



Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE PHYSICS

F

Foundation Tier Paper 2

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

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

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- 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).
- In all calculations, show clearly how you work out your answer.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

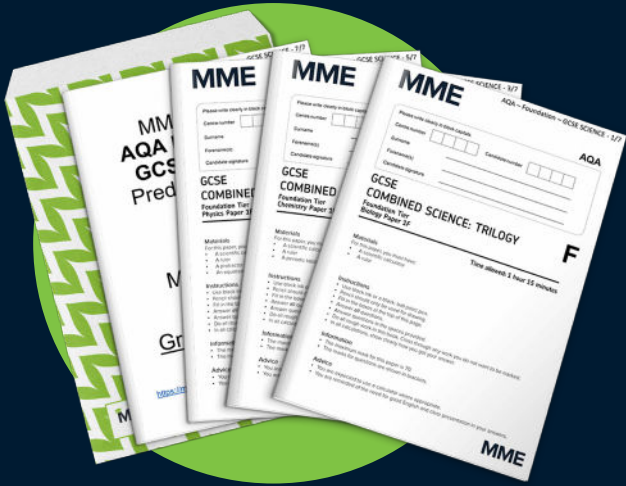


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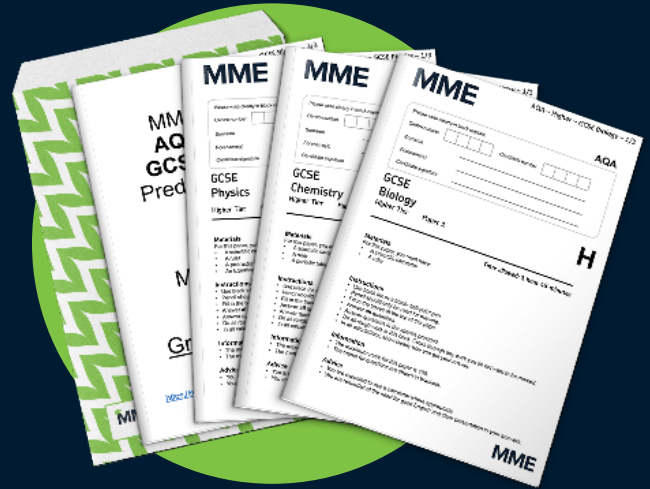
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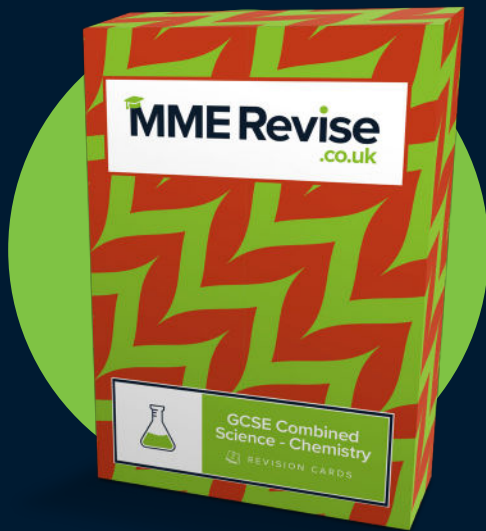
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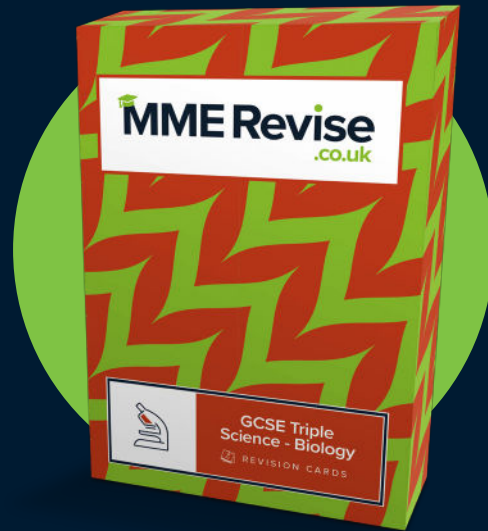
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Answer **all** questions in the spaces provided.

0 1

When two magnets are close together they exert a force on each other.









0 1 . 1

Complete **Table 1** to show if the magnets would attract or repel.

[2 marks]

Tick (✓) **one** box in **each** row.

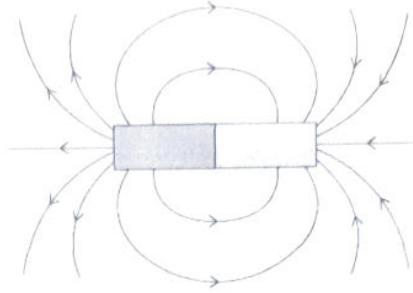
Table 1

		Attract	Repel
		✓	
		✓	
			✓
			✓



0 1 . 2 **Figure 1** shows the magnetic field around a bar magnet.

Figure 1



Which statements are true for the magnetic field shown in **Figure 1**?

[2 marks]

Tick (✓) **two** boxes.

The magnetic field gets weaker further from the magnet.

The magnetic field is strongest at the poles.

The magnetic field is uniform away from the poles.

The magnetic field lines all meet at a single point.

The magnetic field lines point from south to north.

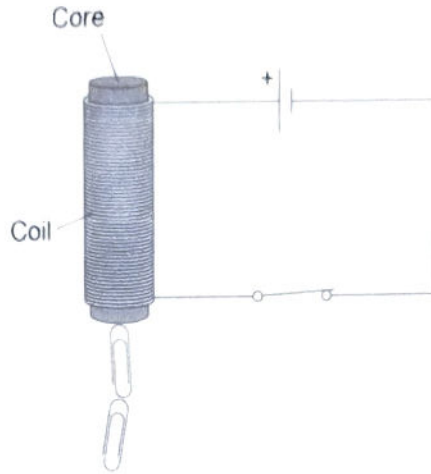
Question 1 continues on the next page

Turn over ►



Figure 2 includes an electromagnet.

Figure 2



0 1 . 3 Which metal is used to make the core of the electromagnet?

[1 mark]

Tick (✓) **one** box.

Aluminium

Copper

Iron

Magnesium

0 1 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

coil

metal core

paper clip

The switch is closed. There is a current in the coil.



0 1 . 5

The number of turns on the coil is increased. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

[1 mark]

Tick (✓) **one** box.

The magnetic field would be stronger.

The magnetic field would stay the same.

The magnetic field would be weaker.

0 1 . 6

The metal core was removed. The current remains the same.

How does this affect the strength of the magnetic field around the electromagnet?

[1 mark]

Tick (✓) **one** box.

The magnetic field would be stronger.

The magnetic field would stay the same.

The magnetic field would be weaker.

8

Turn over for the next question

Turn over ►

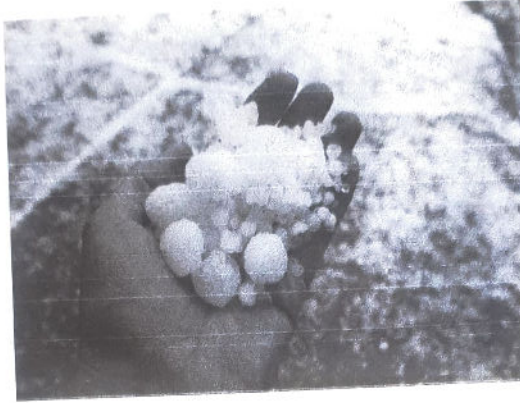


0 2

Hailstones are small balls of ice. Hailstones form in clouds and fall to the ground.

Figure 3 shows different-sized hailstones.

Figure 3



0 2 . 1

Which force causes the hailstones to fall to the ground?

[1 mark]

Tick (✓) **one** box.

Air resistance

Gravitational force

Magnetic force

Tension



0 2 . 2

As the hailstones begin to fall they accelerate.

Which force increases as the hailstones accelerate?

[1 mark]

Tick (✓) **one** box.

Air resistance

Gravitational force

Magnetic force

Tension

0 2 . 3

After a short time hailstones fall at terminal velocity.

Which of the following statements is true at terminal velocity?

[1 mark]

Tick (✓) **one** box.

The hailstones begin to slow down.

The mass of the hailstones increases.

The resultant force on the hailstones is zero.

Question 2 continues on the next page

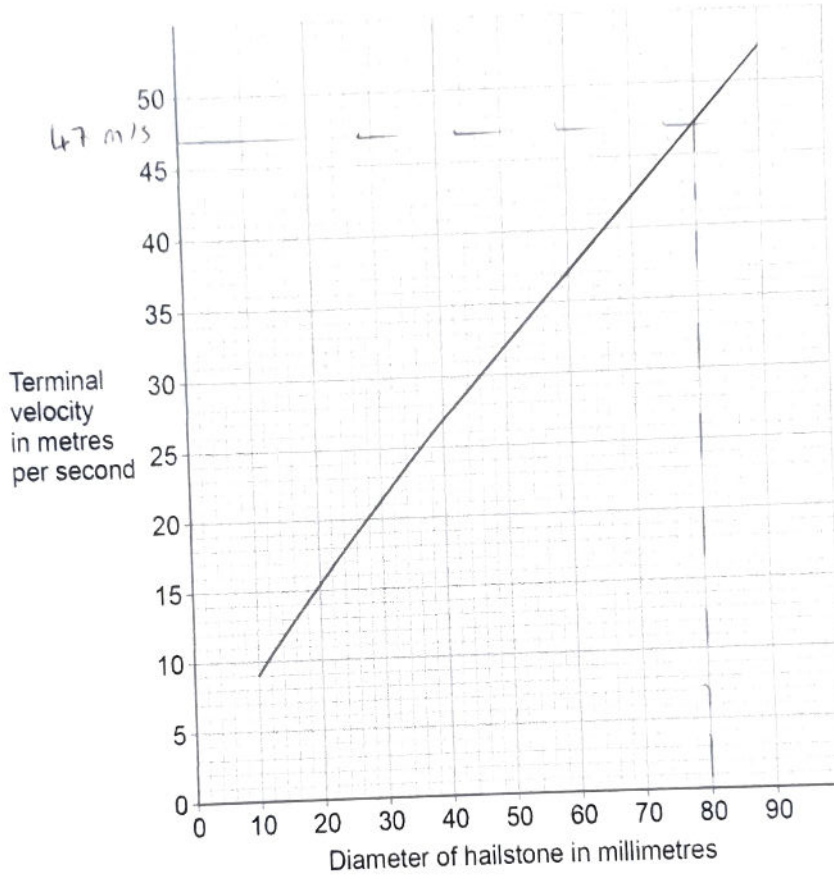
Turn over ►



A scientist investigated how the terminal velocity of hailstones varies with their diameter.

Figure 4 shows the results.

Figure 4



0 2 . 4 Estimate the terminal velocity for a hailstone with a diameter of 80 mm.

Show how you obtain your answer.

[2 marks]

47 m/s

Terminal velocity = 47 m/s m/s



0 2 . 5

Give **one** reason why a hailstone with a large diameter has a greater terminal velocity than a hailstone with a smaller diameter.

[1 mark]Tick (✓) **one** box.

It has a greater power.

It has a greater pressure.

It has a greater temperature.

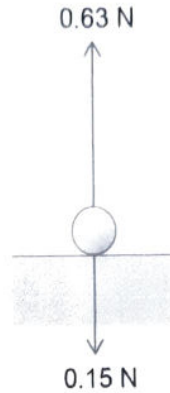
It has a greater weight.

Question 2 continues on the next page**Turn over ►**

After falling, the hailstone hits the ground.

Figure 5 shows the forces acting on the hailstone at the moment it hits the ground.

Figure 5



0 2 . 6 What is the magnitude of the resultant force on the hailstone in **Figure 5**?

[1 mark]

Tick (✓) **one** box.

0.15 N

0.48 N

0.63 N

0.78 N

0 2 . 7 What is the direction of the resultant force on the hailstone in **Figure 5**?

[1 mark]

Upwards

8



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 3

The Sun is at the centre of our solar system.

0 3 . 1

What type of object is the Sun?

[1 mark]

It is a star

0 3 . 2

What is the name of the galaxy our solar system is part of?

[1 mark]

Tick (✓) **one** box.

Andromeda

Milky Way

Sombrero

Tadpole



Table 2 gives information about some of the moons in our solar system.

Table 2

Moon	Radius in kilometres
Ganymede	2630
Titan	2570
Europa	1560
Charon	606

0 3 . 3 What is a moon?

[1 mark]

Natural Satellite

0 3 . 4 A student researched the radius of some planets in the solar system.

radius of largest dwarf planet = 1190 km

radius of smallest planet = 2440 km

The student made the following conclusions:

1. dwarf planets are always smaller than moons
2. planets are always bigger than moons.

Give **one** reason why each of the student's conclusions is wrong.

Use the data given above and in Table 2.

[2 marks]

- 1 Charon is smaller than the largest dwarf planet
- 2 Titan is larger than the smallest planet

Question 3 continues on the next page

Turn over ►



The Earth's Moon and the International Space Station both orbit the Earth.

0 3 . 5

Give **one other** similarity and **one** difference between the orbit of the Earth's Moon and the orbit of the International Space Station.

[2 marks]

Similarity They both have circular orbit

Difference They both have orbital period

0 3 . 6

Very few people have been to the International Space Station.

Suggest **one** reason why very few people have been to the International Space Station.

[1 mark]

Because it is very dangerous

8



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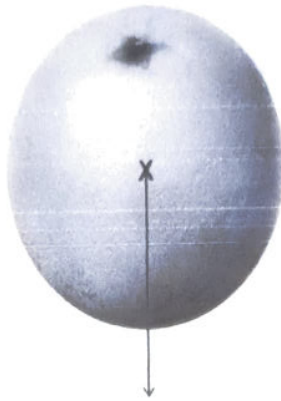


1 5

0 4

Figure 6 shows the weight of an orange acting from a point labelled X.

Figure 6



0 4 . 1

What name is given to point X in Figure 6?

[1 mark]

Tick (✓) **one** box.

Centre of force

Centre of mass

Centre of balance

Centre of weight

0 4 . 2

Weight and mass are not the same.

The relationship between weight and mass for an object can be written as:

$$\text{weight} \propto \text{mass}$$

Which sentence describes the relationship between weight and mass?

[1 mark]

Tick (✓) **one** box.

Weight is approximately equal to mass.

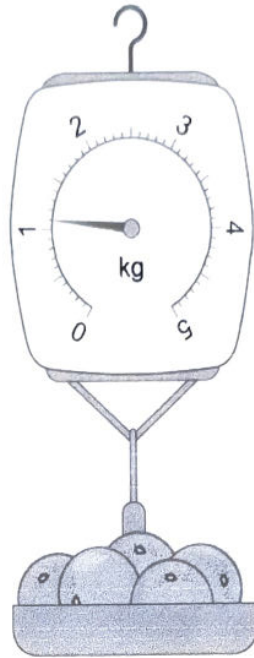
Weight is directly proportional to mass.

Weight is less than mass.



Figure 7 shows a balance used to measure the mass of 5 oranges.

Figure 7



0 4 . 3 All 5 of the oranges have the same mass.

Determine the mass of 1 orange.

[2 marks]

$$\text{Reading on balance} = 1.1 \text{ kg} \quad 1.1/5 = 0.22 \text{ kg}$$

$$\text{Mass} = 0.22 \text{ kg}$$

0 4 . 4 Calculate the weight of 1 orange.

gravitational field strength = 9.8 N/kg

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

[2 marks]

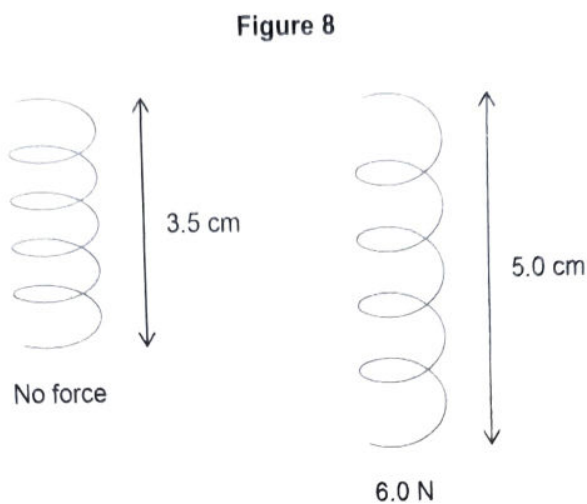
$$\begin{aligned} \text{weight} &= 0.22 \times 9.8 \\ &= 2.156 \text{ N} \end{aligned}$$

$$\text{Weight} = 2.156 \text{ N}$$



The balance shown in **Figure 7** contains a spring.

Figure 8 shows the spring with no force acting on it and with a force of 6.0 N acting on it.



0 4 . 5 What is the extension of the spring when a force of 6.0 N acts on it?

[1 mark]

Tick (✓) **one** box.

0.015 m

0.035 m

0.050 m

0.085 m

0 4 . 6 Calculate the spring constant of the spring.

Use the equation:

$$\text{spring constant} = \frac{\text{force}}{\text{extension}}$$

[2 marks]

Spring constant = $\frac{6.0}{0.015} = 400 \text{ N/m}$

Spring constant = 400 N/m



04.7

What will happen to the spring when the force is removed?

[1 mark]

Return to it's original length

10

Turn over for the next question

Turn over ►



0 5

Ultraviolet and visible light are both parts of the electromagnetic spectrum.

0 5 . 1

How does the speed of ultraviolet in a vacuum compare to the speed of visible light in a vacuum?

[1 mark]

Tick (✓) **one** box.

Ultraviolet travels at a faster speed than visible light.

Ultraviolet travels at a slower speed than visible light.

Ultraviolet travels at the same speed as visible light.

0 5 . 2

Figure 9 shows parts of the electromagnetic spectrum.

Figure 9

Radio waves	A	B	C	D	X-rays	Gamma rays
-------------	---	---	---	---	--------	------------

Which letters represent the positions of ultraviolet and visible light in the electromagnetic spectrum?

[2 marks]

Ultraviolet _____ D _____

Visible light _____ C _____



0 5 . 3 Table 3 shows the range of wavelengths for different types of ultraviolet.

Table 3

Type	Range of wavelength in nanometres
Ultraviolet A (UVA)	315–400
Ultraviolet B (UVB)	280–315
Ultraviolet C (UVC)	100–280

Determine which type of ultraviolet shown in Table 3 has the largest range of wavelengths.

To gain full marks you must calculate the range of wavelengths for each type of ultraviolet.

[3 marks]

$$A: 400 - 315 = 85 \text{ nm}$$

$$B: 315 - 280 = 35 \text{ nm}$$

$$C: 280 - 100 = 180 \text{ nm}$$

so ultraviolet C has the largest range.

Type of ultraviolet with the largest range of wavelengths ~~UVA~~ UVC

Question 5 continues on the next page

Turn over ►



Figure 10 shows how different types of ultraviolet are absorbed by the ozone layer in the Earth's atmosphere.

Table 4 shows the relative ionising power from each type of ultraviolet.

Figure 10

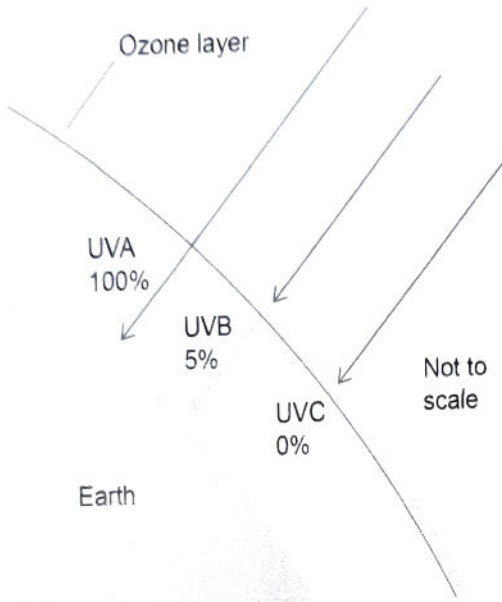


Table 4

Type	Relative ionising power
UVA	Low
UVB	Medium
UVC	High

0 5 4

Explain the importance of the ozone layer in reducing the risk to people from all types of ultraviolet.

Use Figure 10 and Table 4.

[4 marks]

UVC has the most ionising power and this means it is the most dangerous. The ozone layer absorbs all UVC, hence reducing exposure. UVB has a medium risk and the ozone absorbs nearly all of it. It absorbs no UVA, so does not reduce risk of UVA. However it carries the least risk. The more ionising the more the ozone absorbs. UV damages skin cells and can lead to skin cancer, hence the importance of the ozone layer to reduce risk.



0 5 . 5 The Sun emits visible light.

A student concludes that visible light is **not** absorbed by the ozone layer.

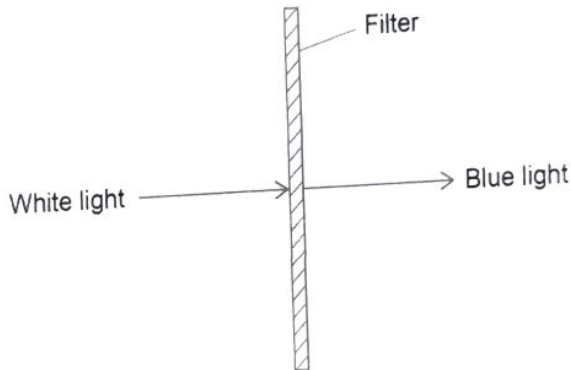
Give **one** piece of evidence that shows the student's conclusion is correct.

[1 mark]

Our eyes detect visible light so it
must come through the ozone.

0 5 . 6 Figure 11 shows white light incident on a colour filter.

Figure 11



Complete the sentence.

Choose the answers from the box.

[2 marks]

absorbed radiated reflected refracted transmitted

When white light is incident on the filter, only blue light is transmitted
and all other colours of light are absorbed.

13

Turn over ►



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0 6

The Earth is surrounded by an atmosphere.

0 6 . 1

The radius of the Earth is 6400 km.

Which of the following could be an approximate depth of the Earth's atmosphere?

[1 mark]

Tick (✓) **one** box.

100 km

6400 km

100 000 km

640 000 km

0 6 . 2

What state of matter is most of the Earth's atmosphere?

[1 mark]

Tick (✓) **one** box.

Gas

Liquid

Solid

Question 6 continues on the next page

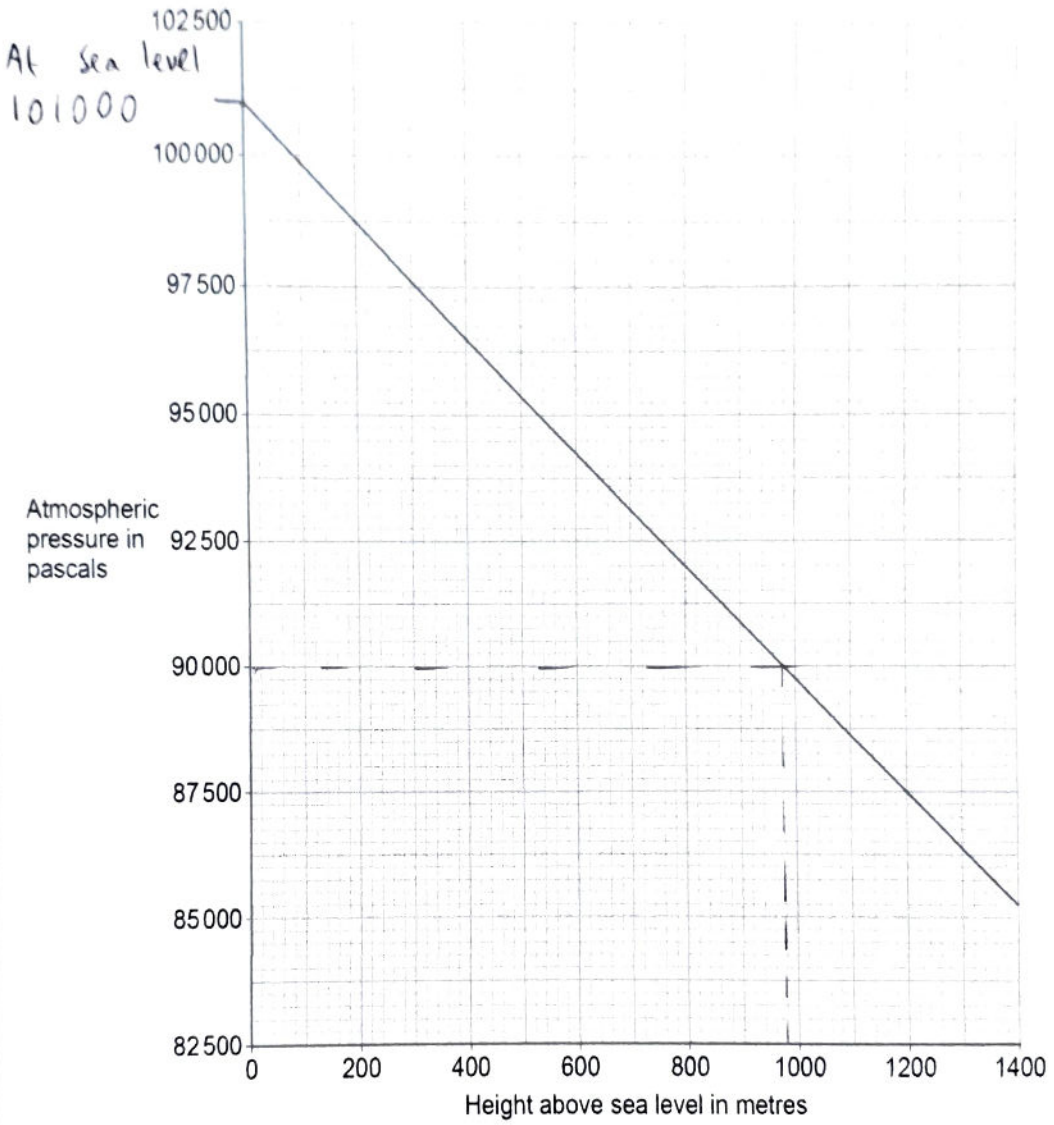
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Figure 12 shows how atmospheric pressure varies with height above sea level.

Figure 12



- 0 6 . 3 The highest point above sea level in England is the top of a mountain called Scafell Pike.

The height above sea level of Scafell Pike is 978 m.

Determine the atmospheric pressure at the top of Scafell Pike.

Use **Figure 12**.

[1 mark]

reading of graph = 90000 Pa

Atmospheric pressure = 90000 Pa

- 0 6 . 4 Determine the difference between the atmospheric pressure at sea level and at the top of Scafell Pike.

Use **Figure 12** and your answer from Question **06.3**

[1 mark]

reading of graph: 101000
101000 - 90000

Difference in atmospheric pressure = 11000 Pa

- 0 6 . 5 A student climbs Scafell Pike.

Why does the atmospheric pressure decrease as the student climbs higher?

[2 marks]

Tick (✓) **two** boxes.

The air exerts a greater force on the student.

The density of the air decreases.

The mass of air above the student decreases.

The temperature of the air increases.

The volume of air above the student increases.

Question 6 continues on the next page

Turn over ►



0 6 . 6 Figure 13 shows a mountain lake.

Figure 13



The lake has a surface area of 2000 m².

Atmospheric pressure exerts a force of 188 000 000 N on the surface of the lake.

Calculate the atmospheric pressure at the surface of the lake.

Use the equation:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

[2 marks]

$$\text{pressure} = \frac{188\,000\,000}{2000}$$

$$= 94\,000 \text{ Pa}$$

Atmospheric pressure = 94 000 Pa

8



07

Sound travels as longitudinal waves.

07.1

Complete the sentences.

Choose the answers from the box.

[2 marks]

amplitude

frequency

speed

wavelength

The distance between the centre of one compression of a sound wave and the centre of the next compression is called the wavelength.

The number of waves passing a point each second is called the frequency.

07.2

Complete the sentence.

Choose the answer from the box.

[1 mark]

opposite

perpendicular

parallel

In a longitudinal wave, the oscillations are parallel
to the direction of energy transfer.

Question 7 continues on the next page**Turn over ►**

0 7 . 3 A sound wave has a frequency of 8.0 kHz.

Which of the following is the same as 8.0 kHz?

[1 mark]

Tick (✓) **one** box.

0.0080 Hz

8.0 Hz

8000 Hz

800 000 Hz

0 7 . 4 Calculate the period of a sound wave with a frequency of 8.0 kHz.

Use the Physics Equations Sheet.

[2 marks]

$$\begin{aligned} \text{period} &= 1 / \text{frequency} = 1 / 8000 \\ &= 0.000125 \text{ s} \\ \text{Period} &= 0.000125 \text{ s} \end{aligned}$$



0 7 . 5

Calculate the wavelength of a sound wave with a frequency of 6600 Hz.

speed of sound = 330 m/s

Use the equation:

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

Choose the unit from the box.

[3 marks]

kg

m

N

$$\text{wavelength} = 330 / 6600 = 0.05$$

$$\lambda = 0.050 \text{ m}$$

Wavelength = 0.050 Unit m

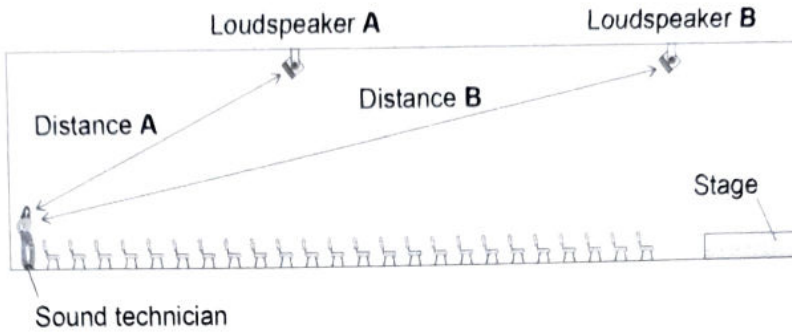
Question 7 continues on the next page

Turn over ►



Figure 14 shows the arrangement of two loudspeakers at a concert venue.

Figure 14



The loudspeakers in Figure 14 are tested by playing the same song through both loudspeakers.

A sound technician listens to the song.

Use the Physics Equations Sheet to answer questions 07.6 and 07.7.

07.6 Write down the equation which links distance (s), speed (v) and time (t).

[1 mark]

$$s = vt \quad \text{or} \quad \text{distance} = \text{speed} \times \text{time}$$

07.7 Distance A on Figure 14 is 13.2 m.

speed of sound = 330 m/s

Calculate the time taken for the sound to travel from loudspeaker A to the technician.

[3 marks]

$$s = vt$$

$$t = \frac{s}{v} \quad t = \frac{13.2}{330} = 0.04 \text{ s}$$

Time taken = 0.04 s



07.8

The sound from each loudspeaker travels at the same speed.

For the sound technician to hear the song clearly, the sound from loudspeaker B should be emitted slightly before the sound from loudspeaker A.

Explain why.

[3 marks]

Loudspeaker B is further from the technician than speaker A. So the sound will take more time to travel to the technician. So the sound from each speaker arrives at the technician at the same time.

16

Turn over for the next question

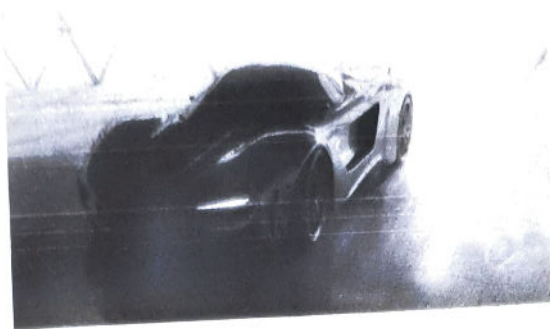
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0 8

Figure 15 shows an electric super-car.

Figure 15



0 8 . 1

The battery in an electric car needs to be recharged.

Suggest **two** factors that affect the distance an electric car can travel before the battery needs to be recharged.

[2 marks]

- 1 The capacity of the battery.
- 2 The streamlining of the car.



Use the Physics Equations Sheet to answer questions **08.2** and **08.3**.

- 08.2** Write down the equation which links acceleration (a), change in velocity (Δv) and time taken (t). **[1 mark]**

$$a = \frac{\Delta v}{t}$$

- 08.3** The maximum acceleration of the car is 20 m/s^2 .

Calculate the time taken for the speed of the car to change from 0 m/s to 28 m/s at its maximum acceleration. **[3 marks]**

$$a = \frac{\Delta v}{t}$$

$$20 = \frac{28 - 0}{t} \qquad t = \frac{28}{20} = 1.4$$

Time taken = 1.4 s

Question 8 continues on the next page

Turn over ►



0 8 . 4 In a trial run, the car accelerates at 10 m/s^2 until it reaches its final velocity.

distance travelled by the car = 605 m

initial velocity of the car = 0 m/s

Calculate the final velocity of the car.

Use the Physics Equations Sheet.

[3 marks]

$$v^2 - u^2 = 2as$$

$$v^2 = 2 \times a \times s - u^2$$

$$v^2 = 2 \times 10 \times 605 - 0^2$$

$$v^2 = 12100$$

$$v = \sqrt{12100}$$

Final velocity = 110 m/s



Use the Physics Equations Sheet to answer questions **08.5** and **08.6**.

- 08.5** Write down the equation which links distance (s), force (F) and work done (W). [1 mark]

$$W = Fs$$

- 08.6** When travelling at its maximum speed the air resistance acting on the car is 4000 N.

Calculate the work done against air resistance when the car travels a distance of 7.5 km at its maximum speed. [3 marks]

$$s = 7.5 \text{ km} = 7500 \text{ m}$$

$$W = F \times s = 4000 \times 7500$$

$$= 30\,000\,000$$

Work done = 30 000 000 J

13

Turn over for the next question

Turn over ►



09

A student used a ray box to shine a ray of light through air into a glass block.

The student investigated how the angle of refraction varied with the angle of incidence.

Table 5 shows the results.

Table 5

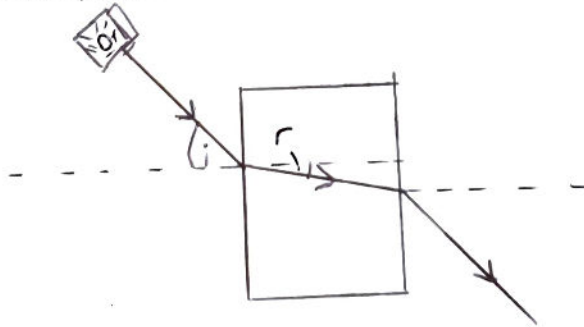
Angle of incidence in degrees	Angle of refraction in degrees
10	5
20	10
30	14
40	19
50	23
60	26
70	28
80	29

09.1

Describe a method the student could have used to obtain the results in Table 5.

Your answer may include a labelled diagram.

[6 marks]



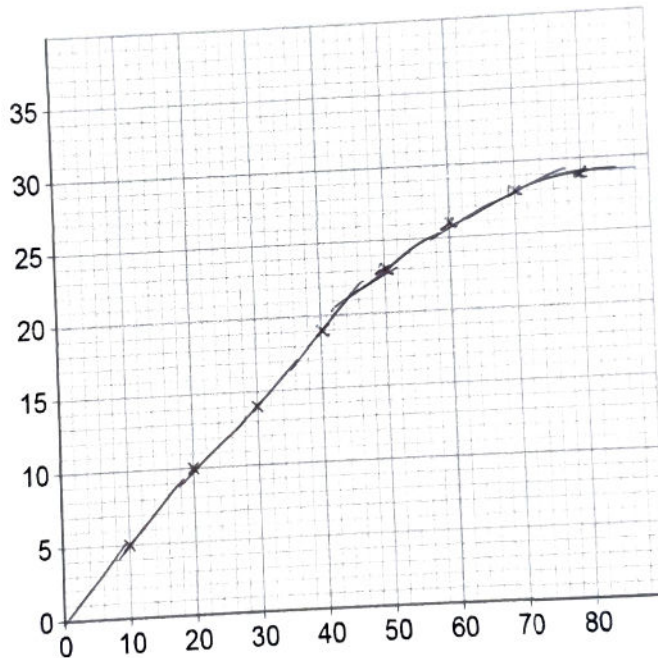
Firstly, place a glass block on a piece of paper, and draw around this glass block. Use a ray box to shine a ray of light through a glass block. Mark where the ray of light enters and emerges from the



glass box. Remove the glass box and join the points to show the path of the complete ray through the block. Draw a normal line at 90 degrees to the surface. Use a protractor to measure the angle of incidence and refraction. Repeat the method by shining the ray box at different angles of incidence. Increase the angle of incidence by 10 degrees each time, from 10 up until 90 degrees.

0 9 . 2 Figure 16 is an incomplete graph of the results.

Figure 16



Complete **Figure 16** using data from **Table 5**.

- Label the axes.
- Plot the remaining data.
- Draw a line of best fit.

[4 marks]

Question 9 continues on the next page

Turn over ►



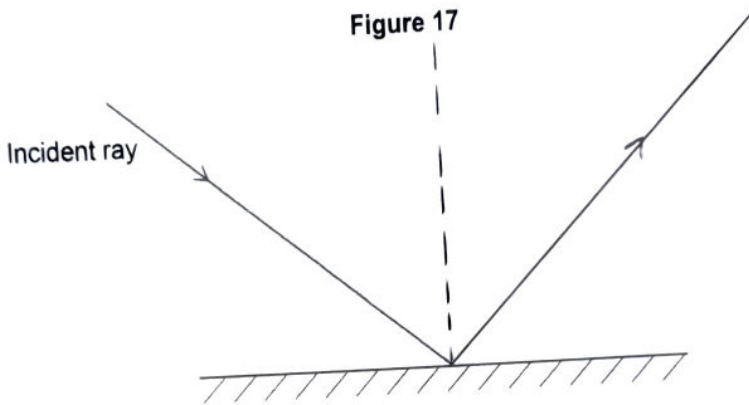
09.3

Complete the ray diagram in **Figure 17** to show the reflection of light from the surface of a plane mirror.

You should:

- draw the normal line
- draw the reflected ray.

[2 marks]

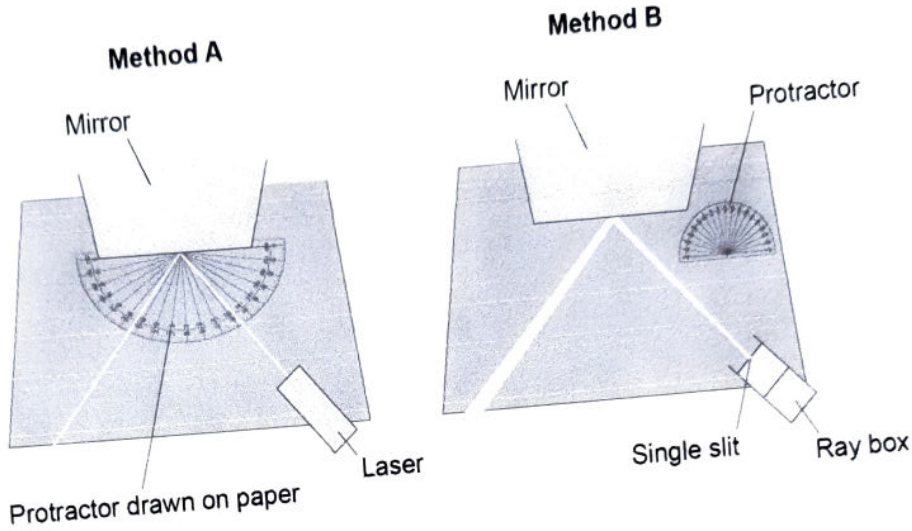


09.4

Two students investigated the reflection of light by a plane mirror.

Figure 18 shows the different equipment the students used.

Figure 18



Explain **two** ways that **Method A** is better than **Method B**.

[4 marks]

1 Method A means you don't have to move the mirror, which means it is more accurate and reduces random errors.

2 Method A is also better because the ray doesn't diverge, meaning that it's easier to judge the position of the ray.

16

END OF QUESTIONS

