The Telford Langley School

ENSURING EXCELLENCE

Combined Physics Foundation Paper 2

Name: _____

Topic 1: Forces

Topic 2: Waves

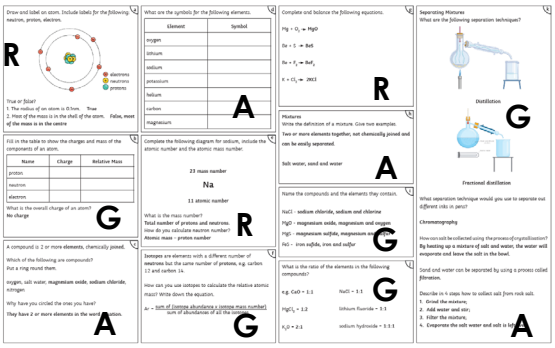
Topic 3: Magnetism and Electromagnetism

Exam Date: Monday 16th June 2025

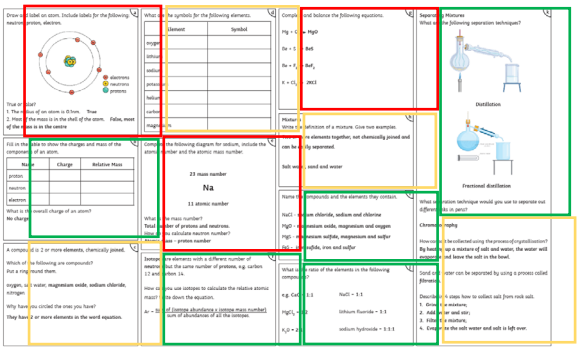
Instructions

This booklet has been separated according to the topic that will be covered in the exam.

1. Go through the revision mat for the topic and rate each box according to your understanding of that content. Use a typical RAG rating or 3 different colours of highlighter.
   For example:



OR



R = Red ☹ Low understanding

A = Amber 😐 Some Understanding

G = Green 😊 Good Understanding

2. Cut along the dotted lines of the question card template provided. Then produce a set of revision questions and answers for that topic – you should focus on those you have rated as red or amber on the revision mat. **For example:**

Front	**Back**
What is the mass number of an atom?	The total number of protons and neutrons found in the nucleus

3. Fold along the line indicated on the following page and glue where indicated to create a storage pocket for your question cards.
4. Regularly test yourself using your question cards or ask someone to test you and return them to your storage pocket for safekeeping after each use.

a

Complete the following sentence:
A vector quantity has a **magnitude** and a **direction** whereas a scalar quantities only has a **magnitude**.

Place a tick in the correct column to show whether the following are vector or scalar quantities. The first one has been done for you.

Quantity	Vector	Scalar
Force	✓	
Speed		✓
Distance		✓
Velocity	✓	
Displacement	✓	

b

Forces can be contact or non contact. For each one, give an example.

Contact:
friction, air resistance, tension, normal

Non-contact:
magnetic, gravitational, electrostatic

c

Explain the difference between mass and weight.

Mass: **the amount of stuff in an object.**

Weight: **the force acting on an object due to gravity.**

Unit of mass: **kg**

Unit of weight: **N**

Name the apparatus used to determine an objects weight.
newton meter

d

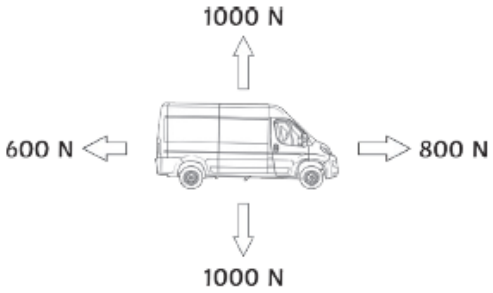
State the equation that can be used to determine the weight of an object.
weight = mass × gravitational field strength

Calculate the weight of an object on the moon if its mass is 3kg. The gravitational field strength on the moon is 1.6N/kg.
weight = 3 × 1.6
= 4.8N

Explain the effect on an object's weight if its mass was doubled.
The weight would also be doubled.

e

Calculate the resultant forces acting on the van below.



Horizontal force: **800 – 600 = 200N**

Vertical force: **1000 – 1000 = 0N**

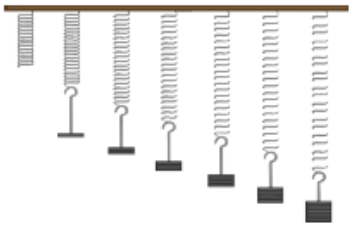
On a force diagram, what two things do the arrows show?
Direction of force and relative size.

f

Complete the sentences below.

Elastic deformation occurs when a force has been applied to a spring and it **returns** to its original shape. **Inelastic deformation** occurs when the spring does not return to its original shape.

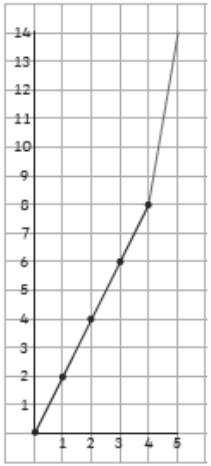
g



Students placed masses, one at a time, on a spring and measured its extension. They collected the following results.

Force (N)	0	1	2	3	4	5
Length of Spring (cm)	3	5	7	9	11	17
Extension (cm)	0	2	4	6	8	14

Plot a force/extension graph for the data shown above. Remember to include a line of best fit.



Mark the limit of proportionality on your graph.

State the equation that links force, spring constant and extension.
force = spring constant × extension

a

Define work done.
This occurs when a force moves an object for a distance.

State the equation that links work done, force and distance.
work done = force × distance

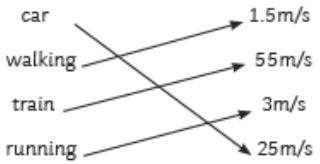
Write the units for...
work done: **joules**
force: **newtons**
distance: **metres**

A lorry travels 200m when the brakes are applied with a force of 600N. Calculate the work done to stop the lorry.
work done = force × distance
= 600 × 200
= 120 000J

Calculate the force if 3000J of energy is required to move a box of books a distance of 150cm.
Convert cm to m: 150cm = 1.5m
Rearrange formula:
force = work done ÷ distance
= 3000 ÷ 1.5
= 2000N

b

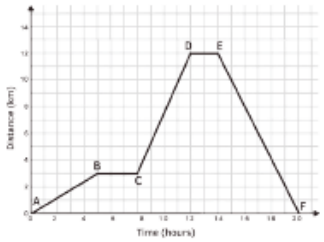
Draw lines to match the methods of transportation with their average speeds.



State three factors that could affect a person's walking speed.
1. **age**
2. **fitness**
3. **terrain**

c

The graph below is a distance/time graph of a person travelling from home to the supermarket and home again.



Where on the graph is the person stationary?
B-C and D-E

Between points A and E, where is the speed the fastest? Explain you answer.
C-D because it is the steepest part of the graph.

A car increases its velocity from 5m/s to 12m/s in a time of 10 seconds. Calculate its acceleration. Remember to include all units.
acceleration = change in velocity ÷ time
= (12 – 5) ÷ 10
= 7 ÷ 10
0.7m/s

d

Explain the term deceleration.
Negative acceleration, when something is slowing down.

A coach travels at an average speed of 30mph for 20 minutes. How far has it travelled in that time?
10 miles

e

Stopping distance is calculated by adding thinking distance and braking distance.
Thinking distance is affected by:
speed;
reaction time.

Braking distance is affected by:
tyres;
road conditions.

f

Are the following forces balanced or unbalanced?

An ornament knocked off a window sill.
unbalanced

A football as it rolls towards a goal.
unbalanced

g

Describe an experiment to determine whether your reaction time is faster with your right or left hand.
Key words: ruler, partner, repeats
Work with a partner.
Person A places their forearm on the table so that their right hand is hanging over the edge of the table.
Person B places a ruler vertically between Person A's thumb and first finger, with the 0cm end of the ruler pointing downwards. The thumb and first finger should be as far apart as possible.
Person B should place the 0cm mark level with the top of Person A's thumb and drop the ruler without telling them.
Person A catches the ruler as quickly as possible.
Reading from the top of the thumb, record how many cms it took to catch.
Repeat 9 more times with the right hand.
Repeat experiment with the left hand.

h

Describe the effect of friction on a moving object.
It slows it down.

State two ways in which friction on a moving object can be overcome.
Using a lubricant.
Make the object more streamlined.
Smoother surfaces.

i

What is terminal velocity?
When an object is falling at a steady speed.

Terminal velocity depends on two things:
shape
area

j

A car is travelling along a busy road. As it approaches a roundabout, the driver applies the brakes.
If the road is icy, how will this affect the braking distance? Explain your answer.
Less friction, therefore it will take longer to stop.

k

State the equation that links force, mass and acceleration.
force = mass × acceleration

Rearrange the equation you have given above to calculate acceleration.
acceleration = force ÷ mass

Calculate the force acting on an object with a mass of 15kg and acceleration of 4m/s².
F = ma 15 × 4 60N

Calculate the mass of an object, if it has a force of 2000N and its acceleration is 50m/s².
mass = force ÷ acceleration
= 2000 ÷ 50
= 40kg

l

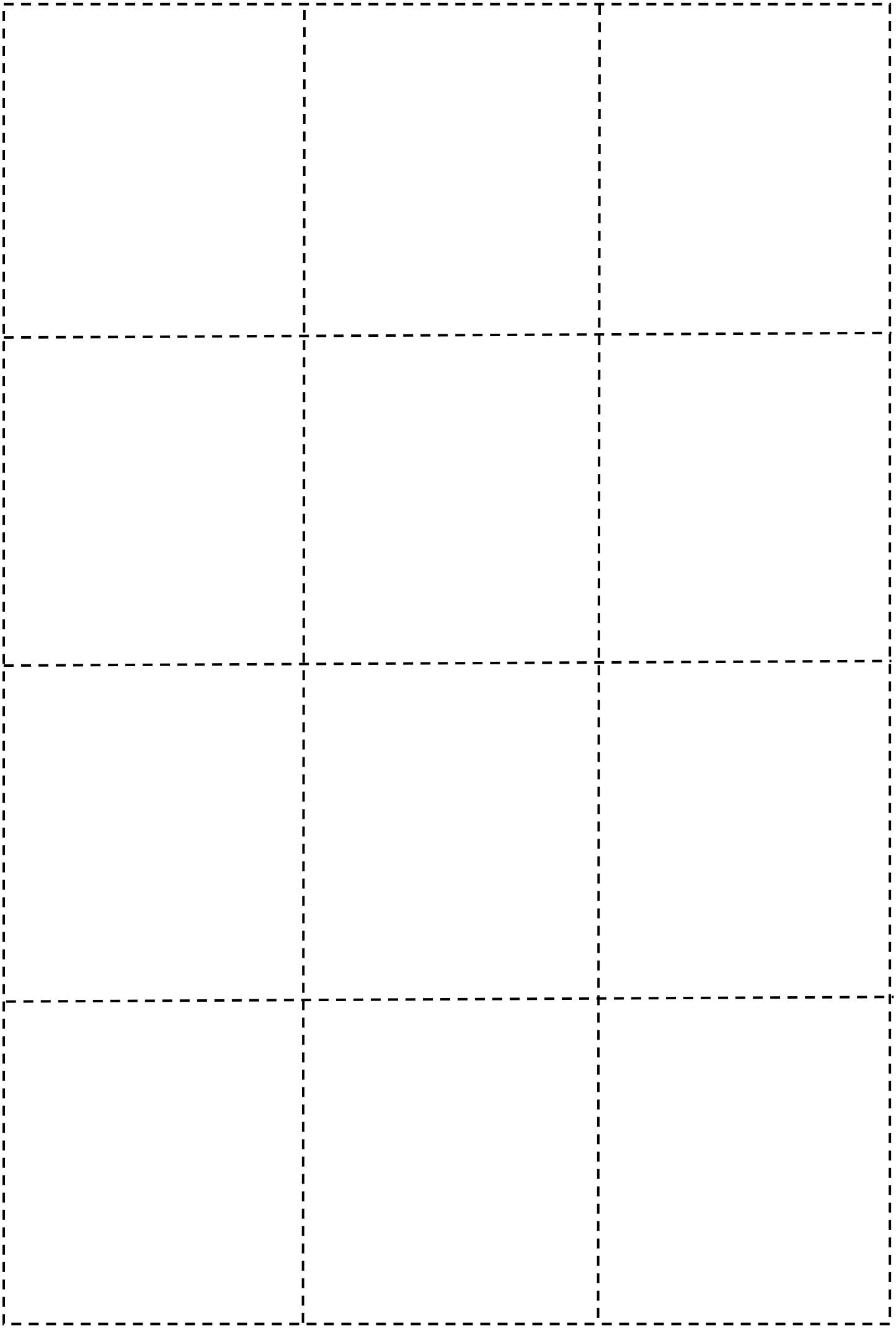
State whether the following statements are true or false. If a statement is false, please write the correct statement.

The resultant force on an object is the overall force acting on it.
True

The larger the resultant force on an object the more it accelerates.
True

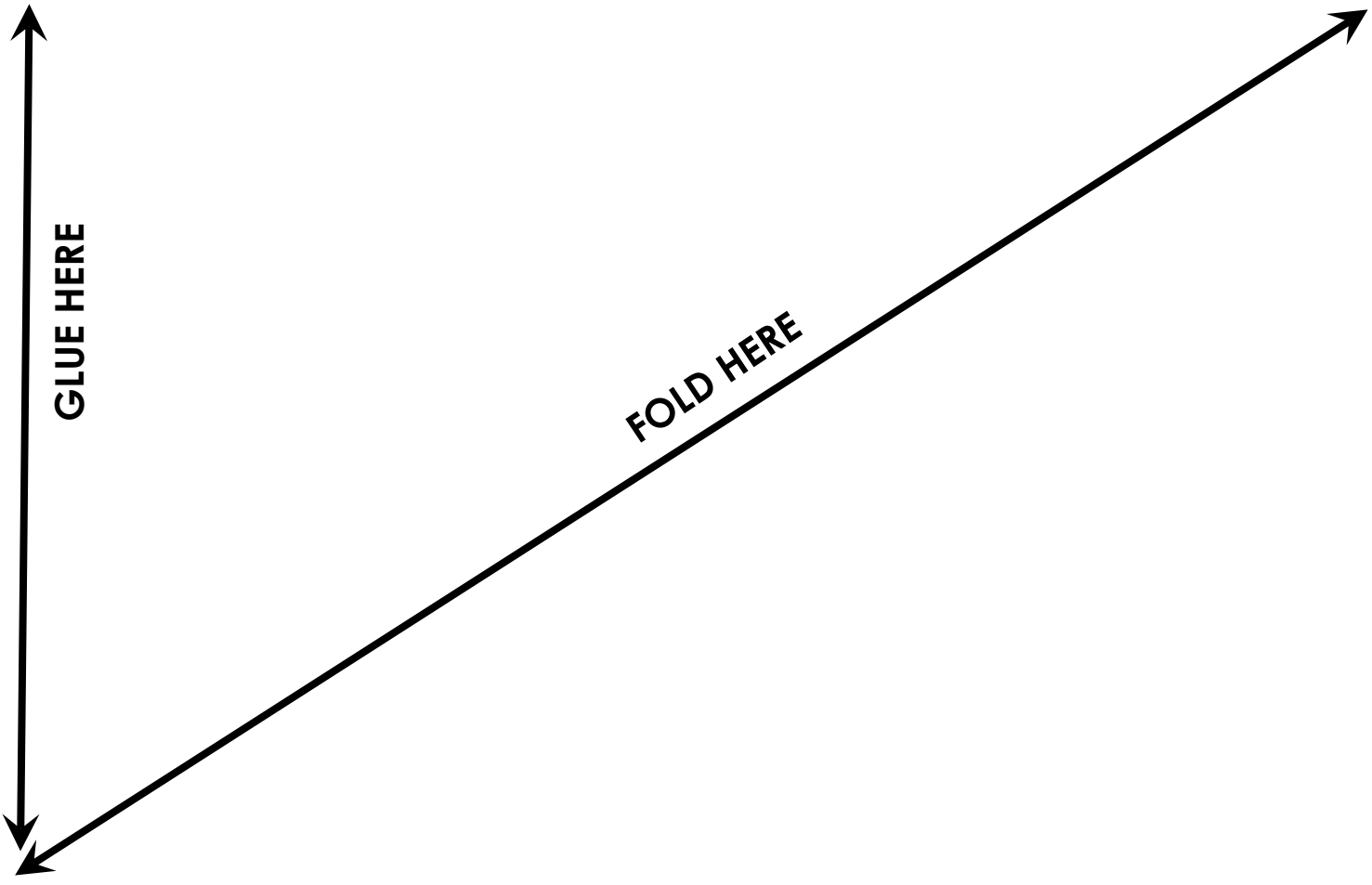
Newton's third law states that when two objects interact, the forces they exert on each other are in the same direction.
False. The forces act in opposite direction.

If the resultant force on an object is zero, then the object must be stationary.
False. It could be travelling at a constant speed.



Topic 1: Forces

Question Card Storage



a

Complete the gap fill:

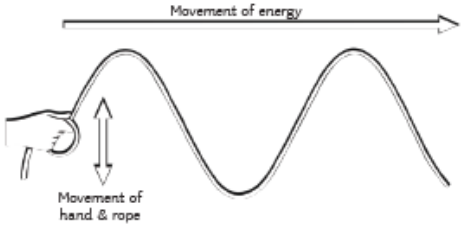
All waves transfer **energy** from one place to another, but the **matter** does not move. The particles oscillate (**vibrate**) around a fixed point and pass **energy** onto the next particle and in turn they oscillate too.

b

State the two types of wave.

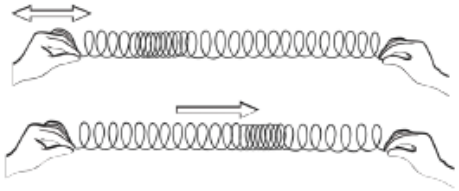
1. **transverse**
2. **longitudinal**

Which type of wave is represented in this picture?



transverse

Which type of wave is represented in this picture?



longitudinal

c

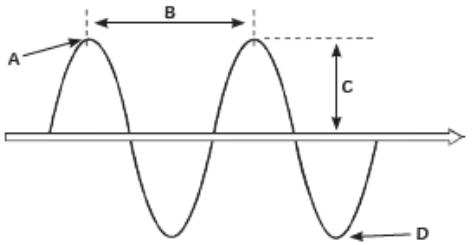
Which type of wave oscillates perpendicular (at right angles) to the direction of energy transfer?
transverse

Which type of wave oscillates parallel to the direction of energy transfer?
longitudinal

d

Which letter on the graph represents...

amplitude? **C**
wavelength? **B**
crest? **A**
trough? **D**



e

Match up the keyword to the correct definition:

frequency	The maximum displacement of a point on a wave away from its undisturbed position.
amplitude	The number of waves passing a point each second.
wavelength	The distance from a point on one wave to the equivalent point on the adjacent wave.

f

You are given the following equation in the exam: period = 1/frequency
What are the units for...

period (time)? **seconds (s)**
frequency? **hertz (Hz)**

g

What is the symbol equation linking wave speed, frequency and wavelength?
$v = f\lambda$

Now complete the rest of the table:

Symbol in the Equation	What It Represents	Units
v	**wave speed**	**m/s**
f	frequency	**Hz**
λ	**wavelength**	m

h

Calculate the speed of a wave with a wavelength of 42cm and a frequency of 11Hz.

***v* = *f*λ**
convert cm into m = 0.42m
Substitute the numbers into the equation:
11Hz x 0.42m = 4.62m/s

i

A wave has a frequency of 54Hz and a speed of 330m/s. Calculate the wavelength.
Rearrange the equation to make wavelength the subject:
$\lambda = v/f$
Substitute the numbers into the equation:
330m/s ÷ 54Hz = 6.12m

j

Identifying the suitability of apparatus to measure wave speed, frequency, and wavelength was a required practical.

State a control variable in this practical:
The volume of water in the tank.

Why was it important to control this variable?
The depth of the water will affect the speed and wavelength.

What was the biggest source of error in your practical?
Counting the waves by eye.

How could you overcome this error?
Use a stroboscope.

a

Which type of wave are electromagnetic (EM) waves - transverse or longitudinal?

transverse

Which part of the EM spectrum can human eyes detect?

Visible light only.

b

Complete the gap fill by choosing from **some** of the following words:

velocity, magnetism, energy, spectrum, acceleration, absorber

Electromagnetic waves transfer **energy** from the source of the waves to an **absorber**. The waves form a continuous **spectrum**, and all types, travel at the same **velocity** through a vacuum (space) or air.

The words acceleration and magnetism should not be used.

c

Which type of EM wave has the...

longest wavelength? **radio waves**

highest frequency? **gamma rays**

shortest wavelength? **gamma rays**

lowest frequency? **radio waves**

most energy? **gamma rays**

least energy? **radio waves**

d

The amount of absorption, or radiation, of infrared by different surfaces was a required practical. What was the...

independent variable? **type of surface**

dependent variable? **temperature (°C)**

control variable? **Volume of water or start temperature of the water.**

hazard, the harm it could cause, and how you minimised the risk?
The hot water could scald skin, so we used test tube racks and ensured the floor was clear of trip hazards.

e

Complete the boxes to show the order of the electromagnetic (EM) spectrum and state at least two uses of each type of EM wave.

EM Wave:	**radio waves**	**microwaves**	**infrared waves**	**visible light**	**ultraviolet waves**	**x-rays**	**gamma rays**
Uses:	**Television, radio and Bluetooth.**	**Satellite communication and cooking food.**	**Remote controls, infrared cameras and heaters.**	**Optical fibres and photography (cameras).**	**Security marking, energy efficient lamps and sunbeds.**	**Medical imaging and medical treatment for cancer.**	**Medical treatments for cancer and sterilising food.**

f

The amount of absorption, or radiation, of infrared radiation by different surfaces was a required practical. Briefly outline a method for collecting valid results for this experiment.

Cover four boiling tubes in different materials to create different surfaces: matt black, shiny black, white and silver (the independent variable). Pour the same volume of the same start temperature of hot water into the tubes (these control variable ensures validity). Measure the temperature of each tube every minute (the dependent variable). The tube that cools the fastest emits infrared energy the fastest.

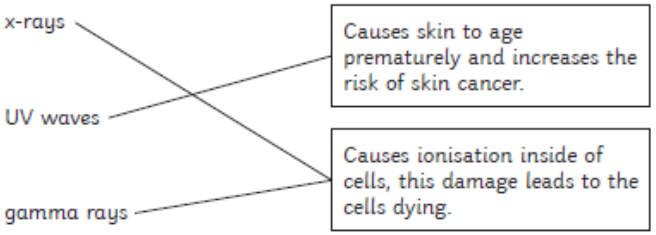
a

Next to each EM wave, place a tick or cross to indicate whether it can cause harm to the human body.

radio waves ☒
microwaves ☒
infrared waves ☒
visible light ☒
ultraviolet waves ☑
x-rays ☑
gamma rays ☑

b

Match up the EM wave to the description of the damage it does to the human body:



c

Complete the gap fill:

Radiation dose is a measure of the risk of **harm** resulting from exposure of the body to the **radiation**.

It is measured in sieverts, and 1 sievert (Sv) is equivalent to **1000** millisieverts (mSv).

Some types of radiation are more hazardous than others due to the amount of **energy** in the wave and how penetrating it is.

d

State two factors that affect the amount of harm caused by certain EM waves:

1. **Type of radiation.**
2. **Amount of exposure.**

e

State one advantage of using gamma rays to treat or detect cancer:
Gamma rays can be used to detect cancer by ingesting or injecting a radioactive source as a tracer. This is beneficial as it means early treatment can commence, and the outcome is therefore more likely to be positive in terms of life-expectancy. Gamma rays can be used to treat cancer without invasive surgery - a high focused beam causes the cancer cells to mutate further, resulting in them dying.

State one disadvantage of using gamma rays to treat or detect cancer:
Normal cells nearby are also affected during treatment and undergo ionisation, resulting in the patient feeling unwell.

f

State one advantage of using x-rays for medical imaging:
X-rays can be used to detect broken bones, visualise dental issues, treat cancer cells and as part of CT scans.

State one disadvantage of using x-rays for medical imaging:
X-rays can cause ionisation in cells and increase the chance of mutation, therefore leading to rapidly growing and dividing cells (a tumour).

g

Suggest why nurses wear lead lined aprons when performing x-ray examinations.

Nurses wear lead lined aprons due to two factors: they are exposed to harmful x-rays towards the upper end of the EM spectrum on a regular basis. The x-rays themselves are highly ionising and can cause damage to body cells, resulting in mutations and potentially leading to uncontrolled cell growth (a tumour). Therefore, nurses can reduce their radiation dose by wearing a lead lined apron which blocks the rays.

h

State two other precautions that nurses and healthcare professionals can undertake to reduce the harm of x-rays.

1. **Work from a distance/step into another room/stand behind a glass window.**
2. **Wear a radiation badge/dosimeter to measure and record exposure.**

a

Complete the gap fill using the following words:
speed, 90, faster, medium, angle, ray, refracted

The **speed** of a wave depends on the material (**medium**) it is travelling through. If a wave changes from one medium to another, the **speed** changes too.

Waves are only refracted when they meet the boundary between two media at an **angle**.

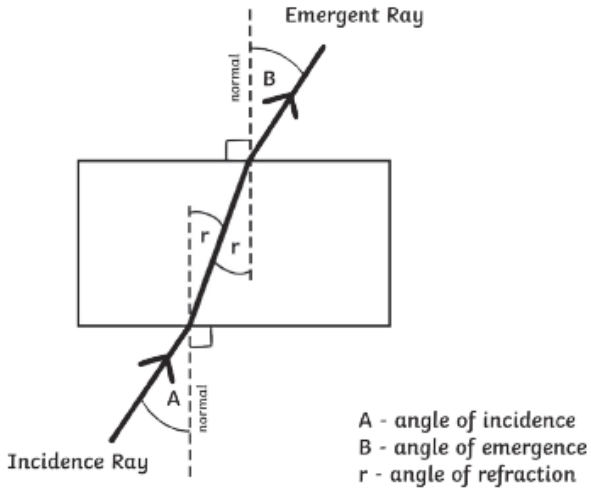
The more the **speed** changes between the two media, the greater the direction of the wave changes.

However, a wave that meets the boundary at **90°** (perpendicular) will not be **refracted**.

Light waves travel **faster** in air than in glass. The change in speed, and thus direction, between these two media can be shown using a **ray** diagram.

b

Use a ruler to draw the path of the light ray as it travels through the glass block.



c

Choose the correct phrase to complete each statement to explain what is happening in your ray diagram on the left.

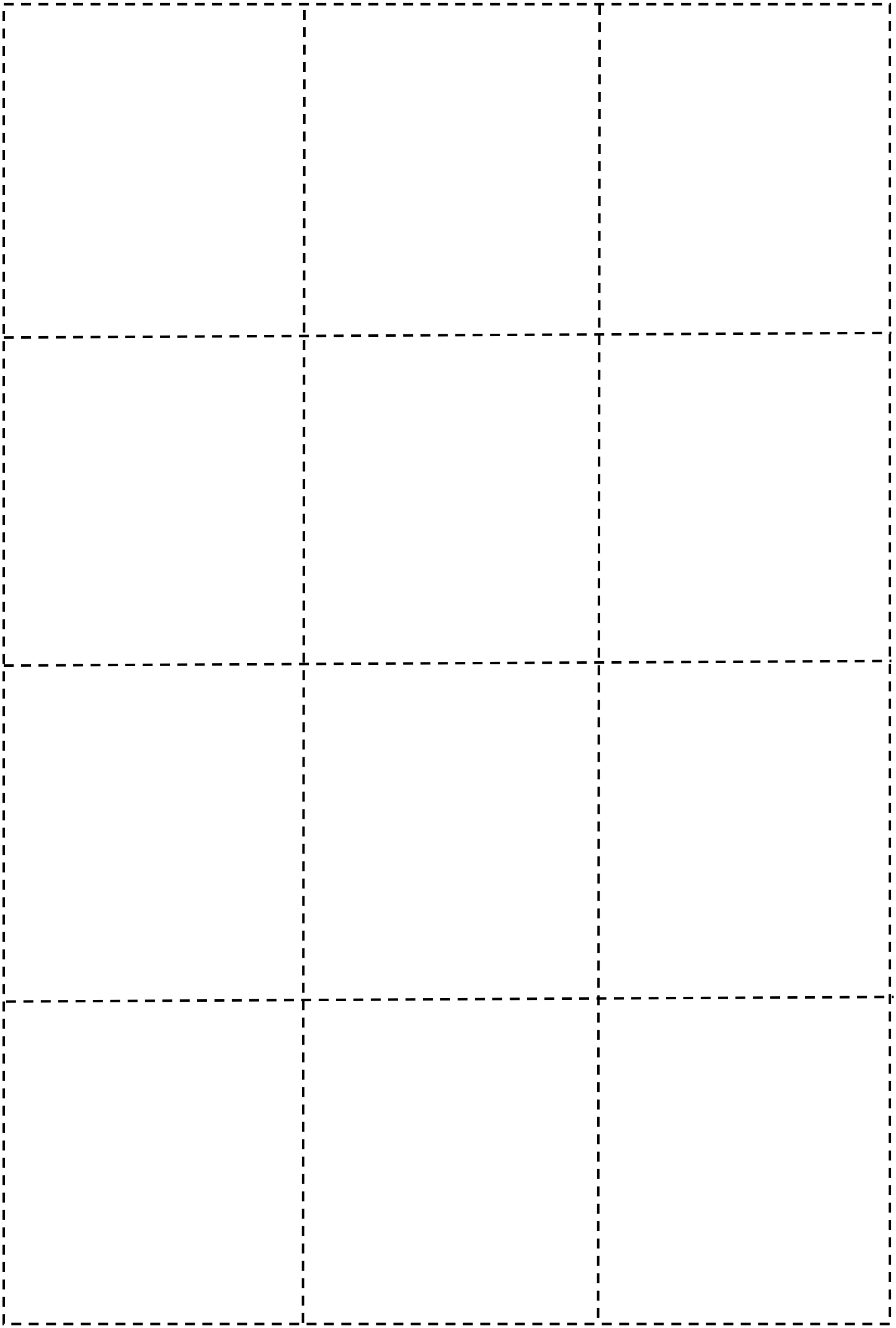
The light ray is travelling from **air**/glass with a low refractive index, into air/**glass** with a higher refractive index.

Upon entering the different medium, the average speed of the ray **decreases**/increases.

The ray is refracted **away from**/towards the normal.

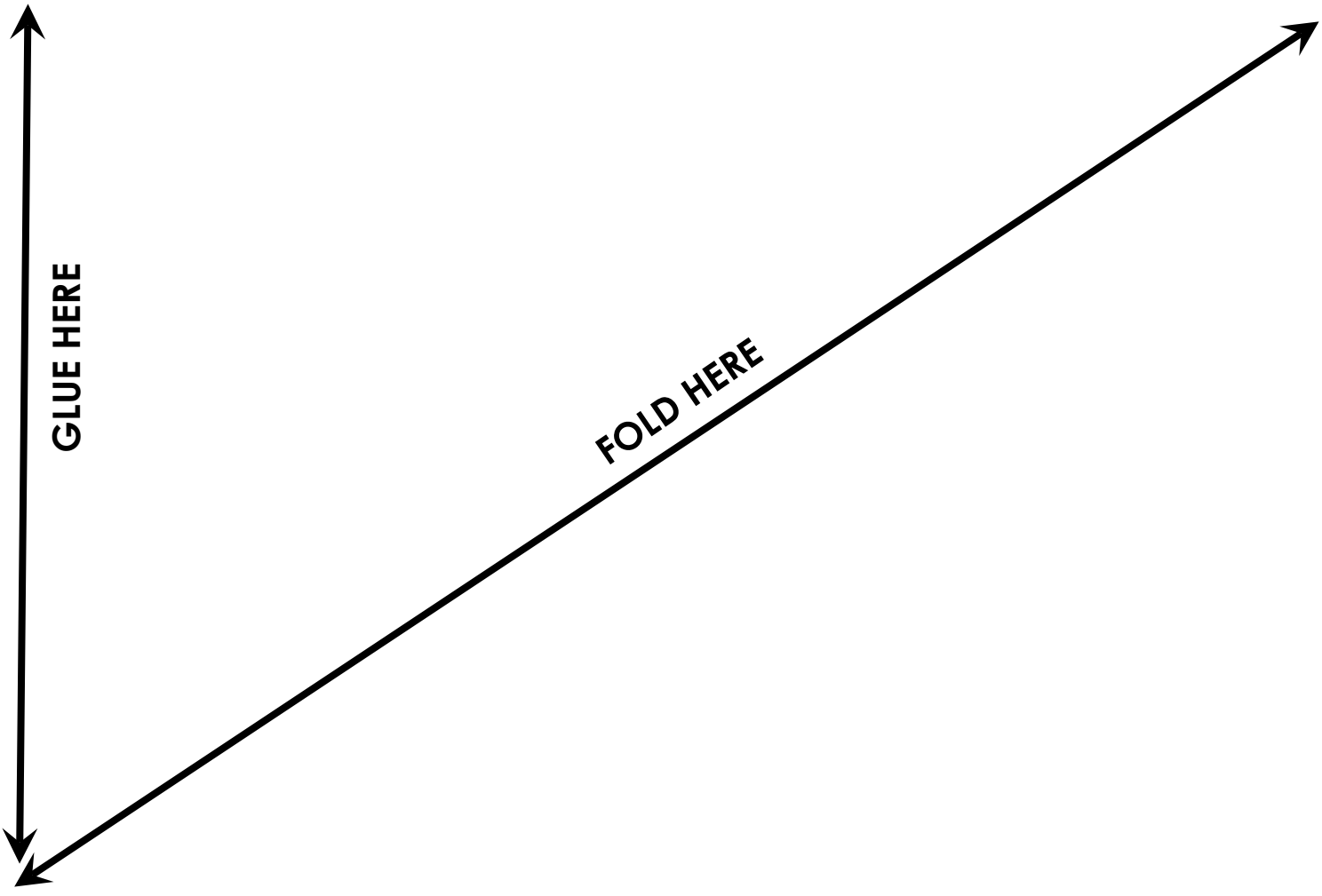
As the light leaves the glass block and travels into the air, the speed of the ray **increases**/decreases.

So the ray is refracted away from/**towards** the normal.



Topic 2: Waves

Question Card Storage



a

Complete the gap fill by choosing from **some** of the following words:
contact, non-contact, east, north, west, south, pole, equator.

Magnetic force is a type of **non-contact** force and it is strongest at the **poles** of the magnet. There are two types of magnetic pole: a **north** pole and a **south** pole.

b

What would happen between the poles in each of the magnetic interactions below? Chose from the words '**attraction**' or '**repulsion**'.

repulsion

attraction

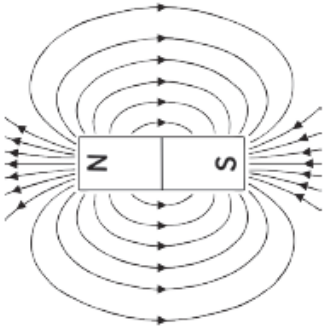
repulsion

c

Define the term 'magnetic field':
The region around a magnet where a force acts on another magnet, or on a magnetic material.

d

Draw the magnetic field lines on the bar magnet below. Remember, lines always start at the **north** pole and point towards the **south** pole.



e

Write 'P' or 'I' next to each statement to indicate whether it refers to a property of a permanent magnet (P) or an induced magnet (I).

- Produce their own magnetic field. [P]
- Become a magnet when placed in a magnetic field. [I]
- Is a temporary magnet. [I]
- Lose their magnetism when removed from a magnetic field. [I]

f

List four magnetic materials:

1. **iron**
2. **steel**
3. **nickel**
4. **cobalt**

g

Place the steps below in the correct order to explain how you would use a plotting compass to investigate the magnetic field around a magnet. The first step has been done for you:

1. Place the magnet on a blank piece of paper.

[5] Repeat until you have moved to the other pole of the magnet.

[2] Place the plotting compass at one end/above the pole of the magnet.

[3] Mark on the paper where the point of the needle points.

[4] Move the compass to the place you have just marked.

h

In which direction do compass needles always align?

magnetic north

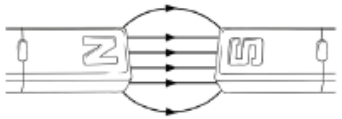
Complete the gap fill:

This is because of the earth's **magnetic field**. This is possibly caused by the **iron** in the earth's core.

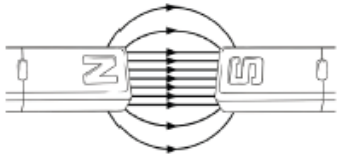
i

Which of these magnets will exert a stronger force on a magnetic material?

A.



B.



B

Explain your answer:

B has more lines of magnetic flux.

j

When a current flows through a conducting wire, a magnetic field is produced around the wire. Circle two factors the strength of the magnetic field depends on:

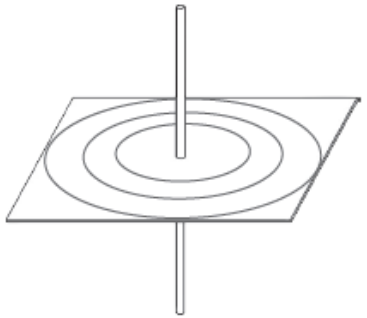
1. size of the poles
2. **size of current**
3. **distance from the wire**
4. distance from the equator

k

Notes:

a

A long, straight, conducting wire is placed vertically so that it passes through a horizontal piece of board. Iron filings are sprinkled onto the board. Draw the pattern they would form:



b

State the piece of equipment you could use to investigate the magnetic field you have drawn above:

plotting compass

c

State the method that informs you of the direction of the current in a straight wire.

Right hand grip method/rule.

What do you thumb and fingers represent in this method?

thumb:
The direction of the current.

fingers:
The direction the field lines should be drawn.

d

Place the statements below in the correct order to describe how you would use the piece of equipment previously stated, to investigate the magnetic field you have drawn. The first one has been done for you.

1. Place a magnetic compass at one point along the wire.

3 Move the magnetic compass further along the wire.

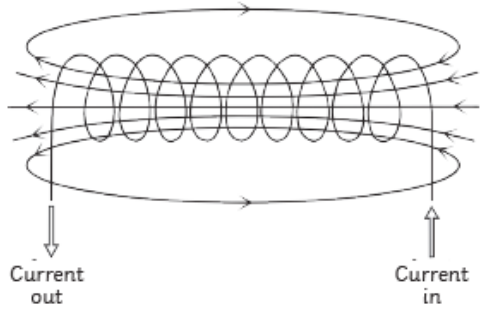
4 Again, turn the power supply on and off and observe the direction of the compass needle.

5 Move the compass further away from the wire to see that the magnetic field is weaker.

2 Turn the power supply on and off and observe the direction of the compass needle.

e

Draw the magnetic field pattern around the solenoid below:



Which other type of magnet produces a similar pattern?

A bar magnet.

f

What is a solenoid?

A solenoid is formed when a long piece of conducting (and insulated) wire is looped into a coiled cylinder.

g

Describe what happens to the magnetic field around a straight wire when the current is reversed.

The magnetic field is also reversed.

h

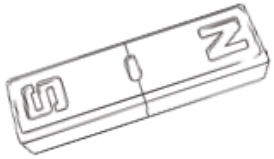
List four ways in which you can make the magnetic field around a solenoid/electromagnet stronger:

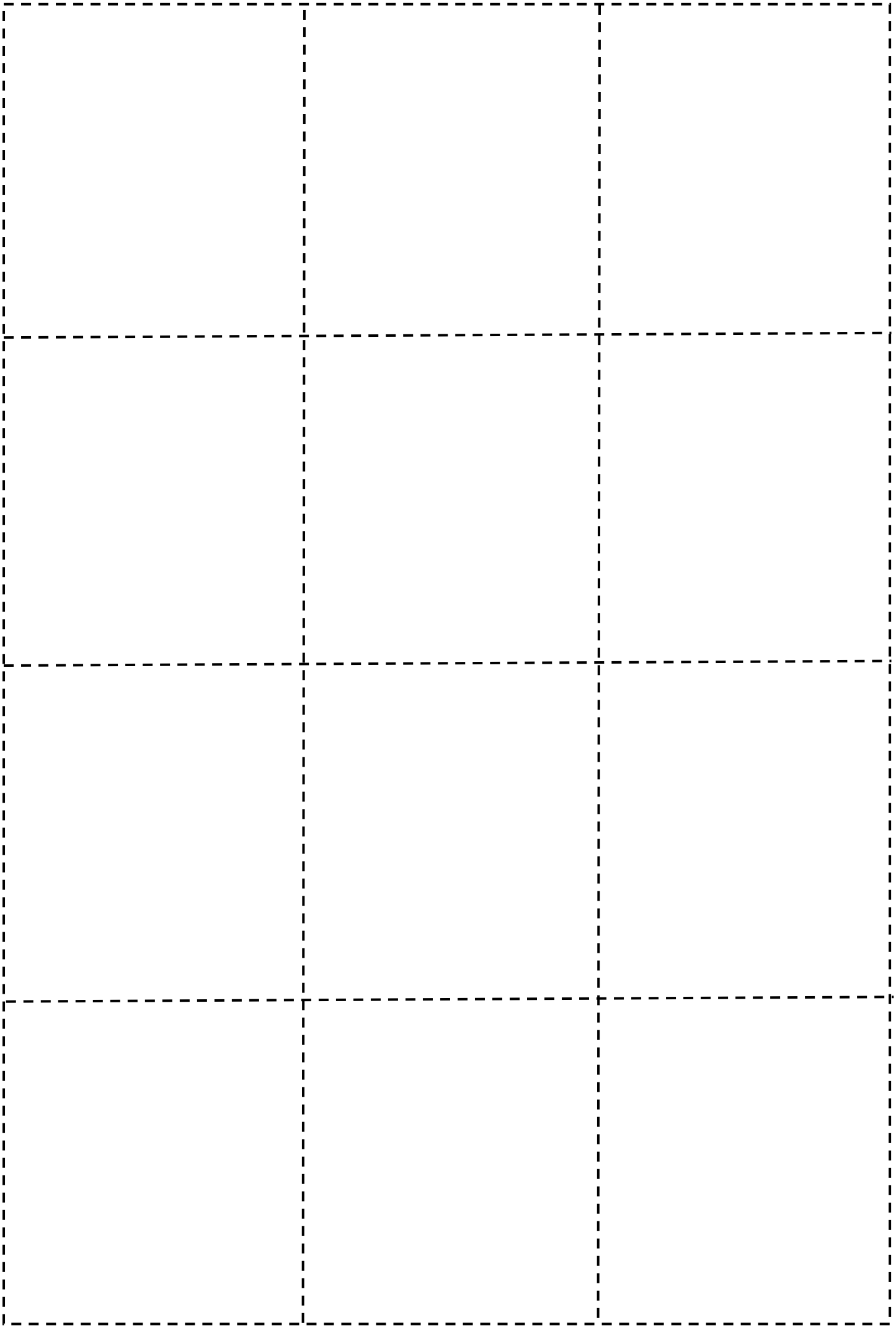
1. **Using a larger current.**
2. **Using an iron core.**
3. **Add more turns to the wire.**
4. **Place the turns of the wire more closely together.**

i

A student draws on paper the field lines around a magnet. They are close together. What does this tell you about the strength of the magnet?

It is a strong magnet.





Topic 3: Magnetism and Electromagnetism

Question Card Storage