OCR
Oxford Cambridge and RSA

H

Friday 13 November 2020 – Morning

GCSE (9–1) Combined Science (Physics) A (Gateway Science)

J250/11 Paper 11 (Higher Tier)

Time allowed: 1 hour 10 minutes

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You must have:
- a ruler (cm/mm)
- the Data Sheet for GCSE (9–1) Combined Science (Physics) A (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

J250111

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **28** pages.

ADVICE
- Read each question carefully before you start your answer.

SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

1 Which statement describes an atom?

A The nucleus is smaller than the atom and contains no mass.

B The nucleus is smaller than the atom and contains most of the mass.

C The nucleus orbits the electrons and contains most of the mass.

D The nucleus orbits the protons and contains electrons.

Your answer ☐ **[1]**

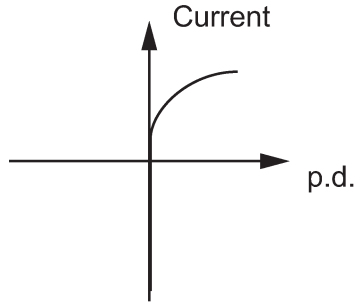
2 Which row of the table describes a physical change?

	Process	Material
A	Can be reversed	Keeps new properties when reversed.
B	Can be reversed	Returns to original properties when reversed.
C	Cannot be reversed	Has new properties after the change.
D	Cannot be reversed	Keeps its original properties after the change.

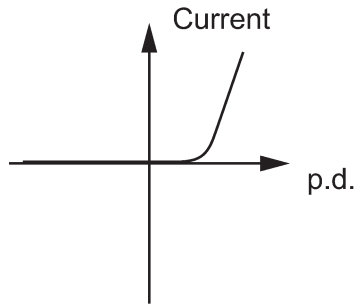
Your answer ☐ **[1]**

3 Which is the correct graph for a diode?

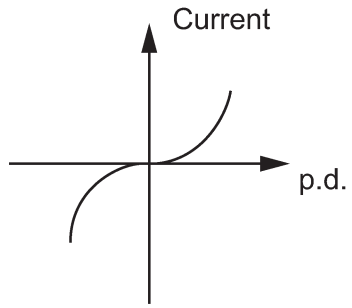
A



B



C



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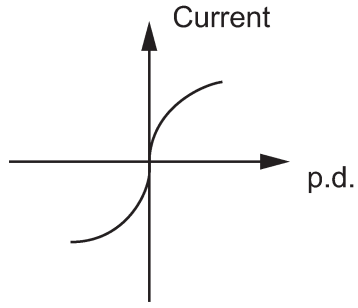
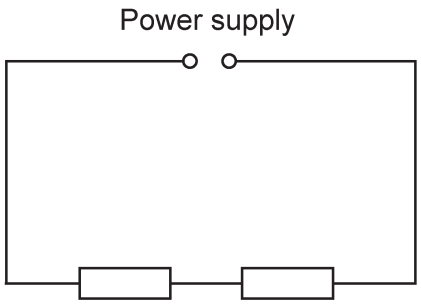
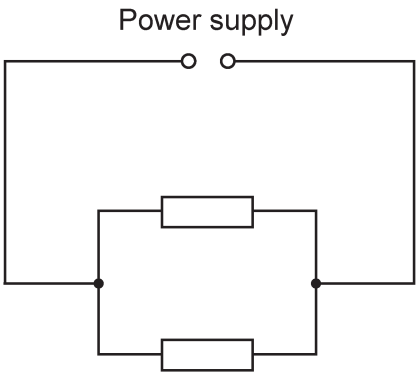


Your answer ☐ **[1]**

4 Look at circuits **X** and **Y**. The resistors are all identical.



Circuit **X**



Circuit **Y**

Which statement about circuit **X** or circuit **Y** is correct?

A Circuit **Y** has a higher resistance than circuit **X**.

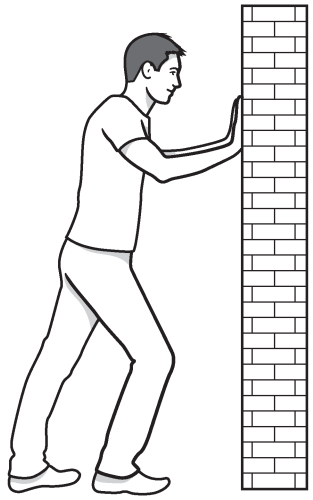
B Circuit **Y** is a series circuit with a lower resistance than circuit **X**.

C Circuit **X** is a parallel circuit with a higher resistance than circuit **Y**.

D Circuit **Y** has a lower resistance than circuit **X**.

Your answer ☐ **[1]**

5 A man stands next to a wall. He exerts a force on the wall by pushing against the wall with both hands. His feet remain in the same place



Which statement is correct?

A Force of wall on man = 0.

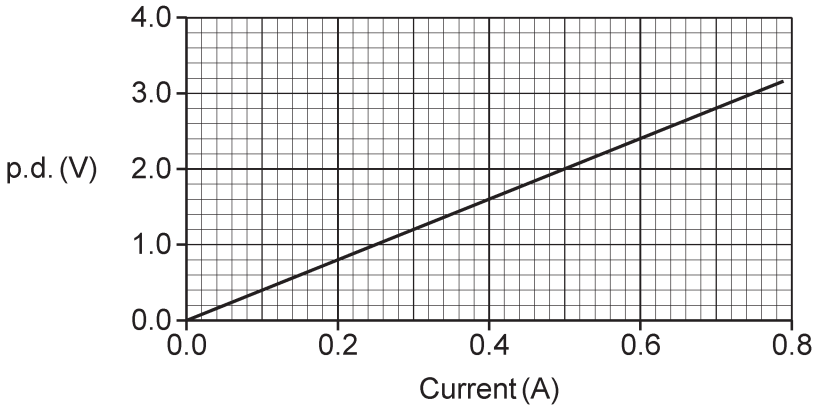
B Force of wall on man < Force of man on wall.

C Force of wall on man = Force of man on wall.

D Force of wall on man > Force of man on wall.

Your answer ☐ **[1]**

6 Look at the graph of potential difference (p.d.) against current for a component.



Calculate the resistance of the component at 1.6 V.

Use the equation: potential difference = current × resistance.

A 0.25 Ω

B 0.40 Ω

C 4.0 Ω

D 25 Ω

Your answer ☐ **[1]**

7 In an experiment, it takes 3006 J of energy to melt an ice cube.

The ice cube has a mass of 0.009 kg.

Calculate the specific latent heat of melting for ice.

Use an equation from the Data Sheet to help you.

A 27.1 J / kg

B 334 J / kg

C 27 100 J / kg

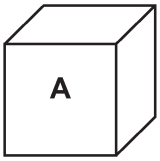
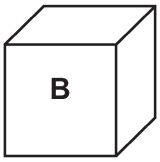
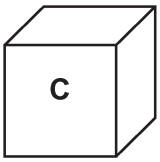
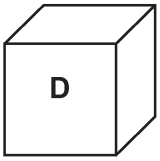
D 334 000 J / kg

Your answer ☐ **[1]**

8 A student heats 4 blocks using the same heater for the same amount of time.

Each block has the same **mass** but a different **specific heat capacity**.

Which block will have the greatest temperature rise?

Block	Specific heat capacity (J / kg °C)
	130
	390
	460
	490

Your answer ☐ **[1]**

9 A man weighs 700 N on Earth.

Estimate the weight of the man on the Moon.

Use the equation: gravity force = mass × gravitational field strength

The gravitational field strength on the Moon = 1.6 N / kg.

A 112 N

B 438 N

C 700 N

D 1120 N

Your answer ☐ **[1]**

10 Which row of the table describes **inertia** and **mass**?

	Inertia	**Mass**
A	How difficult it is to change the velocity of an object.	Force ÷ acceleration
B	The momentum of an object at high speed.	Force × acceleration
C	The opposition of a circuit to a flow of charge.	Force ÷ acceleration
D	Using a force to transfer energy between stores.	Force × acceleration

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 This question is about magnetic fields.

(a) **Fig. 11.1** is a diagram of the magnetic field around a bar magnet.

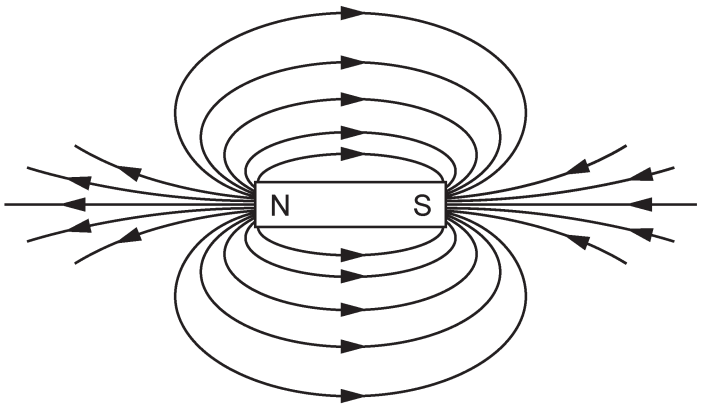

Fig. 11.1

The field lines give information about magnetic forces.

State **two** pieces of information **Fig. 11.1** gives you.

1 .....

.....

2 .....

.....

[2]

(b) A student has a permanent magnet and three metal blocks marked **A**, **B** and **C**, as shown in **Fig. 11.2**.

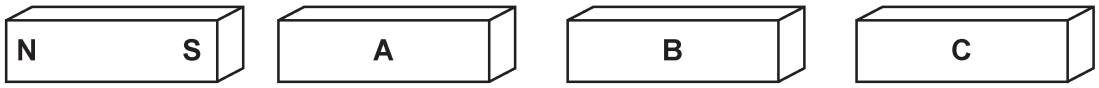

Fig. 11.2

- One block is a permanent magnet.
- One block is a piece of copper.
- One block is a piece of iron.

Explain how the student can use the permanent magnet to identify block **A**, **B** and **C**.

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..... **[3]**

(c) **Fig. 11.3** is a picture of a dipping compass.

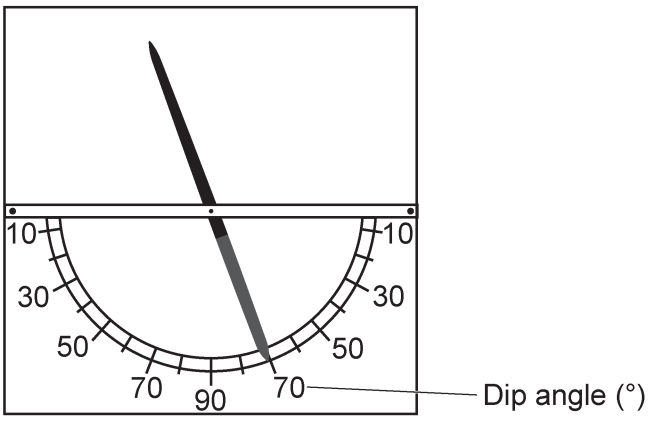

Fig. 11.3

The dip angle can be measured at different distances from the Earth's North pole.

The graph in **Fig. 11.4** shows how the dip angle varies with distance from the Earth's North pole.

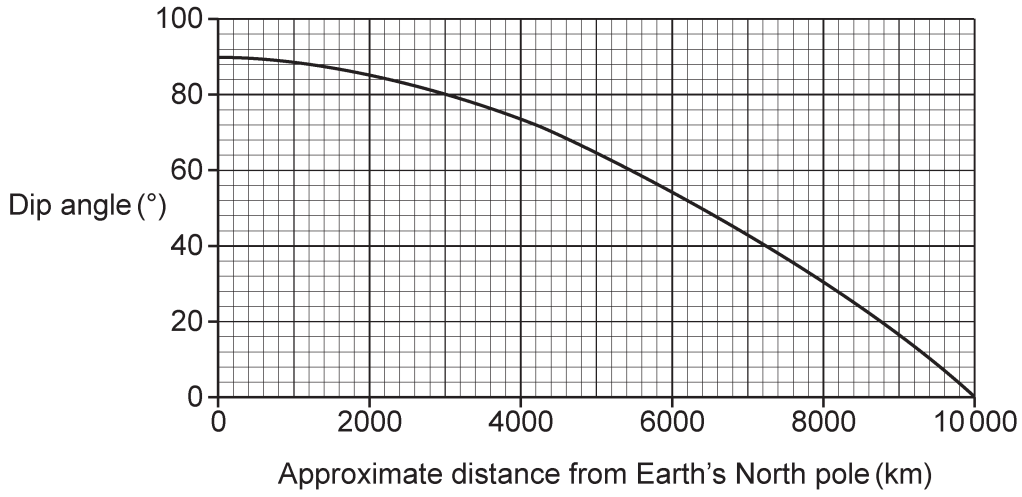

Fig. 11.4

(i) Describe the relationship shown in the graph in **Fig. 11.4**.

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..... **[2]**

(ii) London is approximately 4200 km from the North pole.

Use the graph in **Fig. 11.4** to estimate the dip angle in London.

Dip angle = ...° **[1]**

(iii) The actual value of the dip angle in London is 66°, with an uncertainty of +/– 3°.

Is the value you obtained in part **(c)(ii)** accurate? Explain your answer.

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..... **[1]**

(iv) The dipping compass gives important information about the Earth.

Describe what the dipping compass tells us about the Earth.

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..... **[1]**

(d) The graph in **Fig. 11.5** shows how the magnetic field strength around a straight wire decreases with distance from the wire.

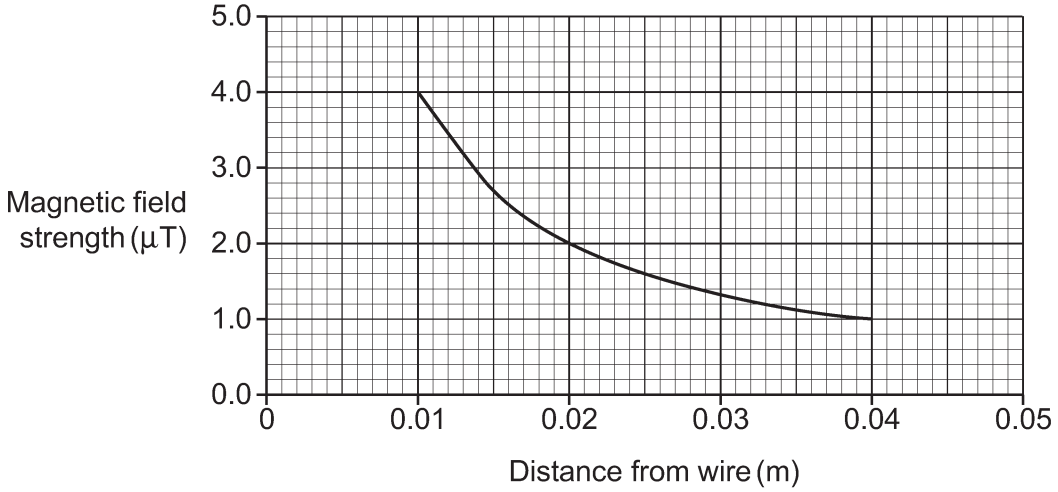

Fig. 11.5

Two students are discussing the graph in **Fig. 11.5**. This is what they say:

Student **X**: 'As distance doubles, field strength is multiplied by 0.25.'

Student **Y**: 'As distance doubles, field strength is multiplied by 0.75.'

Use the graph in **Fig. 11.5** to evaluate each statement.

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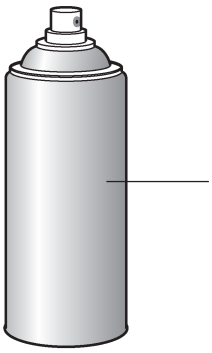
..... **[2]**

12 An aerosol canister may contain a non-flammable gas at high pressure.



The aerosol canister should **not** be exposed to high temperatures.

Explain why.

Include ideas about gas particles in your answer.

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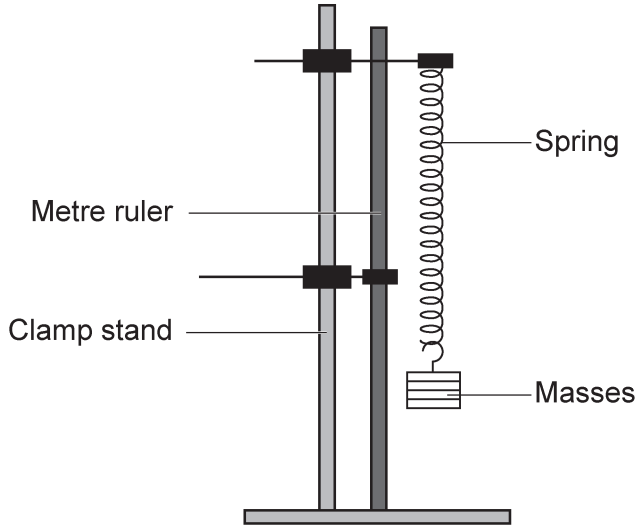
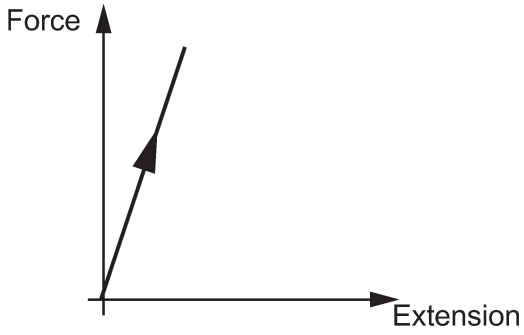
..... **[3]**

13* A student is doing an experiment by hanging some masses on two springs, **A** and **B**, and recording the extension.

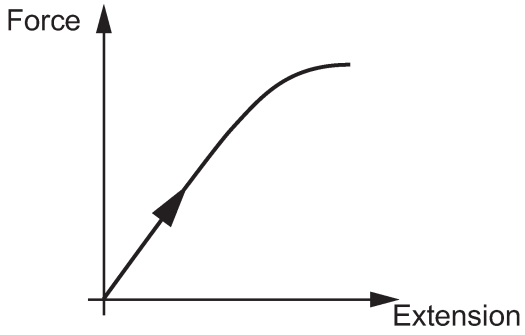


She measures the extension of each spring, after adding 100 g masses one by one.
She then measures the extension of each spring after removing the 100 g masses one by one.

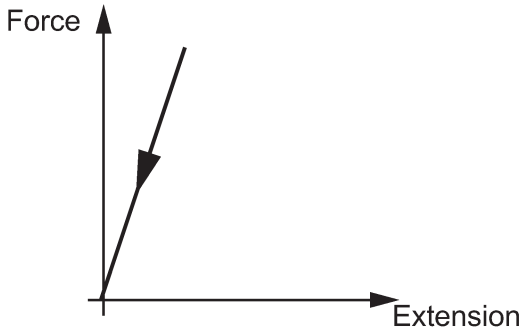
Here are the graphs of her results.



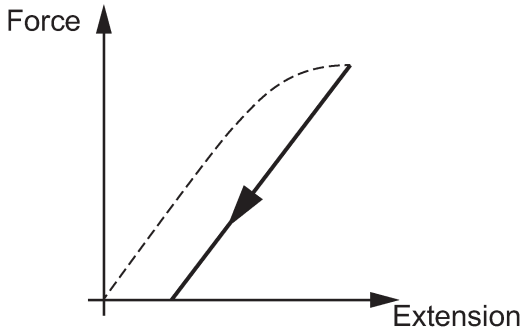
Adding masses to spring **A**



Adding masses to spring **B**



Removing masses from spring **A**



Removing masses from spring **B**

Use the graphs to describe the properties of spring **A** and spring **B**.

Give reasons for your answers.

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..... **[6]**

14 (a) **Fig. 14.1** is a diagram of a plastic rod.

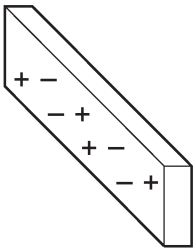

Fig. 14.1

(i) The plastic rod in **Fig. 14.1** is electrically neutral.

Explain how the diagram shows this.

.....

..... **[1]**

(ii) A student rubs the plastic rod with a cloth.

The plastic rod gains a positive charge.

She holds the positively charged plastic rod above her head, as shown in **Fig. 14.2**.

Fig. 14.2

Explain why the hairs on her head stand up.

You may add to the diagram in **Fig. 14.2** to explain your answer.

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..... **[3]**

(iii) The student repeats the experiment with a metal rod.

Her hair does **not** stand on end. Suggest why.

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..... **[1]**

(b) A Van de Graaff generator, as shown in **Fig. 14.3**, is often used to produce charges.

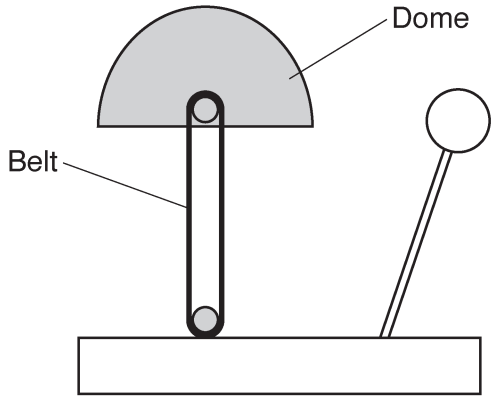


Fig. 14.3

A Van de Graaff generator has a charge of 1.2×10^{-5} C on its dome.

(i) The p.d. when the dome sparks is 30 kV.

How much energy is transferred when the dome sparks?

Energy transferred = ... J **[4]**

(ii) The dome takes 0.0005 s to discharge through a person.

Calculate the current in the person.

Use the equation: charge flow = current × time.

Current = ... A **[3]**

15 This question is about the motion of objects.

(a) A skydiver steps out of a plane.

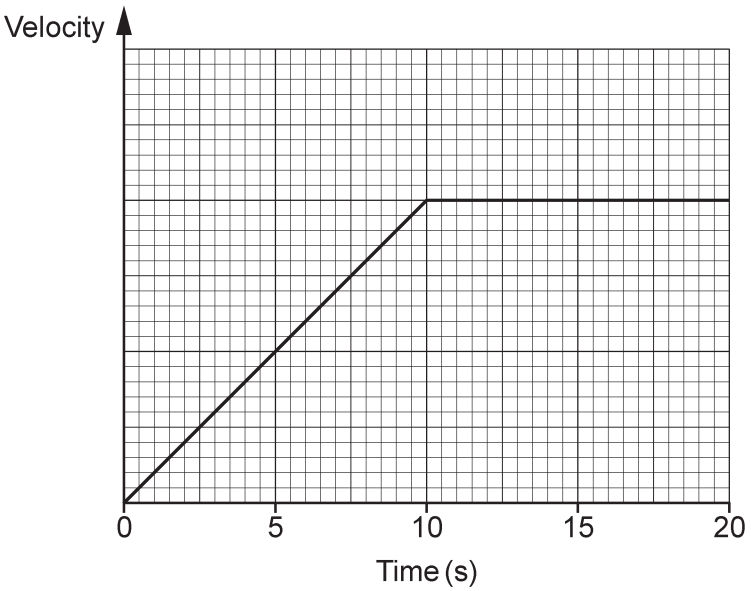
The table describes the motion of the skydiver at different times.

Complete the gaps in the table.

Situation	Free-body force diagram	Explanation
Skydiver steps out of plane and accelerates towards Earth.	 Force of Earth on skydiver	
Acceleration of the skydiver decreases.		Air resistance increases with increasing velocity.
	 Air resistance Force of Earth on skydiver	Air resistance equals force of Earth on skydiver so there is no resultant force.

[3]

(b) Look at the velocity-time graph for a car during 20 seconds.



Overall, the car travels 390 m.

Use the graph to calculate the **final** velocity of the car.

Final velocity = ... m/s **[3]**

16 Some students investigate the speed of a trolley down a ramp.

The students do not have light gates, so instead they attach a tape to the trolley and release it down the ramp, as shown in **Fig. 16.1**.

They also set-up a machine with a timer to make a dot on the tape every 0.02 s.

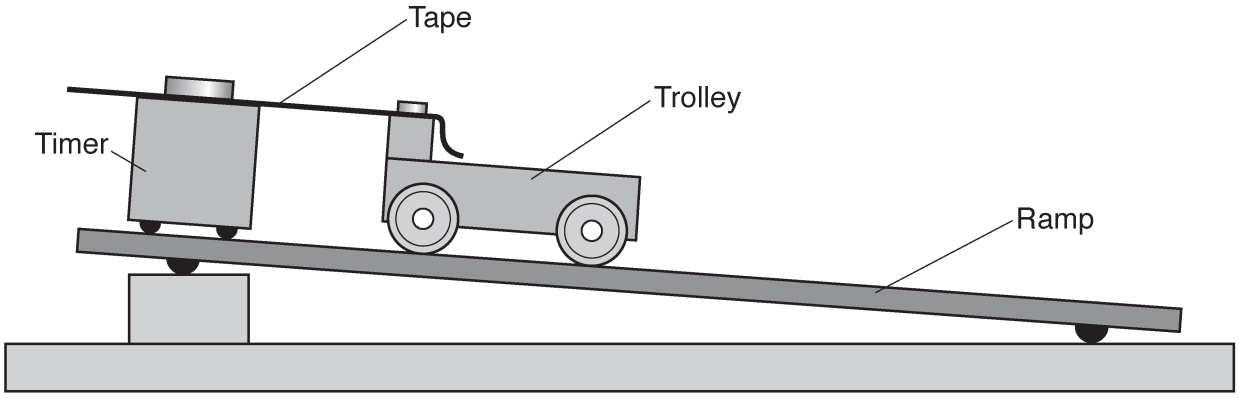


Fig. 16.1

(a) **Fig. 16.2** is part of the tape.

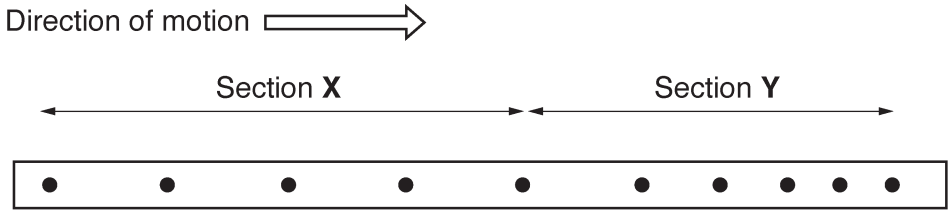


Fig. 16.2

Describe **and** explain the motion of the trolley in each section.

Section **X** .....

.....

Section **Y** .....

.....

[4]

(b) **Fig. 16.3** is part of another tape.

The timer for this tape also makes a dot on the tape every 0.02 s.

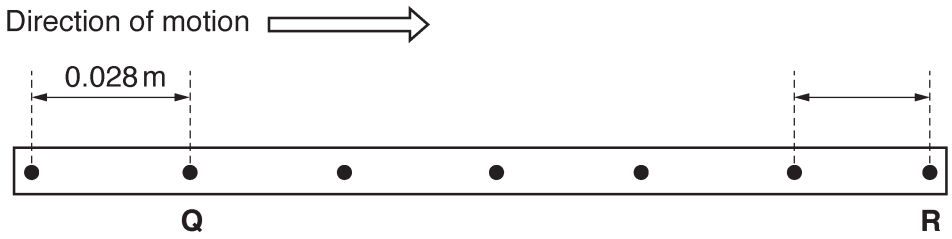


Fig. 16.3

(i) Use the tape in **Fig. 16.3** to calculate the speed of the trolley at point **Q**.

Use the equation: distance travelled = speed × time.

Speed at **Q** = ... m/s **[3]**

(ii) In a repeat experiment:

- the speed at **Q** is 1.3 m/s
- the speed at **R** is 1.0 m/s.

Use these values and the tape in **Fig. 16.3** to calculate the deceleration of the trolley.

Use the equation: deceleration = change in speed ÷ time.

Deceleration = ... m/s^2 **[3]**

(c) **Fig. 16.4** is tape from another trolley on a different ramp.

Fig. 16.4

The speed of the trolley for this experiment means that the dots on the tape are stretched out. This makes measuring the distances between the dots more difficult.

How can the students measure the speed more accurately?

The students do **not** have any other equipment.

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..... **[1]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).