New Specification

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Single Award Science
Physics

Unit 3

Higher Tier

GSA32

[GSA32]

FRIDAY 23 FEBRUARY 2018, MORNING

TIME

1 hour.

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 nine** questions.

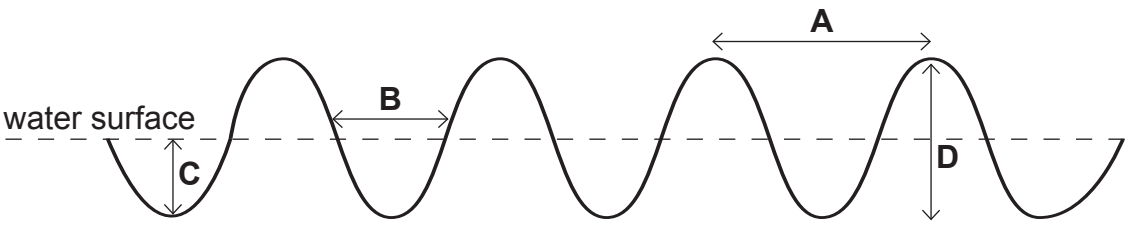
INFORMATION FOR CANDIDATES

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 **4(a)**.

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

Examiner Only	
Marks	Remark

1 The diagram below represents a water wave.



Source: Principal Examiner

(a) Which letter (**A**, **B**, **C** or **D**) represents:

(i) the amplitude?

Answer _____ [1]

(ii) the wavelength?

Answer _____ [1]

(b) Water waves are transverse waves.

(i) Which statement below describes how the particles vibrate in a transverse wave?

Circle the correct answer.

in the same direction as wave travel

at right angles to wave travel

in the opposite direction to wave travel

[1]

(ii) Transverse waves are one type of wave. Name the other type.

_____ [1]

(c) The table below shows how the speed of sound changes with air temperature.

Air temperature/°C	Speed of sound/ m/s
–1	330.0
10	336.9
21	343.6
33	350.3
45	358.0

(i) Describe the trend shown by this information.

_____

_____

_____ [1]

(ii) Use the equation:

$$\textbf{frequency} = \frac{\textbf{wave speed}}{\textbf{wavelength}}$$

to calculate the frequency of a sound wave that has a wavelength of 0.02 m travelling through air which has a temperature of –1 °C.

(Show your working out.)

Answer _____ [2]

(iii) State the unit of frequency.

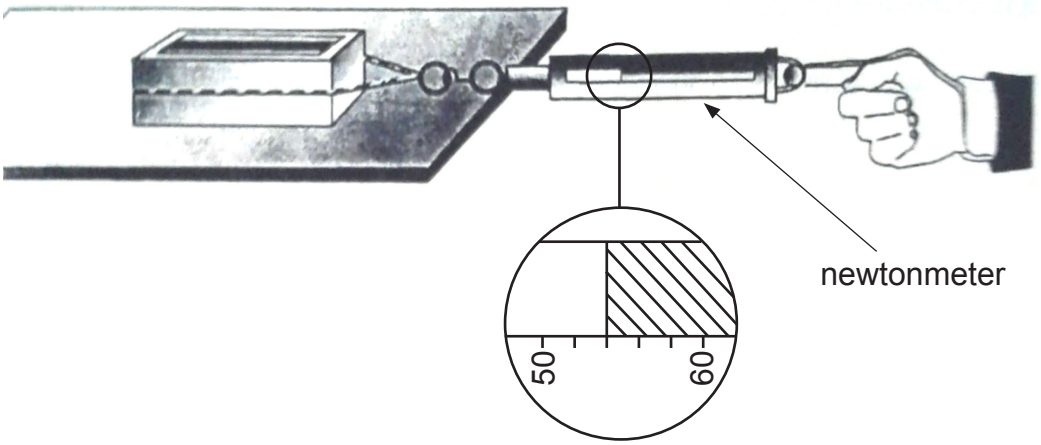
Answer _____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 **(a)** The diagram below shows a newtonmeter being used to pull a brick across a flat table.



Source: CCEA Artwork

(i) What size of force is shown on the newtonmeter?

Answer _____ N [1]

(ii) As the brick moves across the surface of the table a force is produced which opposes motion. Name this force.

_____ [1]

(iii) Suggest **one** way that the size of this force could be reduced.

_____

_____ [1]

(b) The table below gives the recommended safe distance between vehicles moving at different speeds, in order to avoid an accident.

Speed/ mph	Safe distance for good road conditions/metres	Safe distance for poor road conditions/metres
25	34	42
35	51	61
45	61	73
55	73	
65	89	105
75	102	120

(i) Complete the table by suggesting a value for the safe distance at 55 mph. [1]

(ii) Suggest **one** example of poor road conditions.

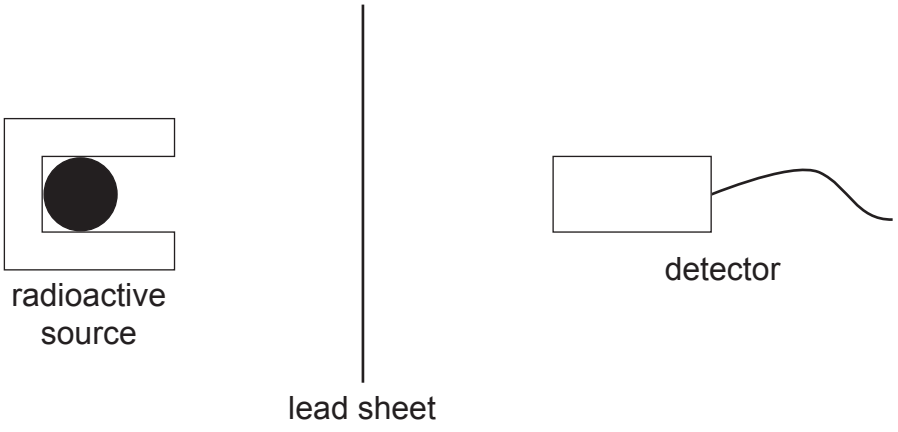
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 The diagram below shows the apparatus used to investigate how the thickness of lead affects the amount of radiation that can pass through to reach the detector.



Source: Principal Examiner

(a) There are three types of radiation. However, gamma is the only type suitable for this investigation.

(i) Name the other **two** types of radiation.

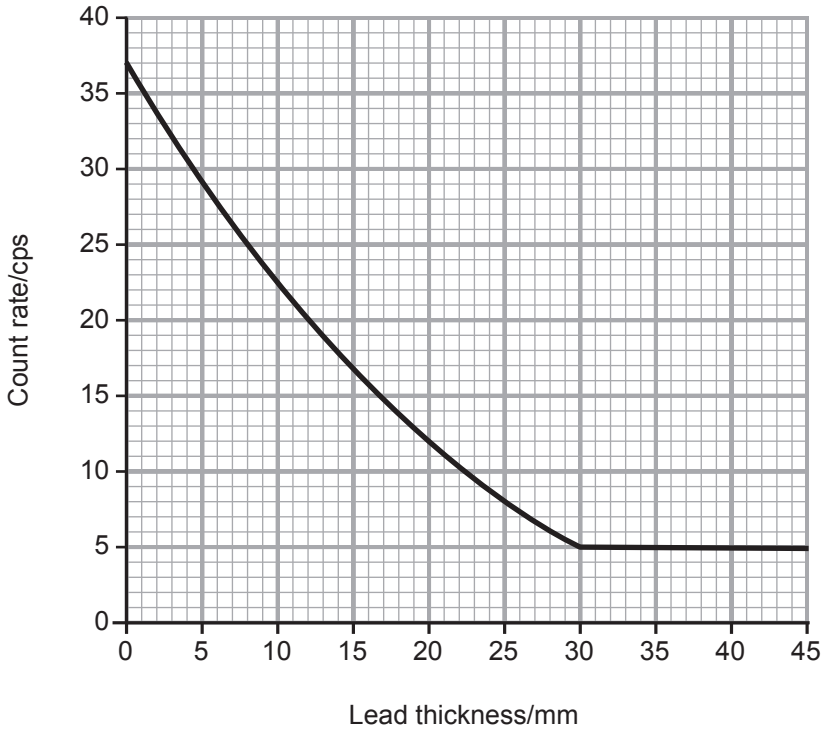
_____ and _____ [1]

(ii) Explain why these types of radiation are **not** suitable for this investigation.

_____

_____ [1]

(b) The graph below shows the results of this investigation.



Source: Principal Examiner

Describe fully the conclusion that can be made from these results.

_____

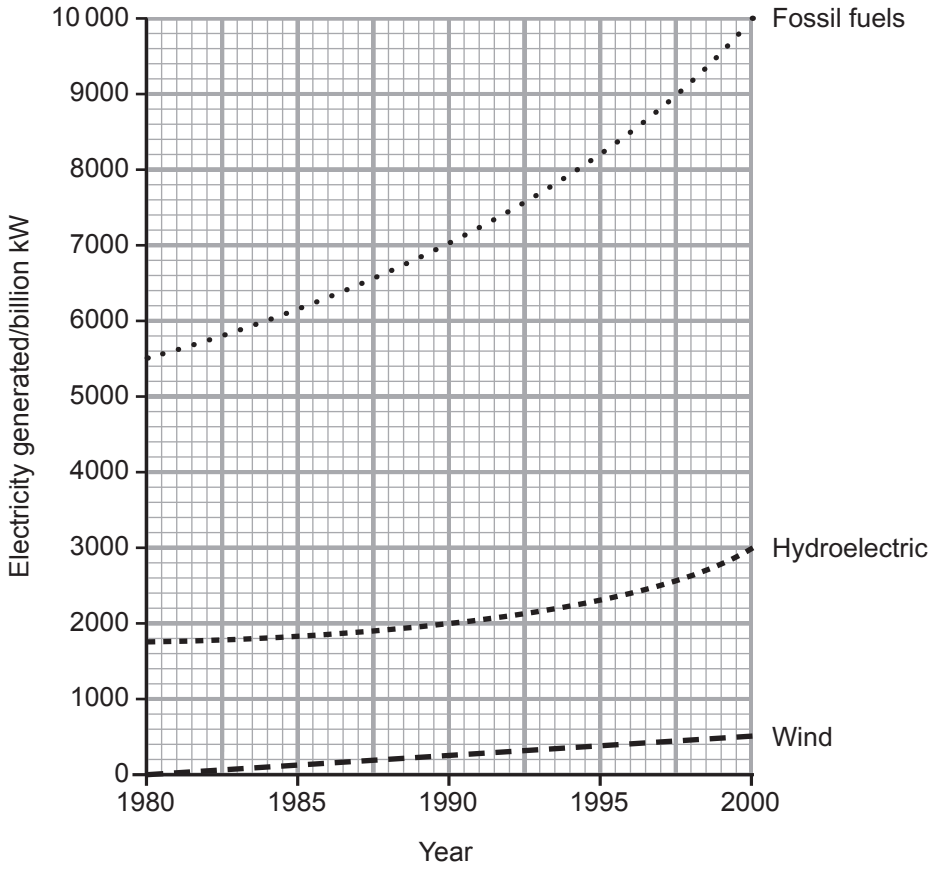
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The graph below shows how much electricity was generated worldwide from three different energy sources over 20 years.



Source: Principal Examiner

Compare the use of renewable and non-renewable energy sources during this 20-year period.

Your answer should include:

- the names of the renewable and non-renewable sources shown;
- the definition of a renewable energy source;
- one environmental disadvantage of each source.

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

Examiner Only

Marks	Remark

[6]

(b) In a power station, electricity is produced when a turbine drives a generator. Describe fully how electricity is made in the **generator**.

[2]

Examiner Only	
Marks	Remark

5 **(a)** The Earth has many artificial (man-made) satellites.

(i) State **two** uses of these artificial satellites.

1. _____

_____

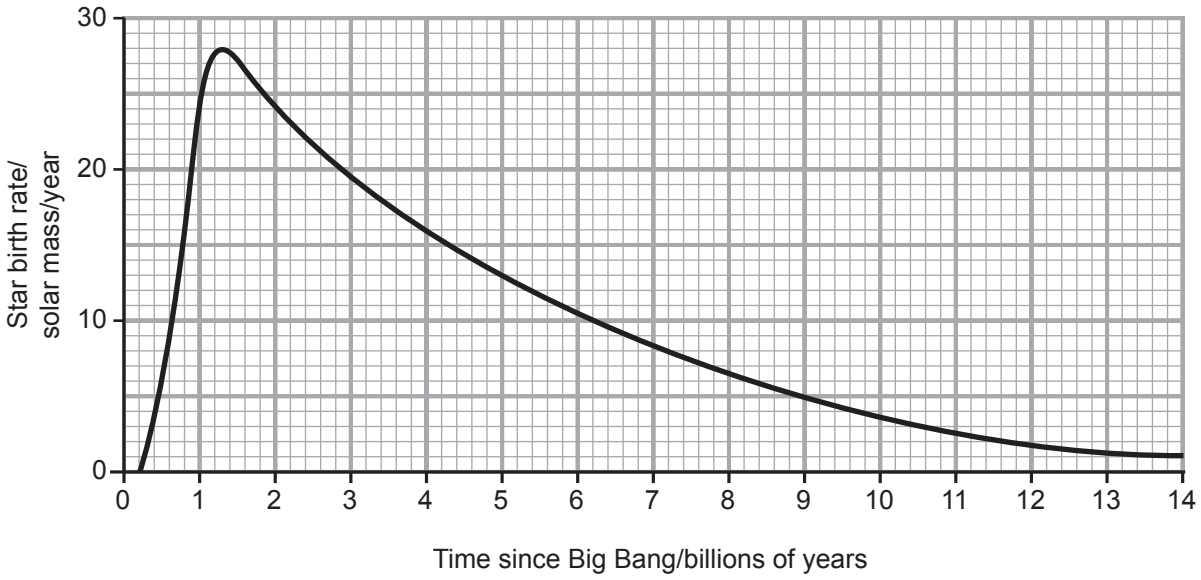
2. _____

_____ [2]

(ii) Name the force that keeps these satellites in orbit.

_____ [1]

(b) The graph below shows how the birth rate of stars has changed since the Universe began.



(i) How long after the Big Bang did the first stars start to form?

Answer _____ billions of years [1]

(ii) How much solar mass was produced each year when the star birth rate was at its highest?

Answer _____ [1]

(iii) State how the **total** number of stars has changed since the Big Bang.

_____ [1]

(c) Describe fully the formation of a star.

_____

_____

_____

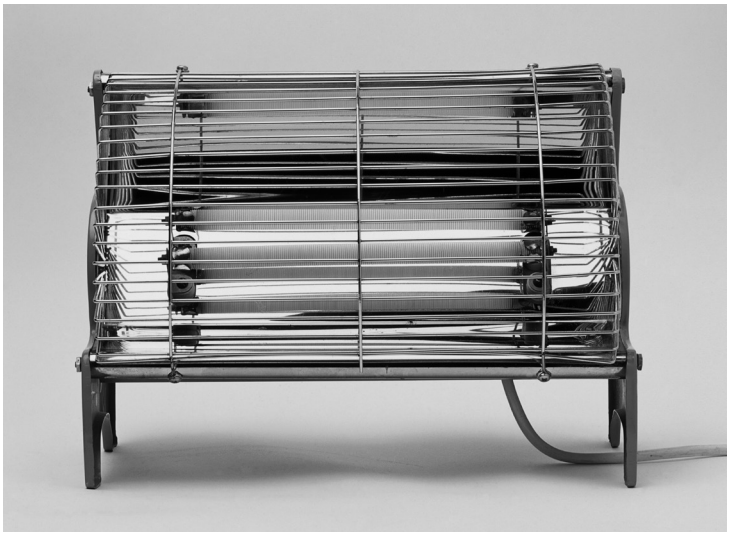
_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 The photograph below shows an electric fire.



© Dorling Kindersley / UIG / Science Photo Library

When a person stands in front of this type of fire, the heat travels to the person by convection and radiation.

(a) Explain fully why heat does **not** travel from the fire to the person by conduction.

_____

_____

_____ [2]

(b) Suggest why the back of the fire is bright and shiny.

_____

_____ [1]

(c) Explain fully how heat travels by convection.

_____

_____

_____ [2]

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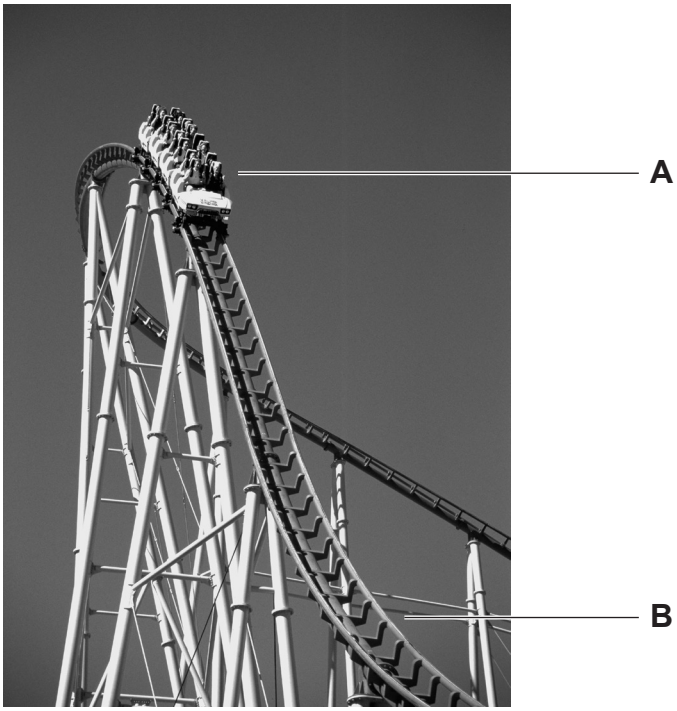
(Questions continue overleaf)

Examiner Only	
Marks	Remark

7 **(a)** The photograph below shows a group of people on a rollercoaster.



© Richard R. Hansen / Science Photo Library

(i) In what way, if any, does the amount of gravitational potential energy change as the rollercoaster travels from **A** to **B**? Explain your answer.

_____

_____

_____ [2]

(ii) Apart from gravitational potential energy, name the forms of energy the rollercoaster will have at **B**.

_____

_____ [2]

(iii) Use the equation:

$$\textbf{kinetic energy} = \frac{1}{2}\,mv^2$$

to calculate the kinetic energy of a 70 kg person travelling at 5 m/s on a rollercoaster.

(Show your working out.)

Answer _____ J [2]

(b) State the Principle of Conservation of Energy.

_____

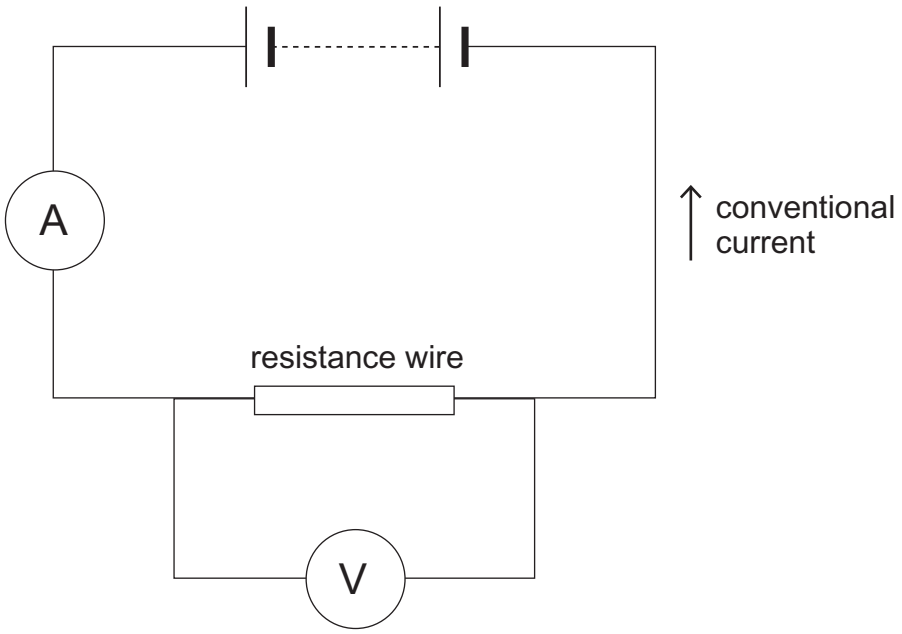
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 The circuit below was used to investigate the relationship between the resistance of a wire and its cross-sectional area.



Source: Principal Examiner

(a) The arrow on the diagram shows the direction of conventional current. Explain fully why current actually flows in the opposite direction.

_____

_____

_____ [2]

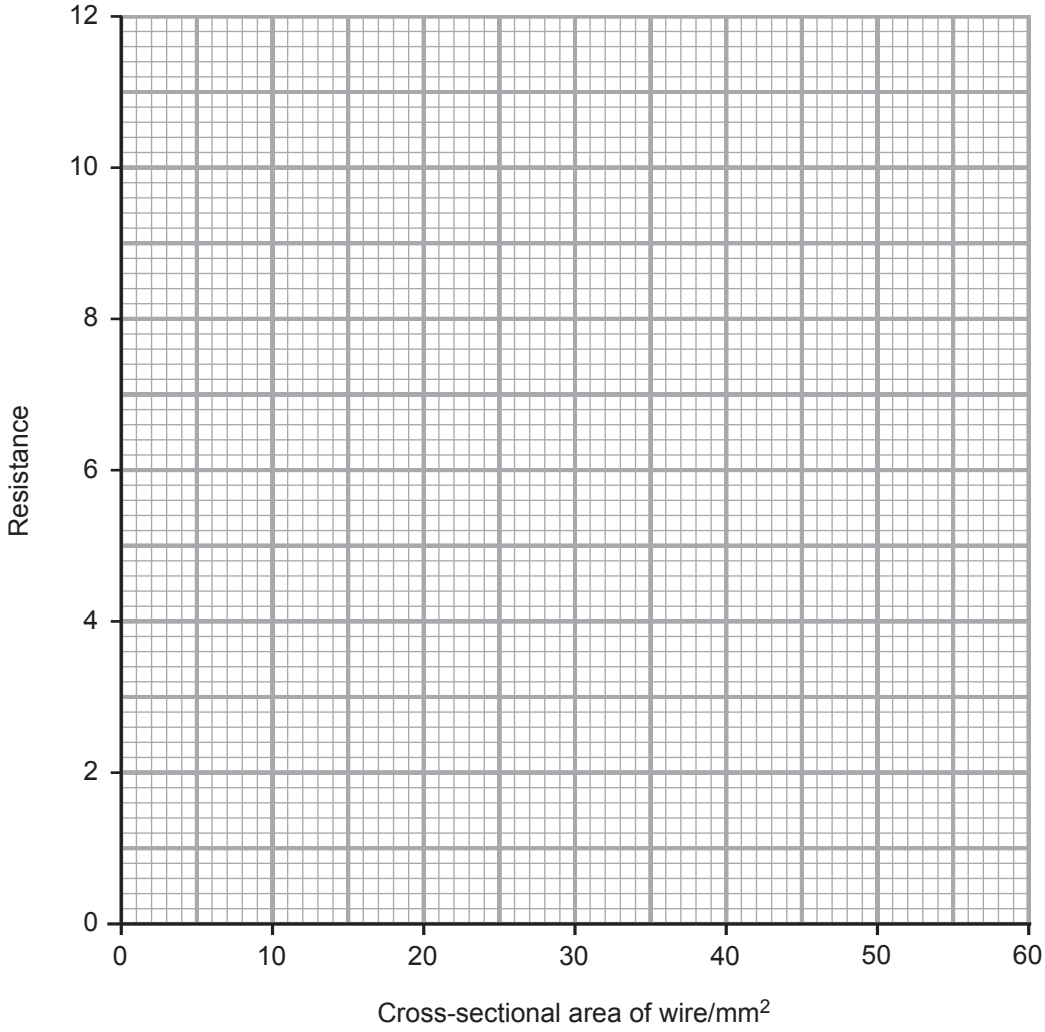
(b) The table below gives the results of the investigation.

Cross-sectional area of wire/mm^2	Voltage/ V	Current/ A	Resistance
10	4	0.40	10.0
20	4	0.80	5.0
30	4	1.20	3.3
40	4	1.60	2.5
50	4	2.00	2.0

(i) Name the unit used to measure resistance.

Answer _____ [1]

(ii) Plot and draw a line graph of resistance against cross-sectional area.



[3]

(iii) Describe fully the trend shown by this graph.

_____

_____

_____ [2]

(c) Name **one** other factor that affects resistance.

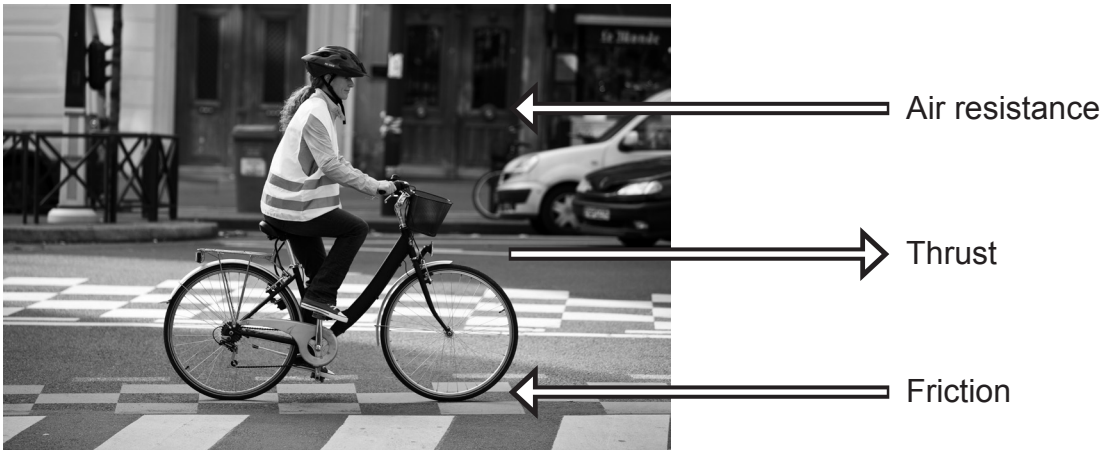
_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

9 The photograph below shows a 65 kg cyclist riding her 5 kg bicycle and the forces affecting her movement.



The table shows how speed affects air resistance and friction.

Speed/ km/h	Air resistance/ N	Friction/ N
5	1	4
10	3	4
15	5	4
20	8	4
25	12	4
30	18	4

(a) Calculate the size of the thrust needed to maintain a steady speed of 20 km/h.

Answer _____ N [1]

(b) Suggest **one** way the cyclist could reduce the force of air resistance when travelling at 30 km/h.

_____

_____ [1]

(c) Use the equation:

force = mass × acceleration

to calculate the cyclist's acceleration when the resultant force is 50 N.

(Show your working out.)

Answer _____ m/s^2 [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER