

Please write clearly in block capitals.

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Centre number

Candidate
number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

PHYSICS

Higher Tier Paper 2

Practice Paper Series – Set 1

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the Physics Equations Sheet (printed at the back of this booklet).

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.
- 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.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 06.3 and 11.3 you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully developed
 - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
TOTAL	

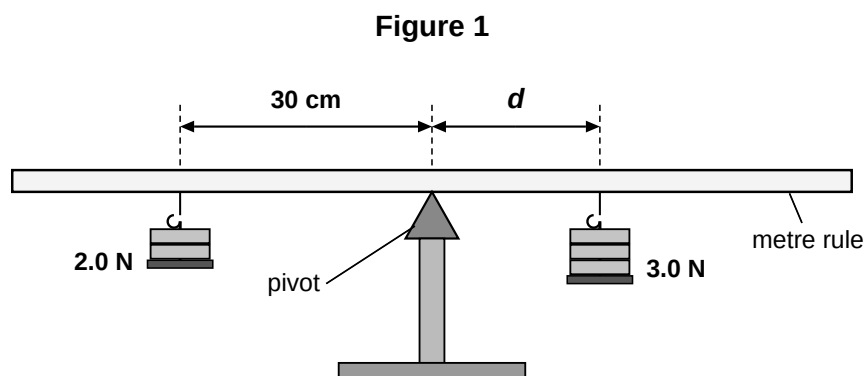
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sciencegcse.co.uk | Practice Paper Series – Set 1 | SGC/S1/SP/2H

0 1 A student investigated the turning effect of forces.

The student balanced a metre rule on a pivot at its centre. The student then hung a 2.0 N weight and a 3.0 N weight from the rule so that the rule stayed balanced.

Figure 1 shows the balanced metre rule.



0 1 . 1 Calculate the moment of the 2.0 N weight about the pivot.

[3 marks]

Give the unit.

Moment = ...

Unit

0 1 . 2 Calculate distance d .

[2 marks]

Use your answer to **01.1**.

$d = \dots\dots\dots$ m

0 1 . 3 The weight of the metre rule was not included in the calculations.

[1 mark]

Explain why the weight of the metre rule does not affect the balance of the rule.

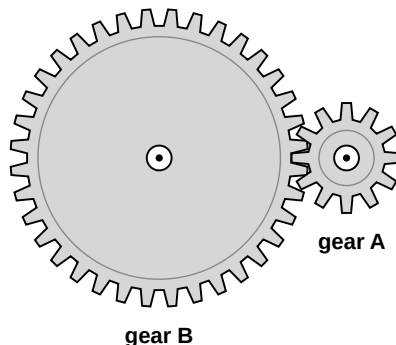
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Question 1 continues on the next page

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Figure 2 shows two gears in a machine.
 A motor turns gear **A**. Gear **A** turns gear **B**.
 Gear **A** has 12 teeth. Gear **B** has 36 teeth.

Figure 2



0 1 . 4 The motor exerts a moment on gear **A**. [2 marks]

Explain why the moment on gear **B** is greater than the moment on gear **A**.

0 2 This question is about pressure.

Table 1 shows how atmospheric pressure changes with height above sea level.

Table 1

Height above sea level in km	0	2	4	6	8
Atmospheric pressure in kPa	101	79	62	47	36

0 2 . 1 Describe how atmospheric pressure changes with height. [2 marks]

Include how the decrease changes at greater heights.

Use data from **Table 1** in your answer.

Do not write outside the box

- 0 2 . 2** Explain why atmospheric pressure decreases as the height above sea level increases. [2 marks]

- 0 2 . 3** A submarine is at a depth of 150 m below the surface of the sea. [4 marks]

The submarine has a window with an area of 0.050 m^2 .

Calculate the force on the window due to the sea water.

Ignore atmospheric pressure.

density of sea water = 1030 kg/m^3

gravitational field strength = 9.8 N/kg

Force = _____ N

- 0 2 . 4** There is an upward force on the submarine called upthrust. [2 marks]

Explain, in terms of pressure, why there is an upthrust on the submarine.

Turn over for the next question

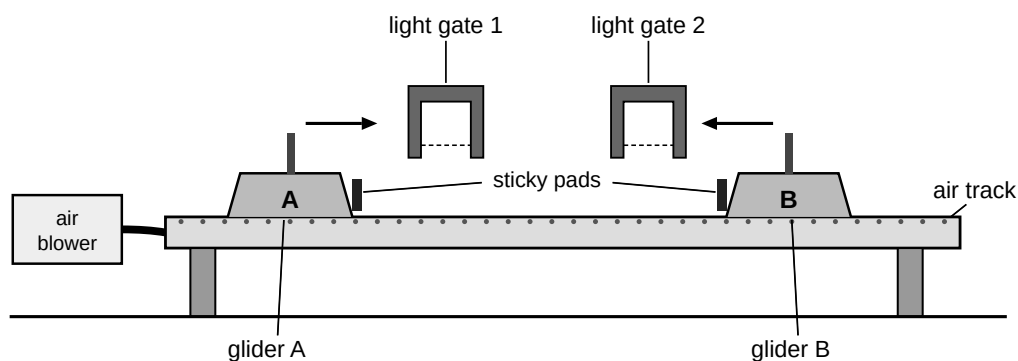
03

A student investigated collisions between two gliders on an air track.

Air blown through small holes in the track lifts the gliders, so the friction on them is very small.

Figure 3 shows the equipment. The light gates are connected to a data logger.

Figure 3



03.1

State the law of conservation of momentum.

[1 mark]

03.2

Each glider carries a card of known length.

[2 marks]

Explain how light gate 1 and the data logger are used to determine the velocity of glider **A** before the collision.

03.3

Glider **A** has a mass of 0.30 kg and moves to the right at 0.50 m/s.

[3 marks]

Glider **B** has a mass of 0.20 kg and moves to the left at 0.20 m/s.

The gliders collide and stick together.

Calculate the velocity of the gliders after the collision.

Give the direction of their velocity.

Velocity = ... m/s

Direction

Do not write outside the box

0 3 . 4 Explain why it is important in this investigation that the friction on the gliders is very small. [2 marks]

0 4 This question is about sound waves and seismic waves.

0 4 . 1 What is the range of normal human hearing? [1 mark]

Tick (✓) **one** box.

- | | |
|-------------------|--------------------------|
| 2 Hz to 2 kHz | ☐ |
| 20 Hz to 20 kHz | ☐ |
| 200 Hz to 200 kHz | ☐ |
| 2 kHz to 20 kHz | ☐ |

0 4 . 2 A ship uses pulses of ultrasound to measure the depth of the sea. [3 marks]

A pulse of ultrasound is reflected by the sea bed. The ship detects the reflected pulse 0.80 s after the pulse was sent.

The speed of sound in sea water is 1500 m/s.

Calculate the depth of the sea.

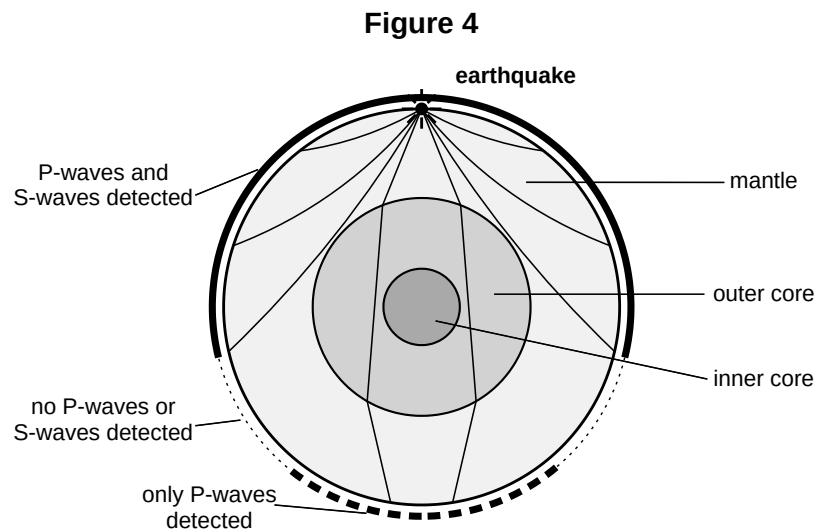
Depth = _____ m

0 4 . 3 Sound travels faster in water than in air. [2 marks]

A sound wave passes from air into water.

Explain what happens to the wavelength of the sound wave.

Earthquakes produce seismic waves that travel through the Earth. **Figure 4** shows where the seismic waves from one earthquake are detected at the surface of the Earth.



0 4 . 4 Scientists concluded that the outer core of the Earth is liquid. [3 marks]

Explain how the evidence in **Figure 4** supports this conclusion.

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0 5 A tennis ball moves towards a racket at a velocity of 20 m/s.

The racket hits the ball. The ball leaves the racket at a velocity of 30 m/s in the opposite direction.

The mass of the ball is 58 g.

The ball is in contact with the racket for 0.0050 s.

0 5 . 1 Calculate the mean force exerted on the ball by the racket. [3 marks]

Mean force = ... N

Do not write outside the box

05.2

A car has an airbag in its steering wheel. In a collision, the airbag inflates in front of the driver.

[3 marks]

Explain how the airbag reduces the force on the driver's head in a collision.

Use ideas about momentum in your answer.

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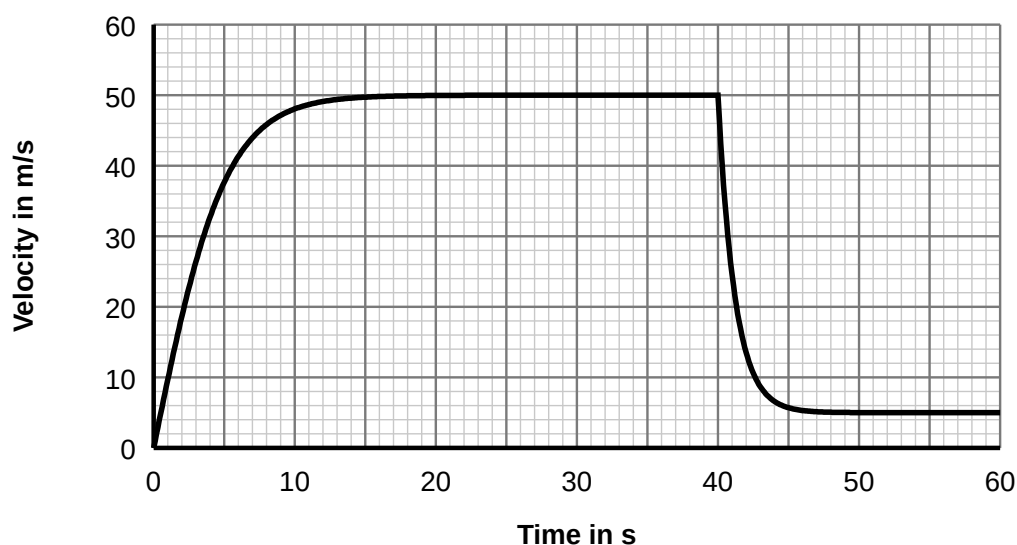
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06

A skydiver jumps from a plane.

Figure 5 shows how the velocity of the skydiver changes during the first 60 seconds of the jump. The skydiver opens a parachute at 40 s.

Figure 5



06.1

Determine the distance fallen by the skydiver between 20 s and 40 s.

[2 marks]

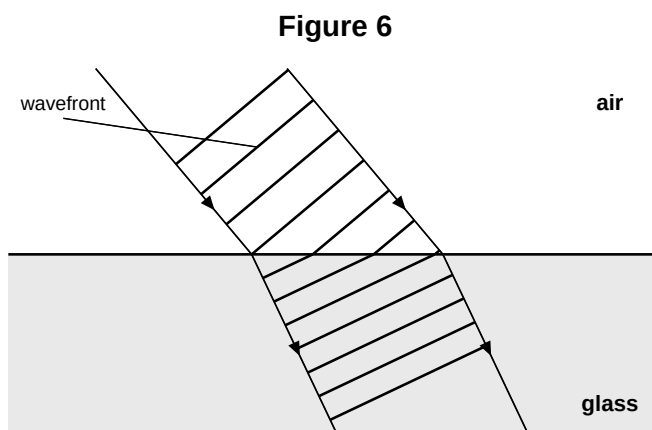
Distance = ... m

Question 6 continues on the next page

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0 7 This question is about electromagnetic waves.

Figure 6 shows wavefronts of light passing from air into a glass block.



0 7 . 1 Light travels more slowly in glass than in air.

[3 marks]

Use **Figure 6** to explain why the light changes direction as it enters the glass.

0 7 . 2 Radio waves can be produced by oscillations in electrical circuits.

[2 marks]

Describe what happens when radio waves are absorbed by the aerial of a radio receiver.

0 7 . 3 A radio station broadcasts radio waves with a frequency of 96 MHz.

[3 marks]

The speed of radio waves is 3.0×10^8 m/s.

Calculate the wavelength of the radio waves.

Wavelength = ... m

Do not write outside the box

X-rays are used in medical imaging. X-rays are ionising and can increase the risk of cancer. **Table 2** shows the radiation dose, in millisieverts (mSv), from some sources.

Table 2

Source of radiation	Radiation dose in mSv
One chest X-ray	0.02
One CT scan of the abdomen	8.0
Background radiation in the UK in one year	2.7

0 7 . 4 A patient is worried about the risk of having a CT scan of the abdomen. [2 marks]

Compare the dose from one CT scan with the other doses in **Table 2**.

Suggest why a doctor would still recommend the scan.

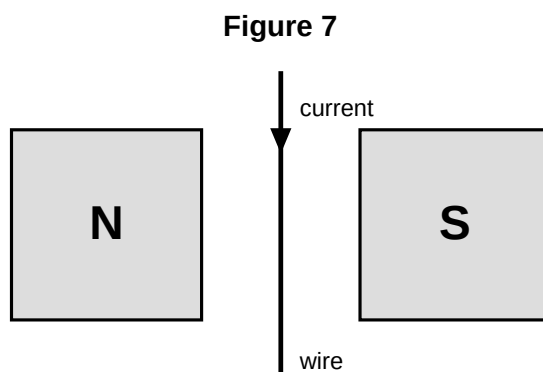
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0 8 . 8 **Figure 7** shows a wire between the poles of two magnets. There is a current in the wire in the direction shown.



0 8 . 1 Use Fleming's left-hand rule to determine the direction of the force on the wire. [1 mark]

Tick (✓) **one** box.

- | | |
|--------------------|--------------------------|
| Towards the N pole | ☐ |
| Towards the S pole | ☐ |
| Into the page | ☐ |
| Out of the page | ☐ |

Do not write outside the box

08.2

The length of the wire in the magnetic field is 5.0 cm.

[4 marks]

The current in the wire is 2.4 A.

The force on the wire is 36 mN.

Calculate the magnetic flux density of the magnetic field.

Give the unit.

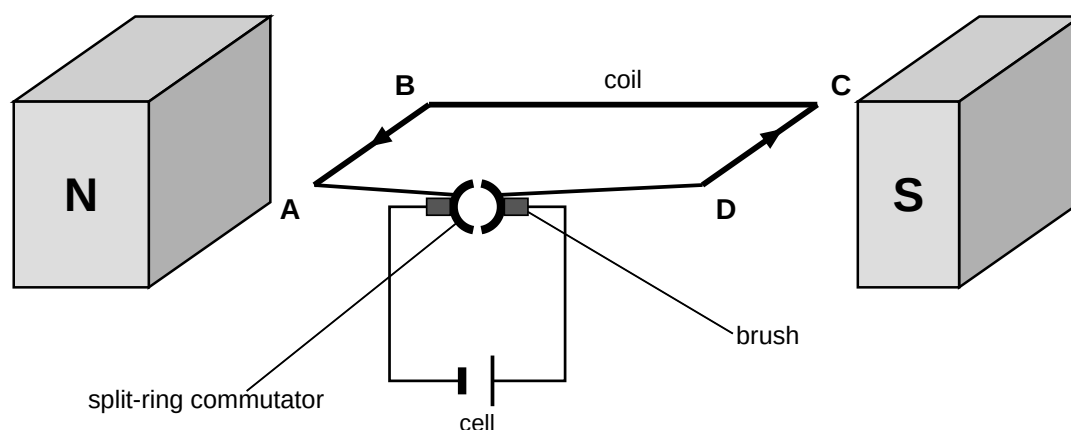
Magnetic flux density = ...

Unit

Figure 8 shows a simple electric motor.

The coil **ABCD** is between the poles of two magnets. The arrows show the direction of the current in sides **AB** and **CD**.

Figure 8



08.3

Explain why the coil rotates when there is a current in it.

[4 marks]

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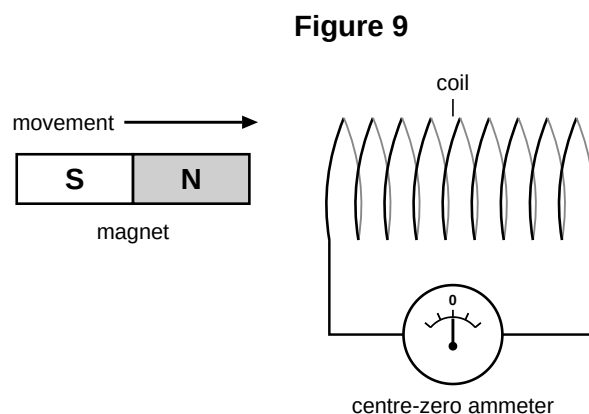
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0 9 A student investigated the generator effect.

Figure 9 shows the equipment.



When the student pushed the north pole of the magnet into the coil, the needle of the ammeter moved to the right.

0 9 . 1 Describe what the ammeter showed when the student:

[2 marks]

- held the magnet stationary inside the coil
- then pulled the magnet out of the coil.

Magnet held stationary

.....

.....

Magnet pulled out

.....

.....

A transformer is used to operate a 12 V lamp from the 230 V mains electricity supply.

The primary coil of the transformer has 2300 turns.

0 9 . 2 Calculate the number of turns on the secondary coil of the transformer. [2 marks]

Number of turns = ...

Question 9 continues on the next page

Do not write outside the box

09.3

The current in the lamp is 2.3 A.

[2 marks]

Calculate the current in the primary coil.

Assume that the transformer is 100% efficient.

Current = _____ A

09.4

The transformer will not work if the primary coil is connected to a direct current (d.c.) supply. [2 marks]

Explain why.

10

This question is about space.

10.1

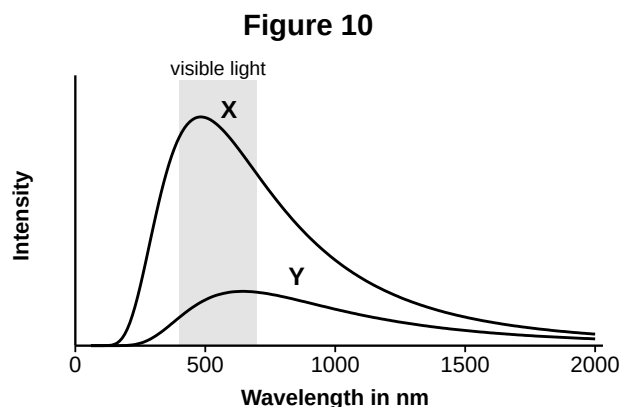
Describe what happens to a star that is much more massive than the Sun after the main sequence stage of its life cycle. [3 marks]

10.2

A satellite moves in a circular orbit around the Earth at a constant speed. [2 marks]

Explain why the satellite is accelerating.

All stars emit electromagnetic radiation. **Figure 10** shows how the intensity of the radiation emitted from each square metre of the surface of two stars, **X** and **Y**, varies with wavelength.



- 1 0 . 3** Which star, **X** or **Y**, has the higher surface temperature? [3 marks]
Give **two** reasons for your answer.

Star

1

2

The light from distant galaxies is red-shifted. **Table 3** shows the distance of four galaxies from the Earth and the speed at which each galaxy is moving away from the Earth.

Table 3

Galaxy	A	B	C	D
Distance from the Earth in millions of light years	80	160	240	400
Speed at which the galaxy is moving away from the Earth in km/s	1760	3520	5280	8800

- 1 0 . 4** Describe the relationship between the distance of a galaxy from the Earth and the speed at which it is moving away. [3 marks]

Explain how this relationship gives evidence for the Big Bang theory.

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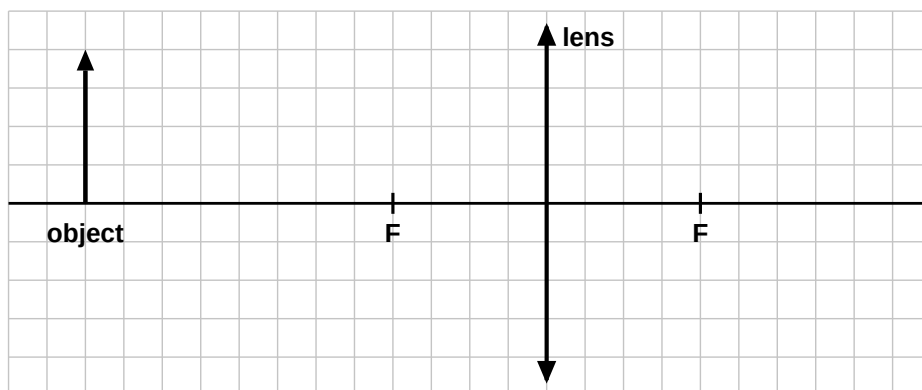
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1 1 This question is about light.

Figure 11 shows an object in front of a convex lens.

Each point labelled F is a principal focus of the lens.

Figure 11



1 1 . 1 Complete the ray diagram in **Figure 11** to show how the lens forms an image of the object. [3 marks]

Draw an arrow to represent the image.

1 1 . 2 A student shone a ray of light at a plane mirror and then at a sheet of white paper. A single reflected ray could be seen from the mirror, but not from the paper. [2 marks]

Explain why.

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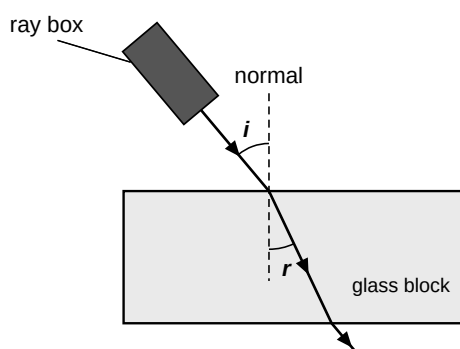
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The student then investigated how the angle of refraction of a ray of light in glass depends on the angle of incidence.

Figure 12 shows a ray of light passing through a rectangular glass block.

Figure 12



[6 marks]

Your plan should give valid results.

[illegible]

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Additional page, if required.

Write the question numbers in the left-hand margin.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Do not write outside the box

Write the question numbers in the left-hand margin.

[illegible]

There are no more questions in this paper. Original practice paper © sciencegcse.co.uk – free to use for non-commercial education. Not an AQA paper.

Physics Equations Sheet

GCSE Physics – Practice Paper Series, Set 1

You may use these equations in your answers. HT = Higher Tier only equations. The equations are those listed in the AQA specification; this sheet is provided by sciencegcse.co.uk and is not an AQA document.

	Word equation	Symbol equation
1	kinetic energy = $0.5 \times \text{mass} \times (\text{speed})^2$	$E_k = \frac{1}{2} m v^2$
2	elastic potential energy = $0.5 \times \text{spring constant} \times (\text{extension})^2$	$E_e = \frac{1}{2} k e^2$
3	gravitational potential energy = mass $\times$ gravitational field strength $\times$ height	$E_p = m g h$
4	change in thermal energy = mass $\times$ specific heat capacity $\times$ temperature change	$\Delta E = m c \Delta \theta$
5	power = energy transferred $\div$ time	$P = E / t$
6	power = work done $\div$ time	$P = W / t$
7	efficiency = useful output energy transfer $\div$ total input energy transfer efficiency = useful power output $\div$ total power input	
8	charge flow = current $\times$ time	$Q = I t$
9	potential difference = current $\times$ resistance	$V = I R$
10	power = potential difference $\times$ current	$P = V I$
11	power = (current) $^2 \times$ resistance	$P = I^2 R$
12	energy transferred = power $\times$ time	$E = P t$
13	energy transferred = charge flow $\times$ potential difference	$E = Q V$
14	density = mass $\div$ volume	$\rho = m / V$
15	thermal energy for a change of state = mass $\times$ specific latent heat	$E = m L$
16	pressure $\times$ volume = constant (fixed mass of gas, constant temperature)	$p V = \text{constant}$
17	weight = mass $\times$ gravitational field strength	$W = m g$
18	work done = force $\times$ distance (along the line of action of the force)	$W = F s$
19	force = spring constant $\times$ extension	$F = k e$
20	moment of a force = force $\times$ distance (normal to direction of force)	$M = F d$
21	pressure = force normal to a surface $\div$ area of that surface	$p = F / A$
22 HT	pressure due to a column of liquid = height of column $\times$ density of liquid $\times$ gravitational field strength	$p = h \rho g$
23	distance travelled = speed $\times$ time	$s = v t$
24	acceleration = change in velocity $\div$ time taken	$a = \Delta v / t$
25	(final velocity) ^{2} – (initial velocity) ^{2} = $2 \times$ acceleration $\times$ distance	$v^2 - u^2 = 2 a s$
26	resultant force = mass $\times$ acceleration	$F = m a$
27 HT	momentum = mass $\times$ velocity	$p = m v$
28 HT	force = change in momentum $\div$ time taken	$F = m \Delta v / \Delta t$
29	period = $1 \div$ frequency	$T = 1 / f$
30	wave speed = frequency $\times$ wavelength	$v = f \lambda$
31	magnification = image height $\div$ object height	
32 HT	force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density $\times$ current $\times$ length	$F = B I l$
33 HT	potential difference across primary coil $\div$ potential difference across secondary coil = number of turns in primary coil $\div$ number of turns in secondary coil	$V_p / V_s = n_p / n_s$
34 HT	potential difference across primary coil $\times$ current in primary coil = potential difference across secondary coil $\times$ current in secondary coil	$V_p I_p = V_s I_s$