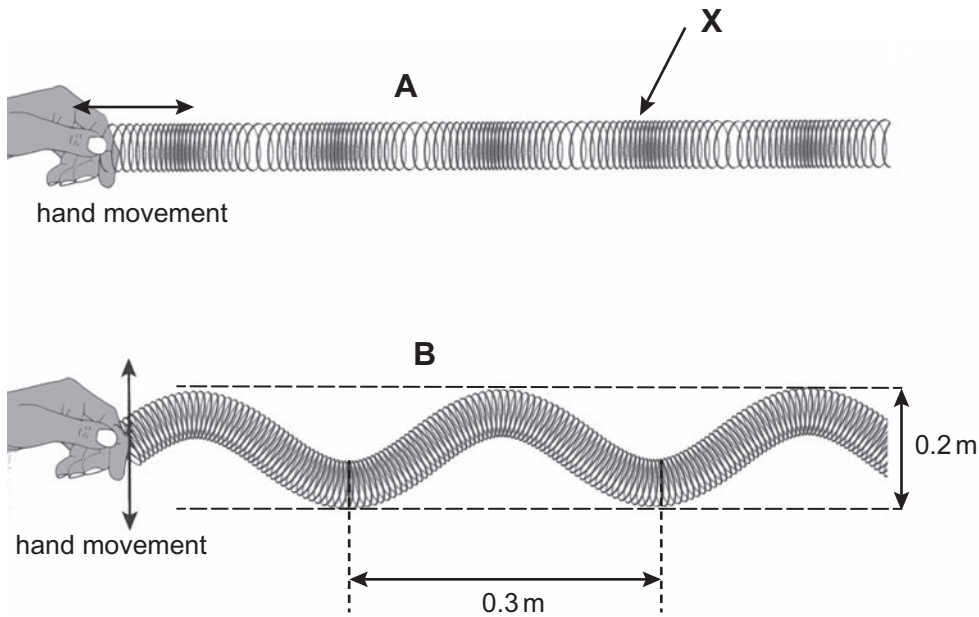
| Question Number | Marks |
|-----------------|-------|
| 1               |       |
| 2               |       |
| 3               |       |
| 4               |       |
| 5               |       |
| 6               |       |
| 7               |       |
| 8               |       |

Total  
Marks

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1 (a) Slinky springs are often used to demonstrate waves as shown in the diagrams **A** and **B** below.



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(i) Name the type of wave represented by diagram **A**.

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

(ii) Describe fully how point **X** moves as the wave passes along the slinky in diagram **A**.

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

(iii) What is the amplitude of the wave represented by diagram **B**?

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

(iv) What is the wavelength of the wave represented by diagram **B**?

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

(b) Wave **B** produces 20 complete waves in 5 seconds.

Calculate the frequency of the wave.

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

| Examiner Only |        |
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| Marks         | Remark |
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(c) Use the equation:

$$\text{speed} = \text{frequency} \times \text{wavelength}$$

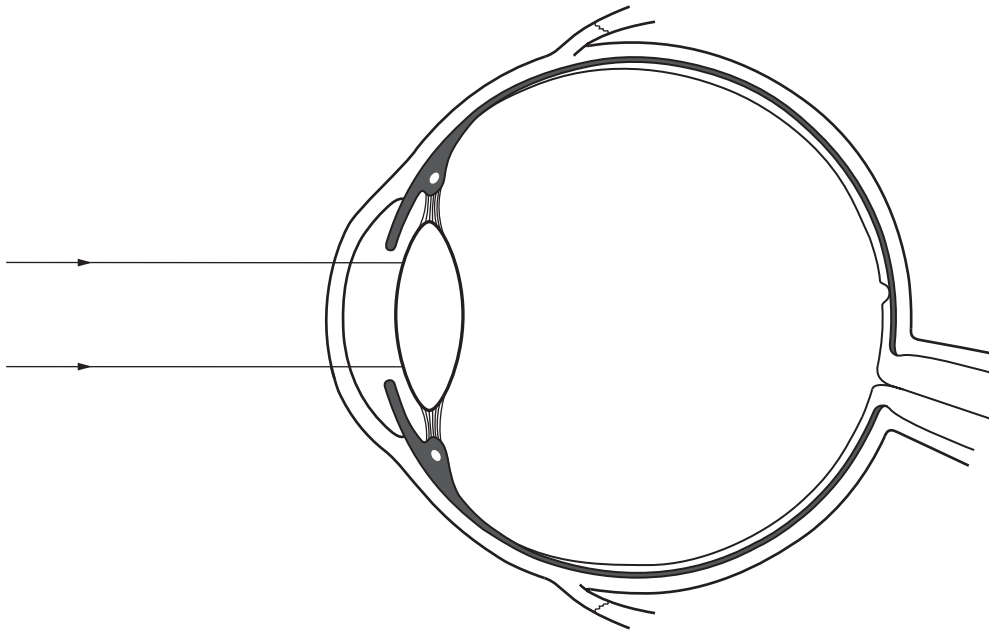
to calculate the speed of a wave with a frequency of 20 Hz and a wavelength of 90 m.

(Show your working out.)

Answer \_\_\_\_\_ m/s [2]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |

- 2 (a) The diagram below shows two parallel rays of light entering the eye. Complete the diagram to show the path of the rays in the formation of a clear image.



[2]

- (b) (i) Short sight is a common eye defect. Explain fully the cause and effect of short sight.

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[3]

- (ii) Name the type of lens used to correct short sight.

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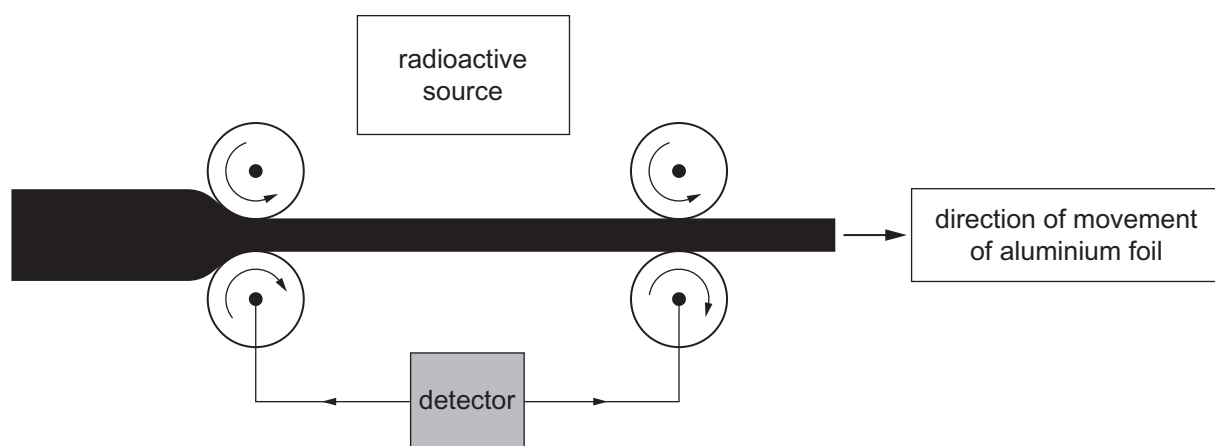
[1]

| Examiner Only |        |
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(b) The equipment shown below is used in industry to monitor the thickness of aluminium foil.



The table below gives possible radioactive sources which could be used.

| Radioactive source | Radiation emitted | Half-life  |
|--------------------|-------------------|------------|
| A                  | alpha             | 1000 years |
| B                  | beta              | 1000 years |
| C                  | beta              | 2 minutes  |
| D                  | gamma             | 4 years    |

(i) Explain fully what is meant by the term 'half-life'.

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

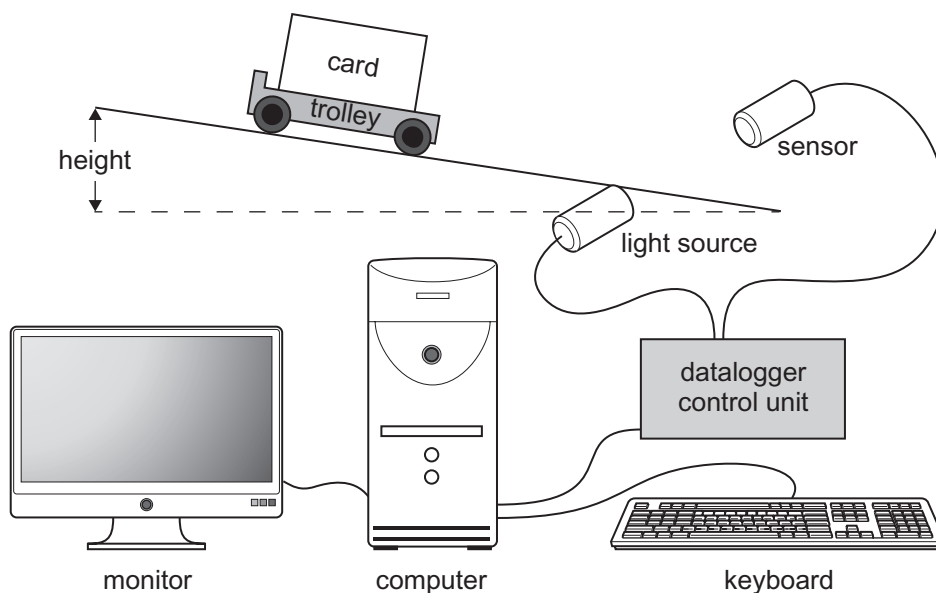
(ii) Which source, **A**, **B**, **C** or **D** would be best to monitor the thickness of the aluminium? Explain your answer.

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

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

| Examiner Only |        |
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| Marks         | Remark |
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- 4 (a) The apparatus below was used to measure the time taken for a trolley to travel 1 m down a ramp raised to different heights.



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The results of the experiment are shown below.

| height/cm | distance/m | time/s |
|-----------|------------|--------|
| 10        | 1          | 1.4    |
| 20        | 1          | 1.1    |
| 30        | 1          | 0.9    |
| 40        | 1          | 0.8    |

- (i) At which height did the trolley reach the fastest speed?  
Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

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

- (ii) State **one** thing that should be done to make the results reliable.

\_\_\_\_\_

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

Examiner Only

Marks Remark



- (iii) This apparatus can also be used to measure average and instantaneous speed. Explain fully the terms average speed and instantaneous speed.

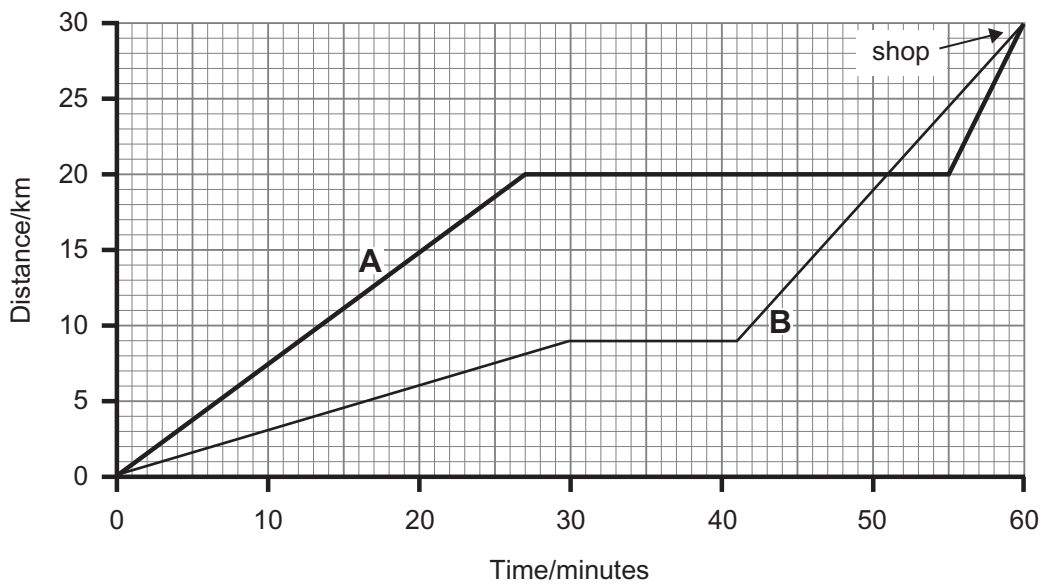
Average speed \_\_\_\_\_

\_\_\_\_\_

Instantaneous speed \_\_\_\_\_

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

- (b) The distance–time graph below shows two cars, **A** and **B**, travelling to the same shop.



- (i) At what times have the cars travelled the same distance?

Answer \_\_\_\_\_ and \_\_\_\_\_ minutes [1]

- (ii) Use the graph to compare the **average** speeds of the cars over the sixty minutes. Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

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

| Examiner Only |        |
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| Marks         | Remark |
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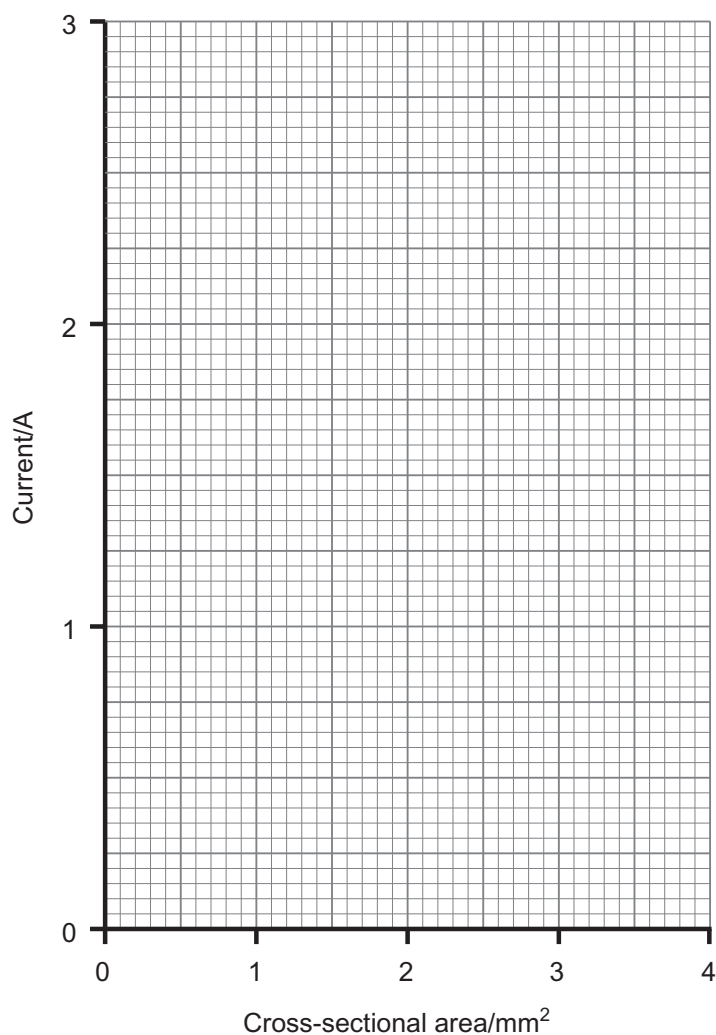
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(b) The table below shows how the current flowing through a wire varies with its cross-sectional area.

|                                      |      |      |      |      |
|--------------------------------------|------|------|------|------|
| Cross-sectional area/mm <sup>2</sup> | 1    | 2    | 3    | 4    |
| Current/A                            | 0.65 | 1.30 | 1.95 | 2.60 |

(i) On the grid below plot and draw a **line graph** of these results.



[2]

(ii) State the trend shown by these results.

\_\_\_\_\_

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

(iii) From the graph, what is the current when the wire has a cross-sectional area of 2.5 mm<sup>2</sup>?

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

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
|               |        |

(iv) Use the equation:

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

to calculate the resistance of a  $2.5 \text{ mm}^2$  wire when the voltmeter reads  $3.2 \text{ V}$ .

(Show your working out.)

Answer \_\_\_\_\_  $\Omega$  [2]

| Examiner Only |        |
|---------------|--------|
| Marks         | Remark |
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(b) The table below gives the estimated cost of generating electricity from different energy sources.

| Energy source | Time to build/years | Output power /MW | Annual cost per kW/£ | Cost to build per kW/£ | Customer cost per kWhr/p |
|---------------|---------------------|------------------|----------------------|------------------------|--------------------------|
| Gas           | 1                   | 40               | 34                   | 330                    | 3.64                     |
| Wind          | 2                   | 21               | 24                   | 740                    | 5.35                     |
| Biomass       | 2                   | 10               | 225                  | 1840                   | 6.67                     |
| Coal          | 4                   | 1600             | 24                   | 840                    | 3.33                     |

The Government needs to build some new power stations quickly to produce electricity with a low customer cost. Suggest a suitable energy source giving reasons for and against.

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[3]

(c) Fossil fuels are described as finite energy sources. Explain what is meant by the term 'finite'.

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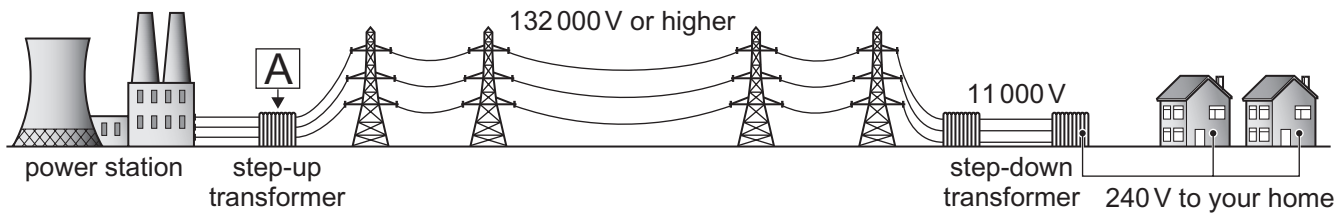


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[1]

| Examiner Only |        |
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| Marks         | Remark |
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(d) The diagram below shows the transmission of electricity through the National Grid.



© Diagram sourced from 'Physics for you' by Keith Johnson, published in 2011 by Nelson Thornes Ltd

The part labelled A is a step-up transformer. Describe fully what it does and explain why it is used as part of the grid system.

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[3]

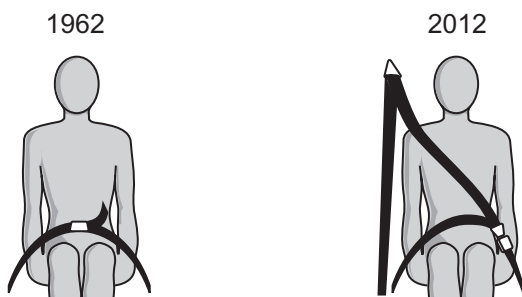
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(c) The diagrams below show how seatbelts have changed in the last 50 years.



Describe and explain how changes in the design of the seatbelt have improved driver safety.

\_\_\_\_\_

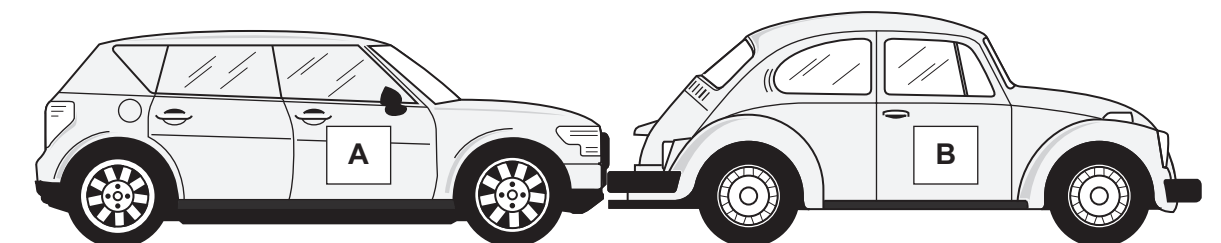
\_\_\_\_\_

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

(d) The diagram below shows a collision between the moving car **A** and a stationary car **B**.

momentum = 6720 kgm/s

mass = 600 kg



When they collide the moving car **A** stops instantly and all the momentum is transferred to car **B**.

Use the equation:

$$\text{momentum} = \text{mass} \times \text{velocity}$$

to calculate the maximum velocity at which car **B** moves.

(Show your working out.)

\_\_\_\_\_ m/s [2]

| Examiner Only |        |
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| Marks         | Remark |
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| Marks         | Remark |
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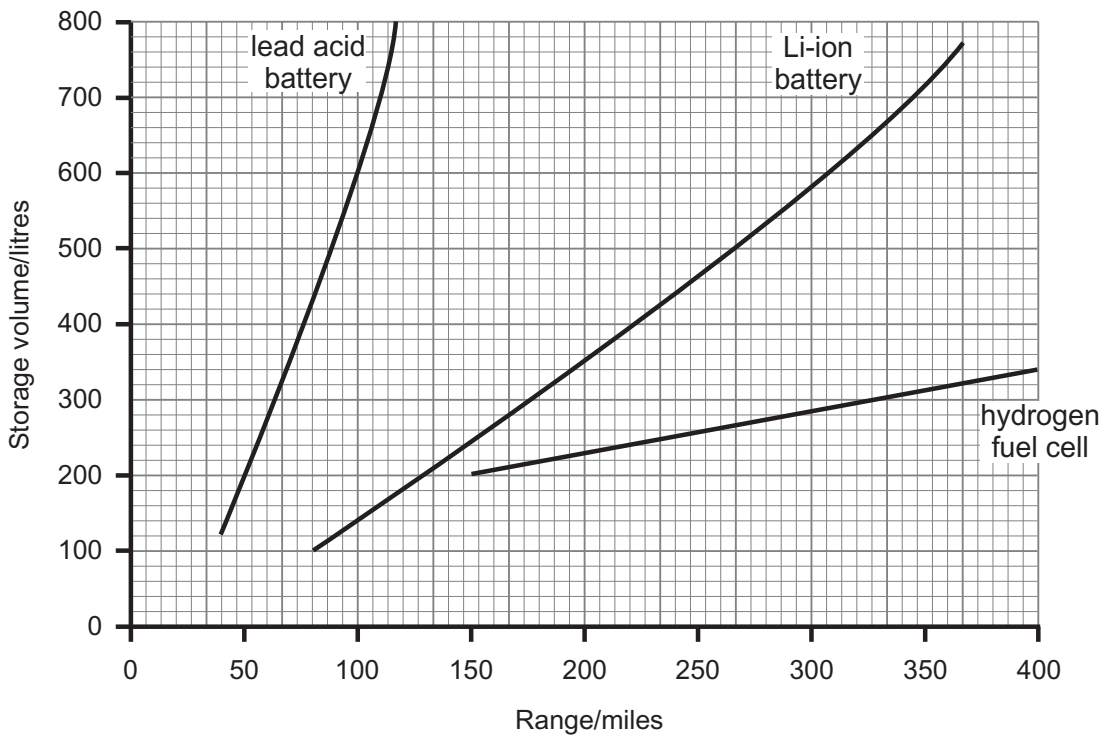
(e) State **two** ways that cars are designed to absorb energy in a collision, therefore reducing injury to the driver.

1. \_\_\_\_\_

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

(f) Many manufacturers are designing both electric and hydrogen fuelled cars. The electric cars need to store batteries and the hydrogen cars need to store fuel cells.

The graph shows the relationship between storage volume and range for various fuel types.



© Isidor Buchmann [www.batteryuniversity.com](http://www.batteryuniversity.com)

Using this information explain fully the advantage of hydrogen fuelled cars over electric cars.

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\_\_\_\_\_

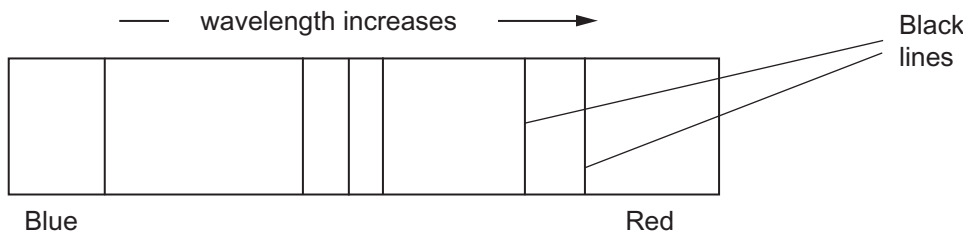
\_\_\_\_\_ [2]

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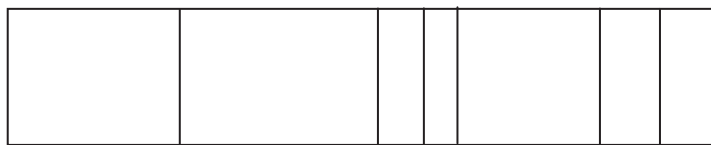
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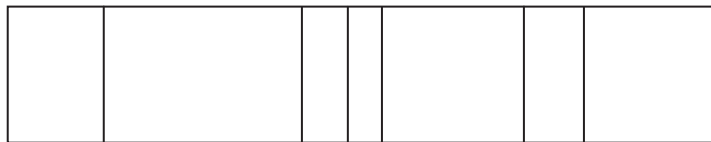
When scientists analyse the spectrum of light from our galaxy they see the following black lines.



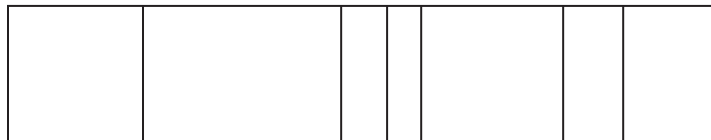
The spectra from three **different** galaxies are shown below.



**Galaxy A**



**Galaxy B**



**Galaxy C**

**(b)** Which galaxy **A**, **B** or **C** is furthest away from us?  
Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [3]

**THIS IS THE END OF THE QUESTION PAPER**

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| Marks         | Remark |
|               |        |

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