

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE COMBINED SCIENCE

Paper 3 Physics Core

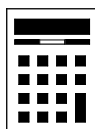
C

Tuesday 5 November 2024 07:00 GMT Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a protractor
- a scientific calculator
- the Physics Equations Sheet (enclosed).



Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a scientific calculator where appropriate.
- The Physics Equations Sheet is provided as a loose insert.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	



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ANSWER IN THE SPACES PROVIDED**



Answer **all** questions in the spaces provided.

0 1

Circuit diagrams use circuit symbols to represent electrical components.

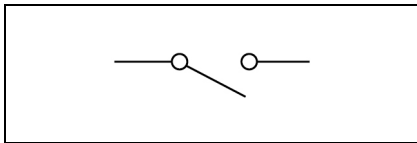
0 1 . 1

Draw one line from each circuit symbol to the name of the component.

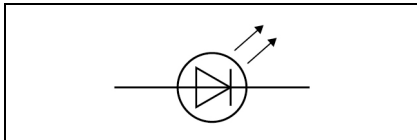
[3 marks]

Circuit symbol

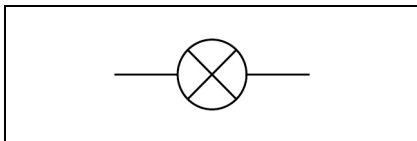
Name of component



Fuse



Lamp



LDR

LED

Switch

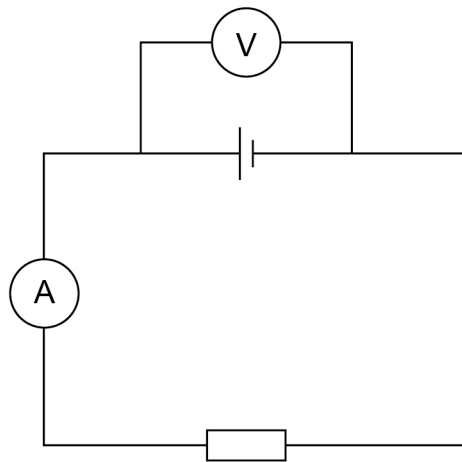
Question 1 continues on the next page

Turn over ►

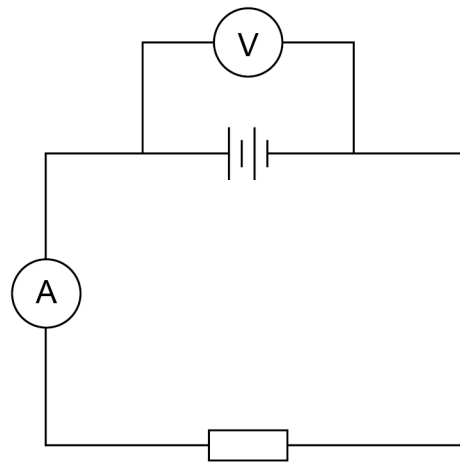


Figure 1 shows two different circuits that a student built.

Figure 1



Circuit A



Circuit B

All the cells in both circuits are identical.

The resistors in both circuits are identical.

0 1 . 2 The reading on the voltmeter in circuit **A** is 1.5 V.

What is the reading on the voltmeter in circuit **B**?

[1 mark]

Tick (✓) **one** box.

0.75 V

☐

1.5 V

☐

3.0 V

☐

6.0 V

☐


0 1 . 3

The reading on the ammeter in circuit **A** is 0.20 A.What is the reading on the ammeter in circuit **B**?**[1 mark]**Tick (✓) **one** box.

0.10 A

☐

0.20 A

☐

0.30 A

☐

0.40 A

☐

0 1 . 4

The reading on the voltmeter in circuit **A** is 1.5 V and the reading on the ammeter is 0.20 A.

Calculate the resistance of the resistor.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

Resistance = _____ Ω **Question 1 continues on the next page****Turn over ►**

0 1 . 5

There was a current of 0.20 A in a resistor for 30 seconds.

Calculate the charge flow in the resistor.

Use the equation:

$$\text{charge flow} = \text{current} \times \text{time}$$

[2 marks]

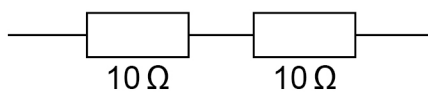
Charge flow = _____ C

The student then built some circuits containing two 10 Ω resistors.

0 1 . 6

Figure 2 shows two 10 Ω resistors connected in **series**.

Figure 2



What is the total resistance of the resistors in **Figure 2**?

[1 mark]

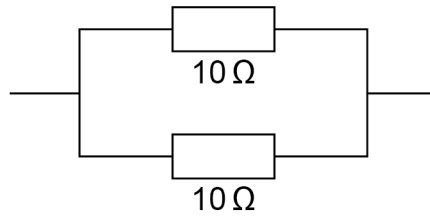
Tick (✓) **one** box.

5 Ω
☐
10 Ω
☐
20 Ω
☐
40 Ω
☐


0 1 . 7

Figure 3 shows two $10\ \Omega$ resistors connected in **parallel**.

Figure 3

What is the total resistance of the resistors in **Figure 3**?

[1 mark]

Tick (✓) **one** box.5 Ω
☐
10 Ω
☐
20 Ω
☐
40 Ω
☐

11

Turn over for the next question

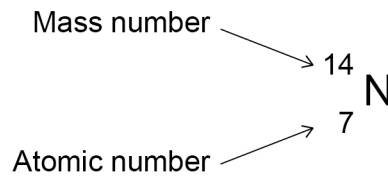
Turn over ►



0 2

Atoms consist of electrons, neutrons and protons.

A nitrogen (N) atom can be represented as:



0 2

1

The nitrogen atom contains 7 electrons, 7 neutrons and 7 protons.

Complete the sentences.

Choose answers from the box.

[2 marks]

electrons

neutrons

protons

The atomic number is the number of _____.

The mass number is the total number of _____ and _____.

0 2

2

Why does the nitrogen atom have no overall charge?

[1 mark]

Tick (✓) **one** box.

The number of electrons is the same as the number of neutrons.

☐

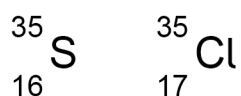
The number of neutrons is the same as the number of protons.

☐

The number of protons is the same as the number of electrons.

☐


0 2 . 3 An atom of sulfur (S) and an atom of chlorine (Cl) can be represented as:



Give **two** reasons why the atoms of chlorine and sulfur are **not** isotopes of each other.

[2 marks]

Tick (✓) **two** boxes.

The atoms are different elements.

☐

The atoms both have the same mass number.

☐

The atoms contain a different number of protons.

☐

The atoms contain the same number of neutrons.

☐

The atoms have the same overall charge.

☐

0 2 . 4 Most of the mass of an atom is concentrated in the centre of the atom.

Give the name of the centre of the atom.

[1 mark]

0 2 . 5 What is the approximate radius of an atom?

[1 mark]

Tick (✓) **one** box.

10^{-10} m

☐

10^{-1} m

☐

10^1 m

☐

10^{10} m

☐

7
--

Turn over ►



0 3

Figure 4 shows a pair of wireless earphones.

Figure 4



0 3 . 1

The wireless earphones are Bluetooth earphones.

Complete the sentence to name the electromagnetic waves Bluetooth uses.

Choose the answer from the box.

[1 mark]

infrared

radio waves

ultraviolet

x-rays

Bluetooth uses _____.

0 3 . 2

Electromagnetic waves are transverse waves.

What is meant by 'transverse waves'?

[1 mark]

Tick (✓) **one** box.

Oscillations are opposite to the direction of energy transfer.

☐

Oscillations are parallel to the direction of energy transfer.

☐

Oscillations are perpendicular to the direction of energy transfer.

☐


The earphones produce sound waves that are within the range of human hearing.

0 3 . 3 Sound waves are **not** transverse waves.

What type of waves are sound waves?

[1 mark]

0 3 . 4 What is the **minimum** frequency a human can hear?

[1 mark]

Tick (✓) **one** box.

2 Hz

☐

20 Hz

☐

200 Hz

☐

2000 Hz

☐

0 3 . 5 What is the **maximum** frequency a human can hear?

[1 mark]

Tick (✓) **one** box.

200 Hz

☐

2000 Hz

☐

20 000 Hz

☐

200 000 Hz

☐

Question 3 continues on the next page

Turn over ►



0 3 . 6 Which of the following affects the pitch of a sound?

[1 mark]

Tick (✓) **one** box.

The amplitude of the oscillations

☐

The frequency of the oscillations

☐

The speed of the wave

☐

0 3 . 7 Which of the following affects the loudness of the sound?

[1 mark]

Tick (✓) **one** box.

The amplitude of the oscillations

☐

The frequency of the oscillations

☐

The speed of the wave

☐

The wavelength of the wave

☐

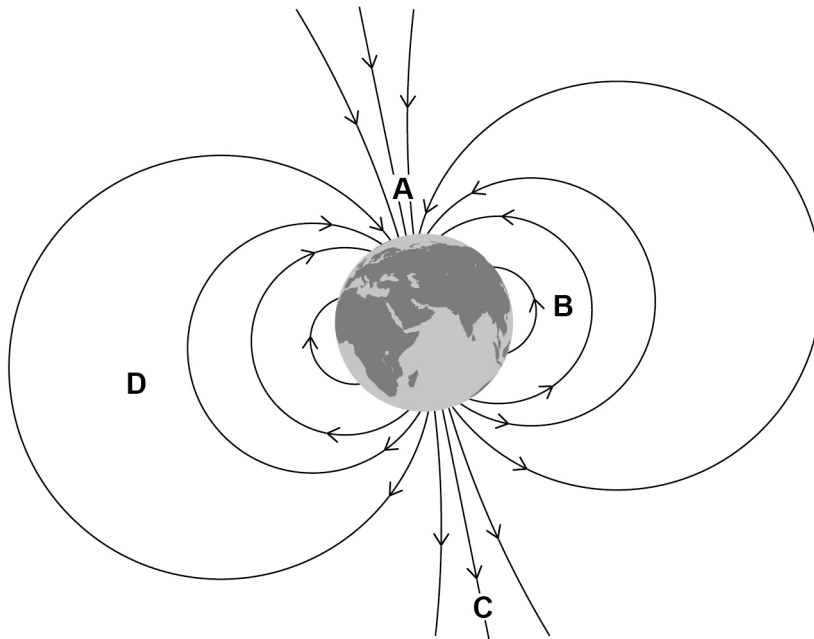
7



0 4

Figure 5 shows the magnetic field of the Earth represented by field lines.

Figure 5



0 4 . 1

Where in **Figure 5** is the magnetic field the strongest?

[1 mark]

Tick (✓) **one** box.

A

☐

B

☐

C

☐

D

☐

0 4 . 2

What names are given to the **two** points on the Earth's surface where the field is the strongest?

[1 mark]

1 _____

2 _____

Turn over ►



0 4 . 3

Which **two** of the following metals are attracted to the Earth's magnetic field?**[2 marks]**Tick (✓) **two** boxes.

Aluminium

☐

Cobalt

☐

Gold

☐

Nickel

☐

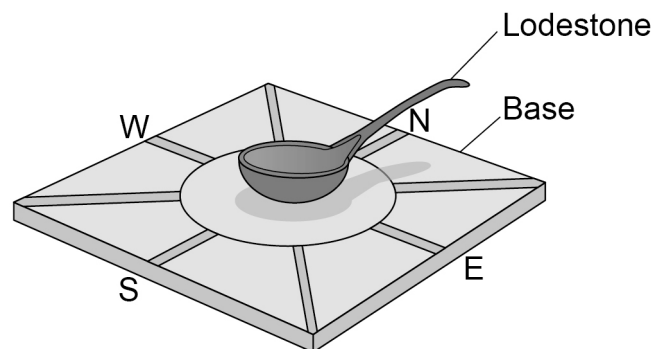
Silver

☐

Lodestones are natural magnets found on the surface of the Earth.

Thousands of years ago lodestones were used to make compasses.

Figure 6 shows a compass made from a lodestone.

Figure 6

The lodestone was made into a spoon-shape with a curved surface so that it could turn on the base.

0 4 . 4

Explain how the compass shown in **Figure 6** helped people know which direction they were travelling in.

[2 marks]

0 4 . 5

A lodestone is a permanent magnet so it always has its own magnetic field.

What name is given to a magnet that loses its magnetism when removed from a magnetic field?

[1 mark]

Tick (✓) **one** box.

Bar magnet

☐

Electromagnet

☐

Induced magnet

☐

7

Turn over for the next question

Turn over ►



0 5

Mains electricity is generated using different energy resources.

Mains electricity is an alternating current (ac) supply.

0 5 . 1

What is meant by 'alternating current'?

[1 mark]Tick (✓) **one** box.

The current is always in the same direction.

☐

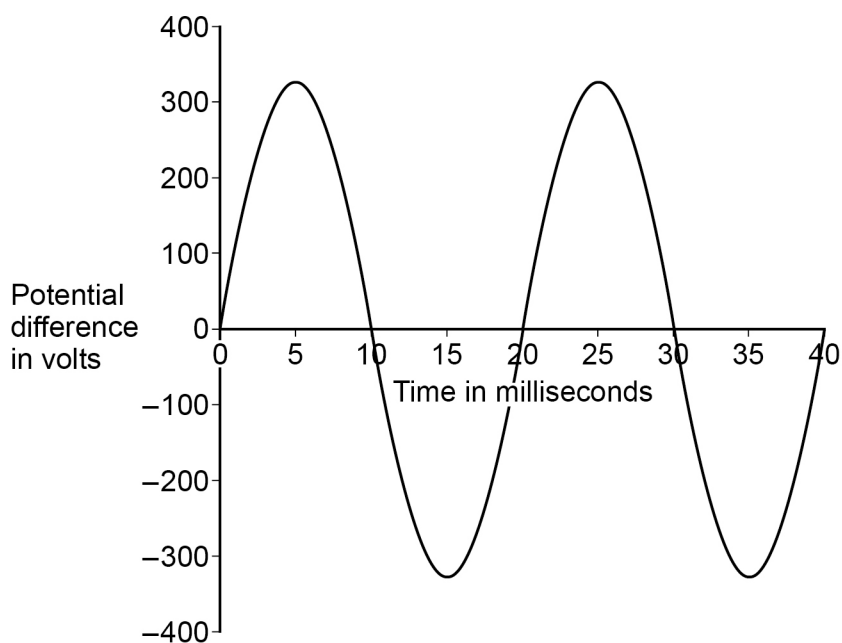
The current repeatedly changes direction.

☐

The direction and magnitude of the current are constant.

☐

The magnitude of the current can increase or decrease.

☐**Figure 7** shows a mains supply represented on a screen.**Figure 7**

0 5 . 2

The units on the x-axis in **Figure 7** are milliseconds.

Which of the following is the same as 1 millisecond?

[1 mark]

Tick (✓) **one** box.

0.000 001 seconds

☐

0.001 seconds

☐

1000 seconds

☐

1 000 000 seconds

☐**0 5 . 3**

The period of the mains supply is the time for one complete cycle.

What is the period of the supply in **Figure 7**?

[1 mark]

Tick (✓) **one** box.

10 milliseconds

☐

20 milliseconds

☐

30 milliseconds

☐

40 milliseconds

☐

Question 5 continues on the next page

Turn over ►

Most countries plan to increase the use of renewable energy resources and decrease the use of fossil fuels.

0 5 . 4 Wind is a renewable energy resource.

A wind farm generates ac electricity with a period of 0.0625 seconds.

Calculate the frequency of the ac.

Use the equation:

$$\text{frequency} = \frac{1}{\text{period}}$$

[2 marks]

Frequency = _____ Hz

0 5 . 5 Explain the **advantages** and **disadvantages** of:

- increasing the use of wind to generate electricity
- decreasing the use of fossil fuels to generate electricity.

[4 marks]



0 5 . 6 Which **two** of the following are also renewable energy resources?

[2 marks]

Tick (✓) **two** boxes.

Biofuel

☐

Coal

☐

Gas

☐

Nuclear

☐

Solar

☐

0 5 . 7 The leaders of different countries meet regularly to set targets to increase the use of renewable resources.

Suggest why setting these targets is a good idea.

[1 mark]

12

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Turn over ►



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0 6

The Sun was formed when the gases hydrogen and helium were pulled together by a force.

0 6 . 1

What is the name of the force that pulled these gases together?

[1 mark]

0 6 . 2

What happened to the temperature of the gases as they were pulled together?

[1 mark]

Tick (✓) **one** box.

The temperature decreased.

☐

The temperature stayed the same.

☐

The temperature increased.

☐**0 6 . 3**

Which part of the Sun has the greatest temperature?

[1 mark]

Tick (✓) **one** box.

The core

☐

The outer layers

☐

The surface

☐

Question 6 continues on the next page

Turn over ►



Rigel Kentaurus is a star close to the Sun. Rigel Kentaurus is very similar to the Sun.

Table 1 gives some information about the two stars.

Table 1

Star	Age in thousands of millions of years	Surface temperature in °C	Relative mass
Sun	4.60	5500	1.0
Rigel Kentaurus	4.85	5520	1.1

0 6 . 4

Give **two** reasons why the Sun and Rigel Kentaurus have very similar surface temperatures.

Use **Table 1**.

[2 marks]

1 _____

2 _____

0 6 . 5

A process in Rigel Kentaurus creates elements heavier than hydrogen.

What is the name of this process?

[1 mark]

Tick (✓) **one** box.

Chemical reaction

☐

Nuclear fusion

☐

Thermal convection

☐


0 6 . 6

When Rigil Kentaurus runs out of hydrogen it will expand and become much bigger.

What name is given to this stage of the star's life cycle?

[1 mark]

0 6 . 7

After a long time as a much bigger star, Rigil Kentaurus will lose its outer layers and become a dwarf star.

Complete the sentence.

Choose answers from the box.

[2 marks]

black	blue	orange	red	white
-------	------	--------	-----	-------

During its time as a dwarf star its colour will change from

_____ to _____.

9

Turn over for the next question

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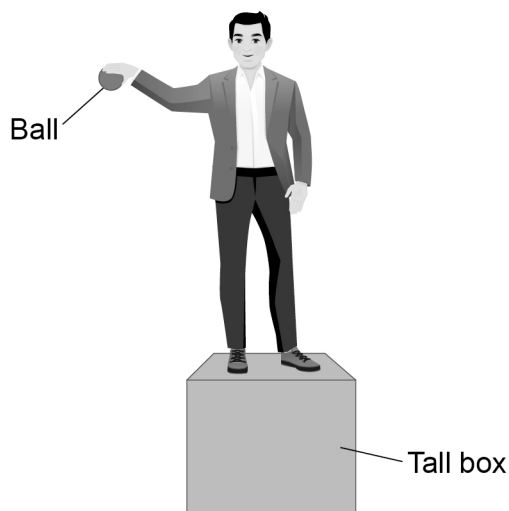


0 7

A teacher demonstrated the energy changes for a ball that was dropped.

Figure 8 shows the teacher before dropping the ball.

Figure 8



0 7 . 1

The teacher held the ball at a height of 2.0 m.

The ball has a mass of 0.14 kg.

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the ball when it is at a height of 2.0 m.

Use the equation:

$$\text{gravitational potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{height}$$

Give your answer to 2 significant figures.

[3 marks]

Gravitational potential energy (2 significant figures) = _____ J



0 7 . 2 The teacher dropped the ball.

The ball hit the ground with a velocity of 6.0 m/s.

The mass of the ball is 0.14 kg.

Calculate the kinetic energy of the ball.

Use the equation:

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times (\text{velocity})^2$$

[2 marks]

Kinetic energy = _____ J

Work is done on the ball when the ball is falling.

0 7 . 3 State which upward force does work on the ball as the ball falls.

[1 mark]

0 7 . 4 The upward force that acts on the ball is a vector quantity.

Complete the sentence to give the meaning of 'vector quantity'.

[1 mark]

A vector quantity has a magnitude and a _____.

Question 7 continues on the next page

Turn over ►



0 7 . 5

The mass of the ball is 0.14 kg.

Calculate the acceleration of the ball when the resultant force acting on the ball is 1.26 N.

Use the Physics Equations sheet.

Choose the unit from the box.

[4 marks]

m/s	m/s ²	m/s ³
-----	------------------	------------------

Acceleration = _____ Unit _____

0 7 . 6

The teacher measured the time taken for the ball to fall using a stopwatch.

The ball took a very short time to fall to the ground.

The teacher was standing on a tall box.

The teacher was **not** standing on the floor.

Explain **one** advantage of dropping the ball when standing on a tall box rather than when standing on the ground.

[2 marks]



0	7	.	7
---	---	---	---

Describe the energy changes that occur as the ball hits the ground.

You should refer to:

- kinetic energy
- elastic potential energy
- thermal energy of the ball.

[3 marks]

16

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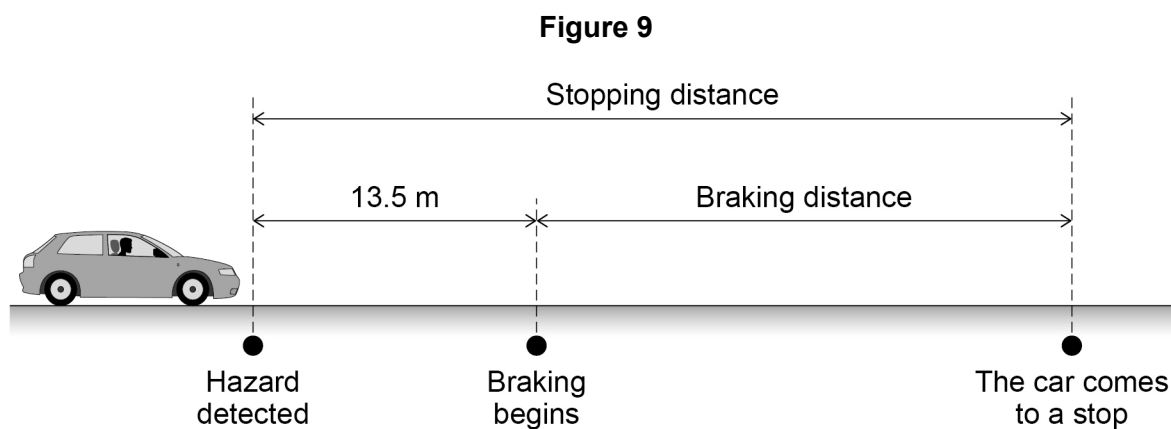
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0 8

A car is being driven along a road. The driver sees a hazard in the road and applies the brakes.

Figure 9 shows the stopping distance of the car.



0 8

. 1

Which of the following describes the thinking distance?

[1 mark]

Tick (✓) **one** box.

The distance travelled between the brakes being applied and the car stopping

☐

The distance travelled between the hazard being detected and the brakes being applied

☐

The distance travelled between the hazard being detected and the car stopping

☐

0 8

. 2

Speed affects the thinking distance.

Give **two** other factors that affect the thinking distance.

[2 marks]

1 _____

2 _____



08.3

When the brakes were applied, a constant force acted on the car until the car stopped.

The force was 7500 N.

The work done by the brakes was 162 000 J.

Calculate the braking distance.

Use the Physics Equations Sheet.

[3 marks]

Braking distance = _____ m

08.4

Determine the stopping distance of the car.

Use **Figure 9** and your answer to Question **08.3**.

[2 marks]

Stopping distance = _____ m

8

Turn over ►



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0 9

Most of the water on Earth is liquid water.

Some of the water on Earth is solid ice.

0 9 . 1

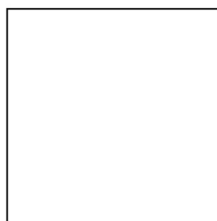
Complete **Figure 10** by drawing particles in the boxes to show the arrangement of particles in liquid water and in solid ice.

You should draw particles the same size as the example in **Figure 10**.

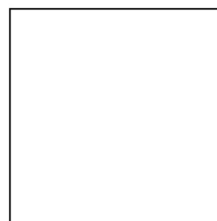
[2 marks]

Figure 10

Particle



Liquid water



Solid ice

0 9 . 2

Name **one** change of state that can happen to liquid water and **one** change of state that can happen to solid ice.

[2 marks]

Liquid water _____

Solid ice _____

Question 9 continues on the next page

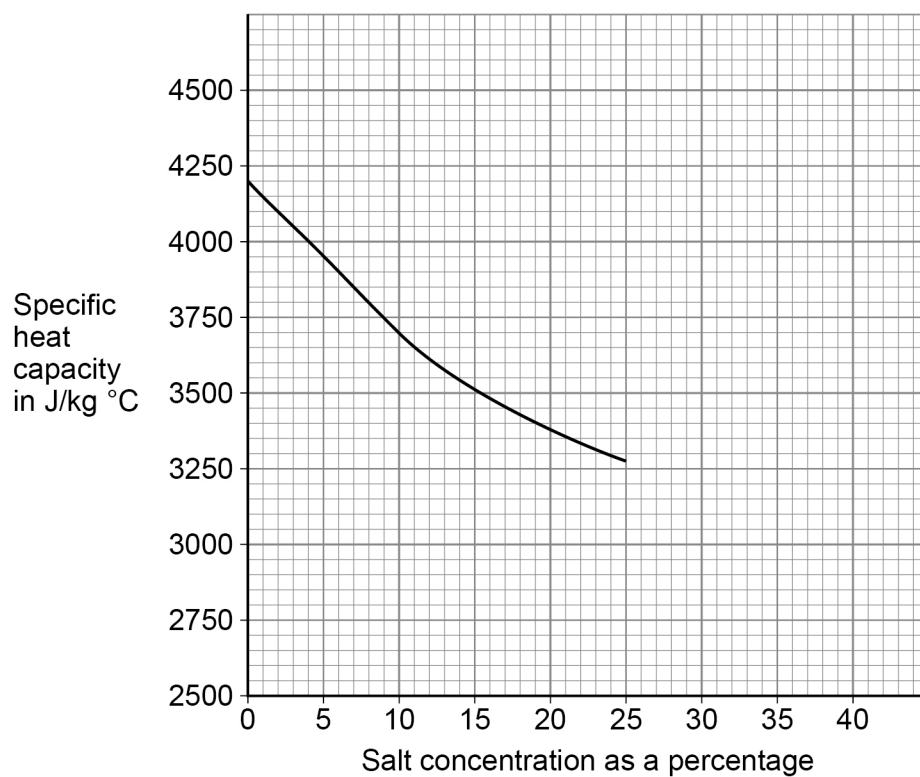
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Most of the water on Earth is in oceans and seas that contain salt.

Figure 11 shows how salt concentration affects the specific heat capacity of water.

Figure 11



The average salt concentration of the oceans and seas on Earth is 3.5%.

0 9 . 3 What is the specific heat capacity of water with a salt concentration of 3.5%?

Use **Figure 11**.

[1 mark]

Specific heat capacity = _____ J/kg °C

09.4

The Dead Sea has a salt concentration that is 10 times the average.

Determine the specific heat capacity of the water in the Dead Sea.

Use **Figure 11**.

[2 marks]

Specific heat capacity = _____ J/kg °C

09.5

The temperature of the Dead Sea varies from 20 °C in the winter to 32 °C in the summer.

Determine the energy needed to increase the temperature of 25 kg of Dead Sea water from 20 °C to 32 °C.

Use your answer from Question **09.4** and the Physics Equations Sheet.

[3 marks]

Energy = _____ J

10

Turn over for the next question

Turn over ►



1 0

A student investigated how the force applied to a spring affected the extension of the spring.

Table 2 shows the results.

Table 2

Weight in newtons	Length of spring in millimetres	Extension of spring in millimetres
0	28	0
0.5	44	16
1.0	60	32
1.5	75	47
2.0	90	62
2.5	102	74

1 0 . 1

Describe a method the student could use to obtain the results in **Table 2**.

You should include a diagram.

[6 marks]



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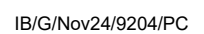


Table 2 is repeated below.

Table 2

Weight in newtons	Length of spring in millimetres	Extension of spring in millimetres
0	28	0
0.5	44	16
1.0	60	32
1.5	75	47
2.0	90	62
2.5	102	74

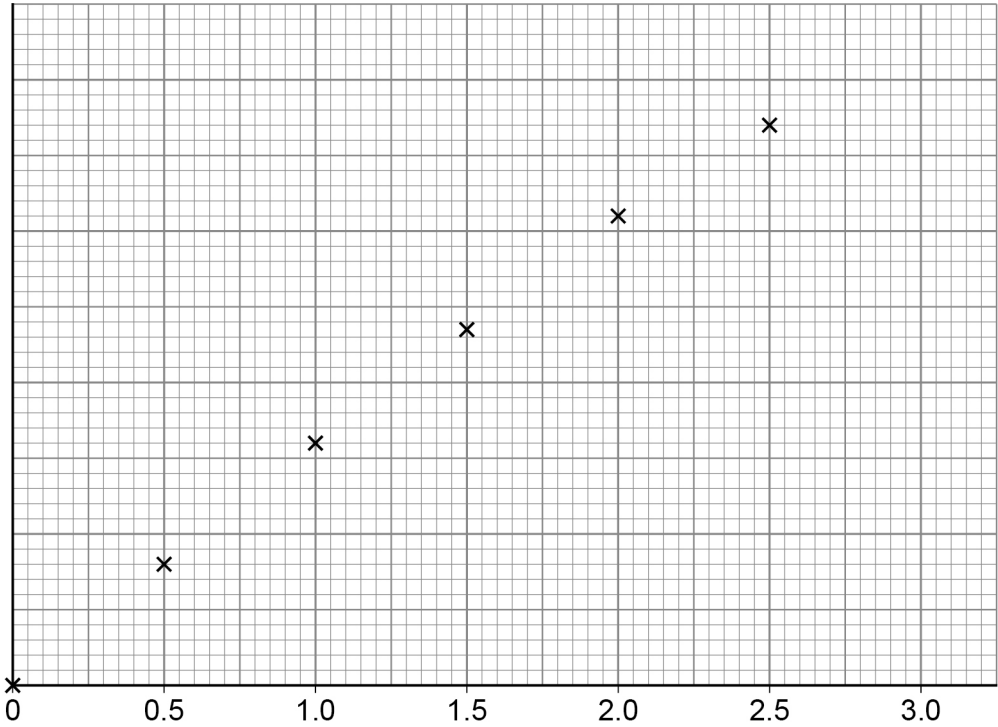
1 0 . 2 Complete Figure 12.

You should:

- label both axes
- add the scale to the y-axis
- draw the line of best fit.

[3 marks]

Figure 12



1 0 . 3

Describe the relationship between force and extension shown in **Figure 12**.**[2 marks]**

1 0 . 4

What was the original length of the spring?

Use **Table 2**.**[1 mark]**

Original length = _____ mm

1 0 . 5

What was the resolution of the instrument used to measure the length of the spring?

Use **Table 2**.**[1 mark]**

Resolution = _____ mm

13

END OF QUESTIONS

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