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 boxesat the top of this page.
- Answer allquestions in the spaces provided.
- Do not write outsidethe 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.

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.

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

Answer all questions in the spaces provided.

Do not write outside the box

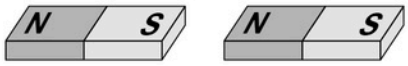
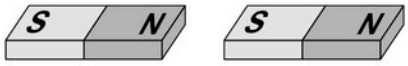
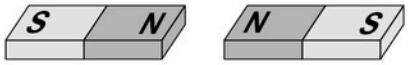
0 1 When two magnets are close together they exert a force on each other.

0 1 . 1 Complete Table 1 to show if the magnets would attract or repel.

[2 marks]

Tick (✓) one box in each row.

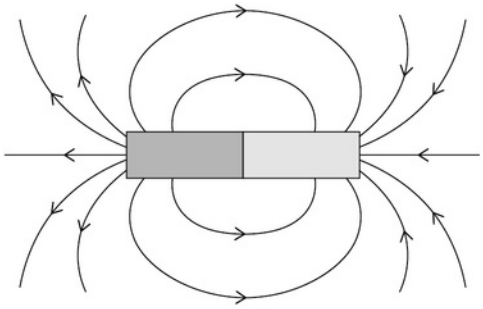
Table 1

	Attract	Repel
	✓	
	✓	
		✓
		✓

Do not write outside the box

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

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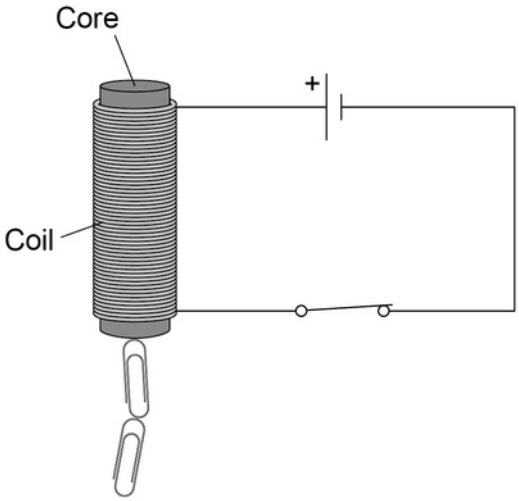
Figure 2 includes an electromagnet.

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.

Do not write outside the box

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

Do not write outside the box

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 ☐

Do not write outside the box

0 2 . 2 As the hailstones begin to fall they accelerate.

Which force increases as the hailstones accelerate?

[1 mark]

Tick (✓) one box.

- [x] 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.
- [x] The resultant force on the hailstones is zero.

Question 2 continues on the next page

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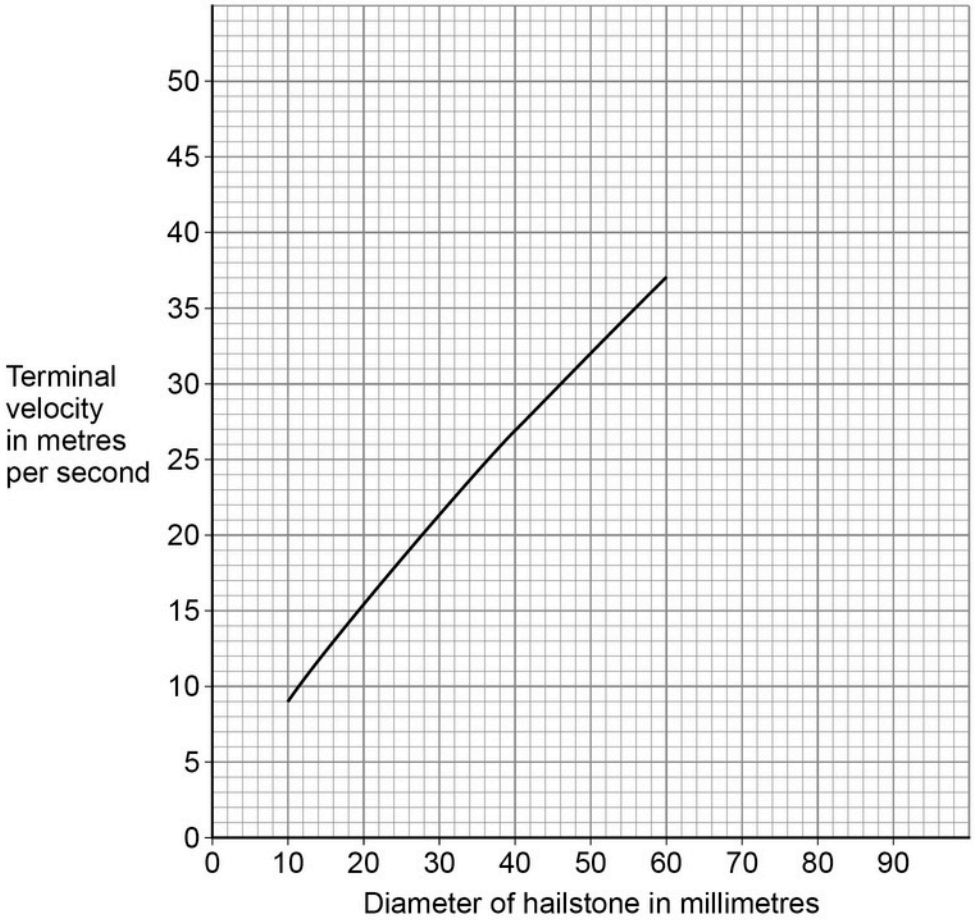
A scientist investigated how the terminal velocity of hailstones varies with their diameter.

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]

line extrapolated to 80 mm

Terminal velocity = 46 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.
Tick (☒) one box.

[1 mark]

Do not write outside the box

It has a greater power. ☐

It has a greater pressure. ☐

It has a greater temperature. ☐

It has a greater weight. ☒

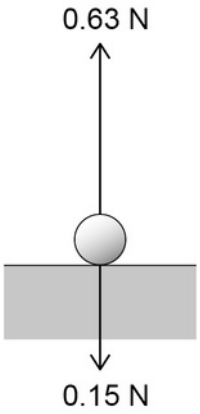
Question 2 continues on the next page

Do not write outside the box

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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0 3 The Sun is at the centre of our solar system.

0 3 . 1 What type of object is the Sun?

[1 mark]

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 ☐

Do not write outside the box

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]

Moon is a natural satellite that orbits a planet.

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 Ganymede / Titan is larger than the (smallest) planet

Question 3 continues on the next page

Do not write outside the box

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 circular orbit

Difference 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]

expensive

8

Turn over for the next question

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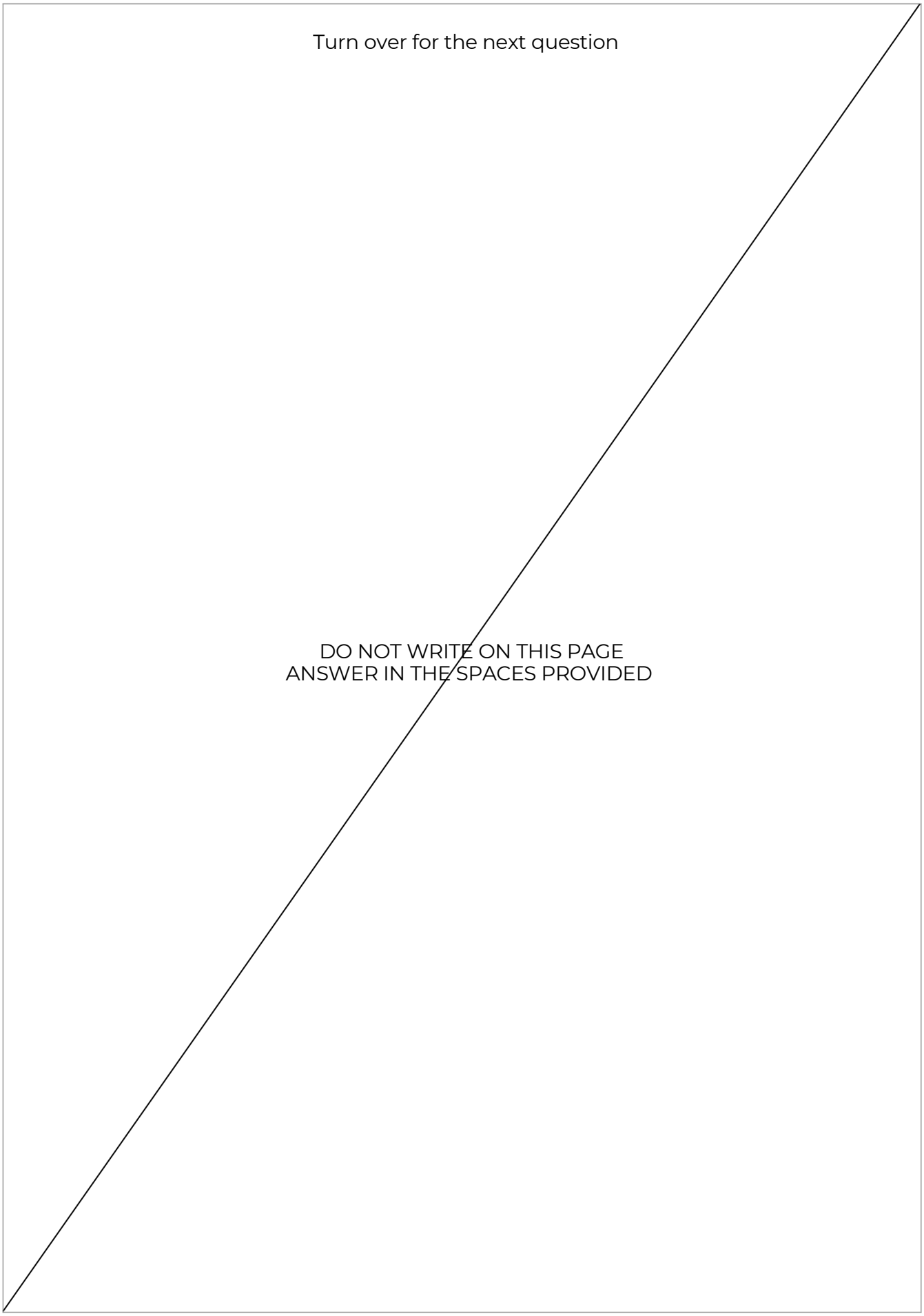
ANSWER IN THE SPACES PROVIDED



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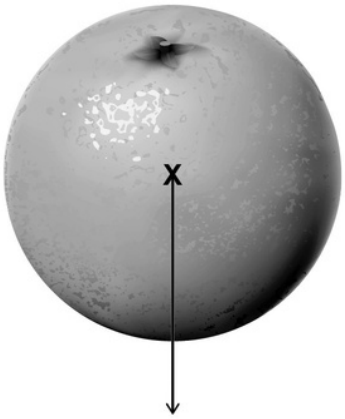
0 4 Figure 6 shows the weight of an orange acting from a point labelled X.

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. ☐

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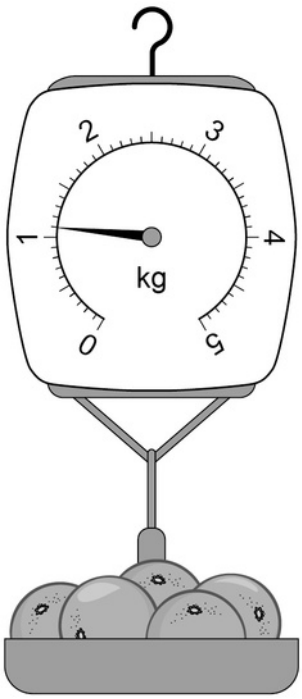
Figure 7 shows a balance used to measure the mass of 5 oranges.

Figure 7



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

Determine the mass of 1 orange.

[2 marks]

reading from balance = 1.1 kg

mass = 1.15 = 0.22 kg

Mass = 0.22 kg

0 4 . 4 Calculate the weight of 1 orange.

gravitational field strength = 9.8 N/kg

Use the equation:

weight = mass × gravitational field strength

[2 marks]

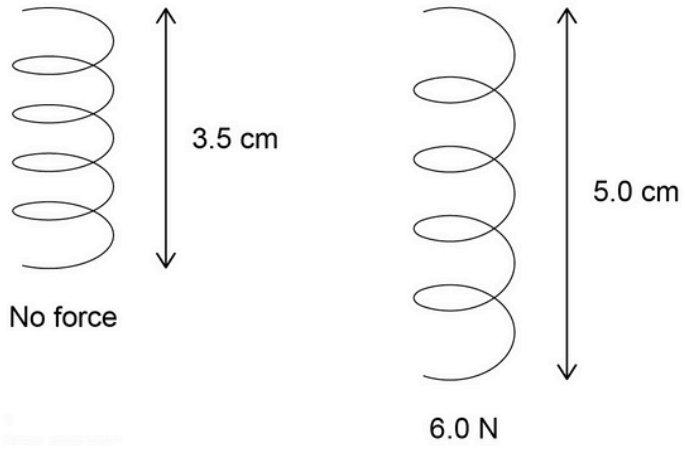
Weight = 0.22 × 9.8

Weight = 2.156 N

The balance shown in Figure 7contains a spring.

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

Figure 8



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

[1 mark]

Tick (✓) onebox.

- 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 = $\frac{6.0}{0.015}$

Spring constant = 400 N/m

0 4 . 7 What will happen to the spring when the force is removed?

[1 mark]

Returns to its original length and shape

Do not write outside the box

10

Turn over for the next question

Do not write outside the box

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?
Tick (✓) one box. [1 mark]

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.

Do not write outside the box

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 (nm)
B 315 – 280 = 35 (nm)
C 280 – 100 = 180 (nm)

Type of ultraviolet with the largest range of wavelengths (ultraviolet) C (UV C)

Question 5 continues on the next page

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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

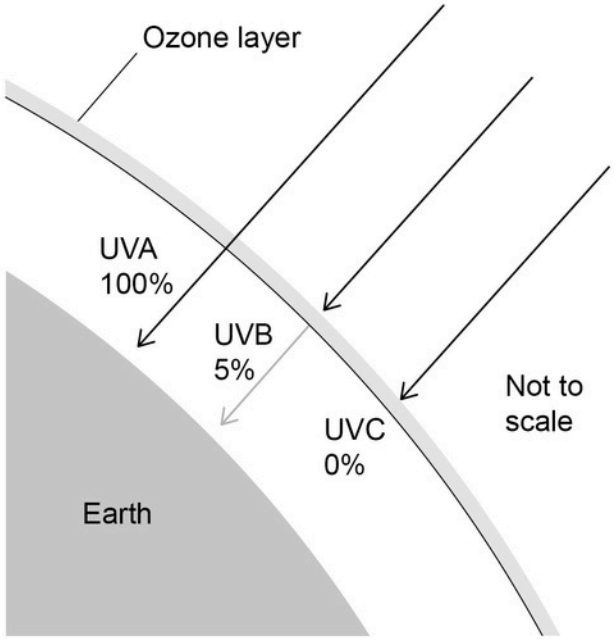


Table 4

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]

- ozone absorbs all of the UVC
- UVC is the most dangerous
- ozone absorbs nearly all (95%) of the UVB
- UVB has a medium risk
- ozo ne does not absorb any UVA
- ozo ne does not reduce risk from UVA
- UVA is the least dangerous
- the greater the ionising power the greater the absorption by ozone
- the greater the ionising power the greater the risk
- UV damages skin cells
- can lead to skin cancer
- can cause sunbu rn
- UV can damage eyes
- leads to problems with eyesight

Do not write outside the box

0 5 . 5 The Sun emits visible light.

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

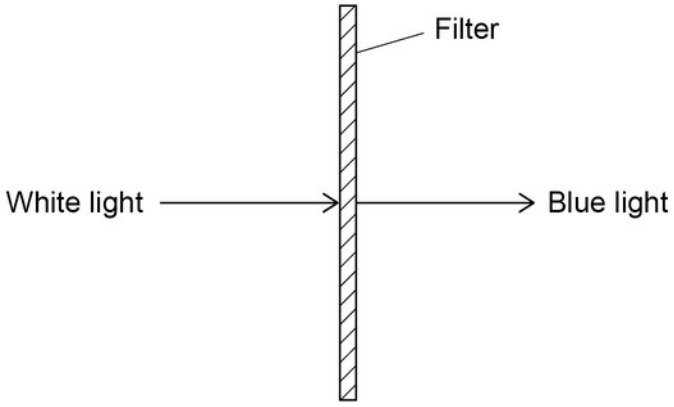
Give one piece of evidence that shows the student's conclusion is correct.

[1 mark]

our eyes detect visible light

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

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ANSWER IN THE SPACES PROVIDED

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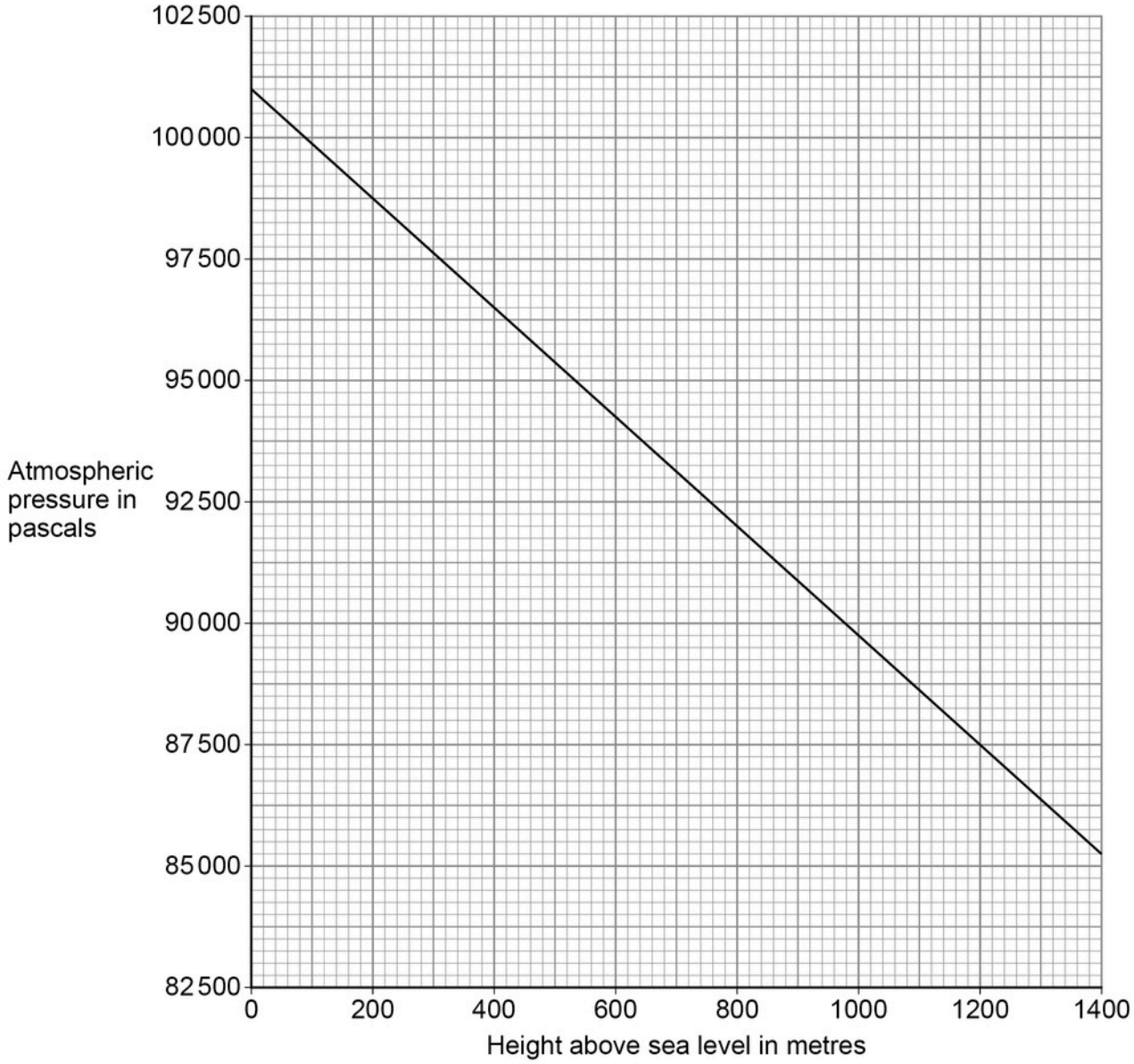
Figure 12 shows how atmospheric pressure varies with height above sea level.

Figure 12



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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]

90 000 (Pa)

Atmospheric pressure = 90 000 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]

101 000 – 90 000 = 11 000 (Pa)

Difference in atmospheric pressure = 11 000 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

Do not write outside the box

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]

$P = \frac{188\,000\,000}{200}$

Atmospheric pressure = 94,000 Pa

8

Do not write outside the box

0 7 Sound travels as longitudinal waves.

0 7 . 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 .

0 7 . 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

Do not write outside the box

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]

Period = 1 / 8000

Period = 0.000125 s

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

$\lambda = \frac{330}{6600}$

Wavelength = 0.050 Unit m

Question 7 continues on the next page

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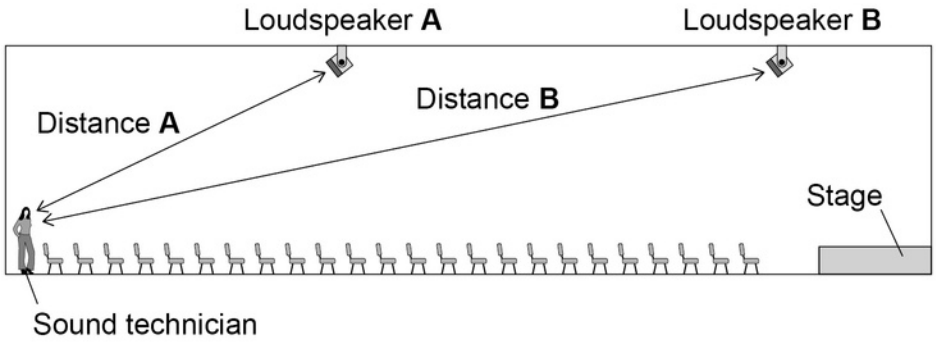
Do not write outside the box

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.

0 7 . 6 Write down the equation which links distance (*s*), speed (*v*) and time (*t*).

[1 mark]

distance (travelled) = speed × time

s = vt

0 7 . 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]

$13.2 = 330 \times t$

$t = \frac{13.2}{330}$

Time taken = 0.04 s

0 7 . 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 would take more time to travel to the technician.
~~so the sound from each speaker arrives at the technician at the same time.~~

16

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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 speed

2 mass / weight

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

0 8 . 2 Write down the equation which links acceleration (a), change in velocity (Δv) and time taken (t).

[1 mark]

acceleration = change in velocity / time (taken)

$a = \Delta v / t$

0 8 . 3 The maximum acceleration of the car is 20 m/s2.
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]

$20 = \frac{28}{t}$

$t = \frac{28}{20}$

Time taken = 1.4 s

Question 8 continues on the next page

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0 8 . 4 In a trial run, the car accelerates at 10 m/s2 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]

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

$v^2 = 12100$

$v = 110$ m/s

Final velocity = 110 m/s

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

Do not write outside the box

0 8 . 5 Write down the equation which links distance (*s*), force (*F*) and work done (*W*).

[1 mark]

work done = force × distance

W = Fs

0 8 . 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=7500 (m)

W= 4000 x 7500

Work done = 30 000 000 J

13

Turn over for the next question

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0 9 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

0 9 . 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]

Som e indicative content could be indicated within a labelled diagram

- place a glass block on a piece of paper
- draw around the glass block
- use the ray box to shine a ray of light through the glass block
- mark the ray of light entering the glass block
- mark the ray of light emerging from the glass block
- Jo in the points to show the path of the complete ray through the bloc k
- an d draw a normal line at 90 degrees to the surface
- us e a protractor to measure the angle of incidence
- use a protractor to measure the angle of refraction

Do not write outside the box

• use a ray box to shine a ray of light at a range of different angles of incidence
• increase the angle of incidence in 10 degree intervals
• from an angle of incidence of 10 degrees to an angle of incidence of 80 degrees

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

Figure 16

Complete Figure 16using 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

Do not write outside the box

0 9 . 3 Complete the ray diagram in Figure 17 to show the reflection of light from the surface of a plane mirror.

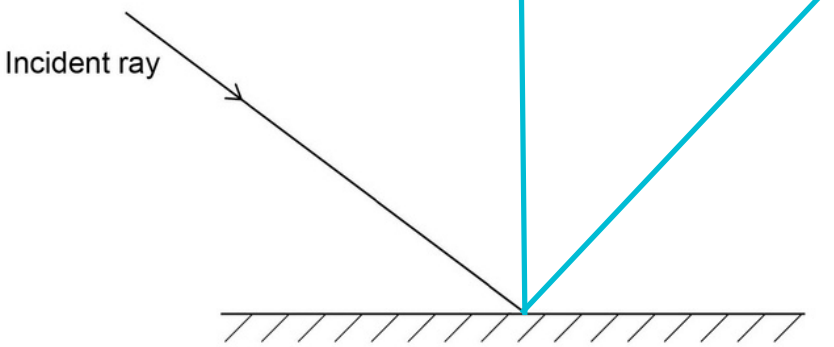
You should:

•draw the normal line

•draw the reflected ray.

[2 marks]

Figure 17



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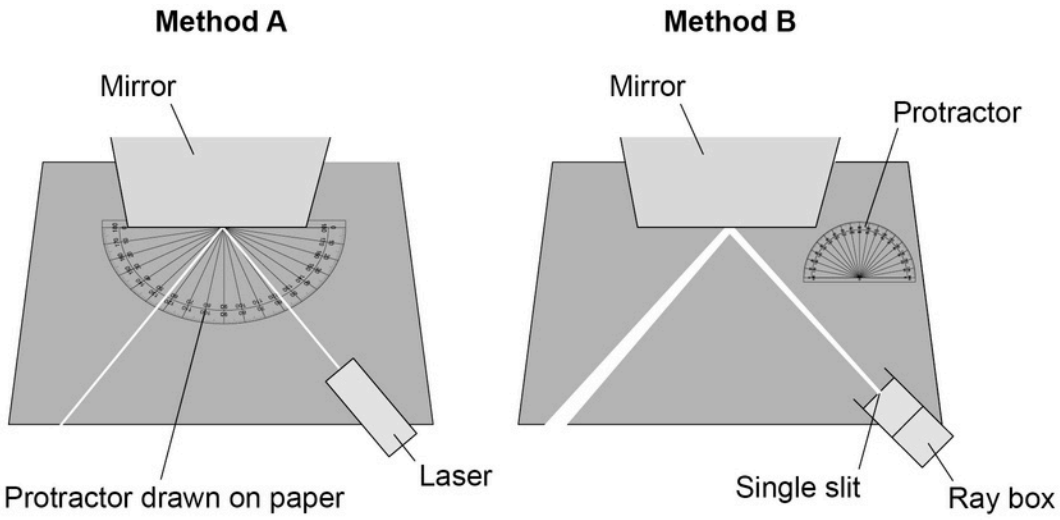
0 9 . 4 Two students investigated the reflection of light by a plane mirror.

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 The protractor drawn on the paper means you) do no t have to move the mirror to measure the angles so more likely to record the correct angle of incidence and reflection

2 Ray in method A does not diverge making it easier t o judge the centre position of the ray

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END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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