PHYSICS FORM 2 TOPICAL QUESTIONS

MAGNETISM

1. (a) A magnet is placed on a bench, as shown in Fig. 8.1a. End P of a rod is held above each end of the magnet in turn, as shown in Fig. 8.1b and in Fig. 8.1c. One end of the magnet is lifted off the bench in both cases.

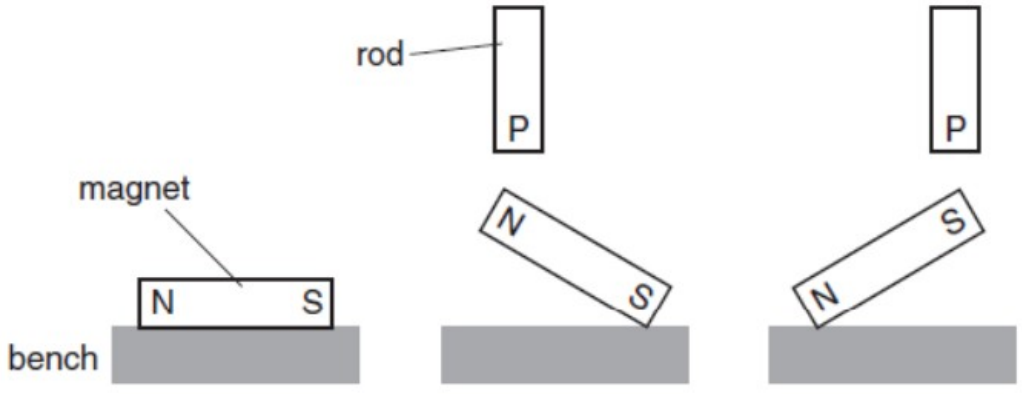


Fig. 8.1a **Fig. 8.1b** **Fig. 8.1c**

(i) Suggest what material the rod is made from.

.....[1]

(ii) Explain how the rod lifts each end of the magnet off the bench.

[2]

(b) Fig. 8.2 and Fig. 8.3 show views of a wire carrying a current downwards through a horizontal board.

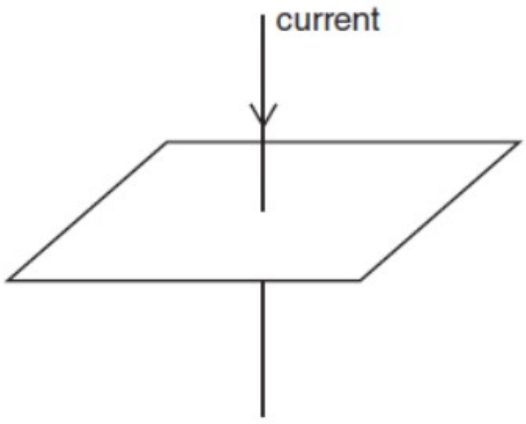


Fig. 8.2

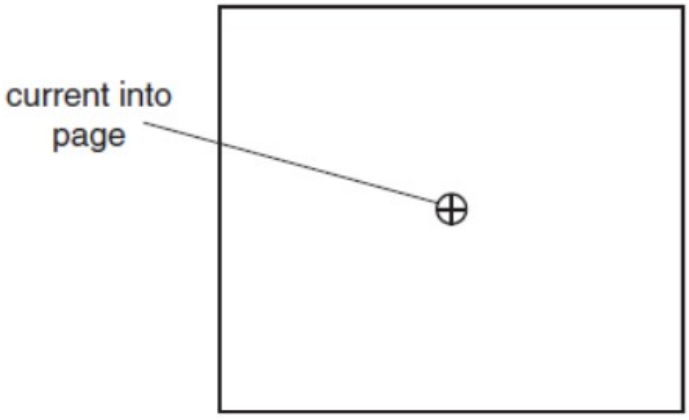


Fig. 8.3 (viewed from above)

(i) On Fig. 8.3, draw the magnetic field due to the current in the wire. [2]

(ii) The magnetic field is stronger closer to the wire. State how the magnetic field lines indicate that the field is stronger.

[1]

2. (a) Describe an experiment to plot the magnetic field around a bar magnet.

[5]

(b) Describe how a coil of wire may be used
(i) To make a bar magnet,
(ii) To demagnetise a bar magnet.

[3]

(c) State how the magnetic properties of iron make it a suitable material for the core of an electromagnet.

[2]

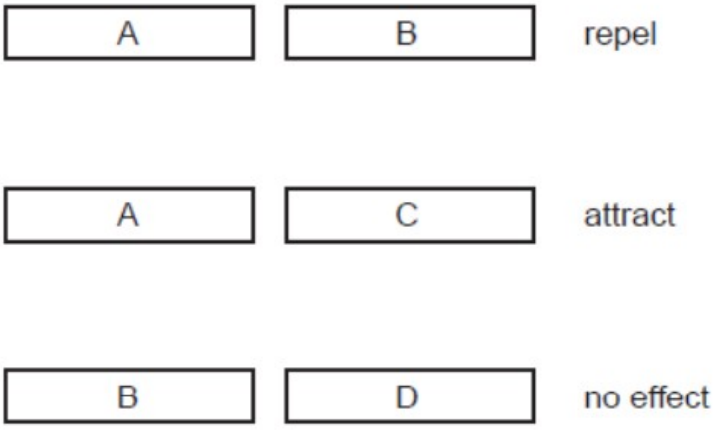
[Total: 10]

3. (a) State what is meant by a magnetic field.

[2]

4. A, B, C and D are an aluminium bar, an unmagnetised iron bar and two bar magnets. Tests are performed to find out which bar is which.

Each row of figure below shows what happens when two of the bars are placed end to end.



Which bar is which? Complete the lines below.

Bar A is.....

Bar B is.....

Bar C is.....

Bar D is.....

[4]

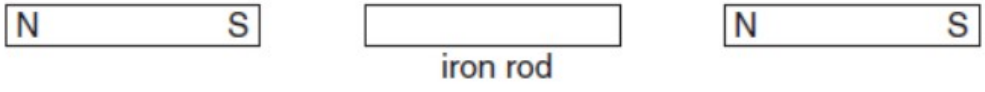
5. (a) An iron rod is placed next to a bar magnet, as shown in Figure below.

[For each of the following question select the answer from the following words]

nothing	
they attract	
they repel	

(i) On figure, mark clearly the north pole and the south pole that are induced in the iron rod.
(ii) What happens to the magnet and the rod?

(b) A second bar magnet is now placed next to the iron rod, as shown in Figure below.



(i) On Figure, mark clearly the magnetic poles induced in the iron rod. [1]
(ii) What happens to the iron rod and the second magnet?

What happens to the two magnets?

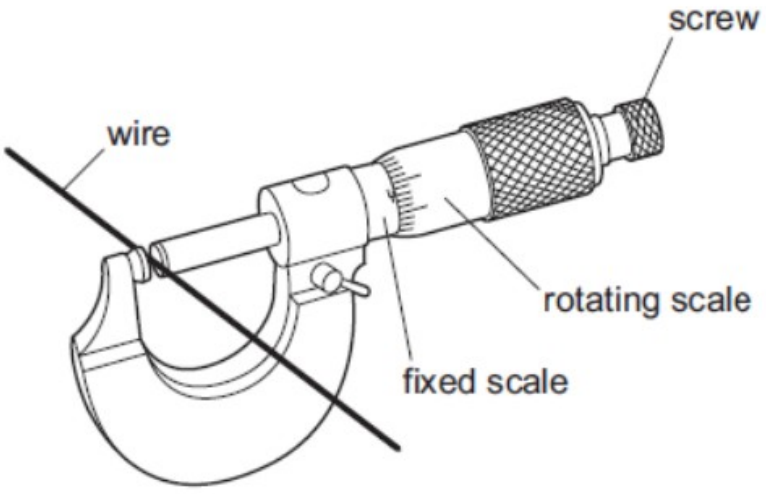
(d) The second magnet is removed and replaced by a charged plastic rod, as shown in Figure below.

What happens to the magnet and the plastic rod?

[6m]

MEASUREMENTS II

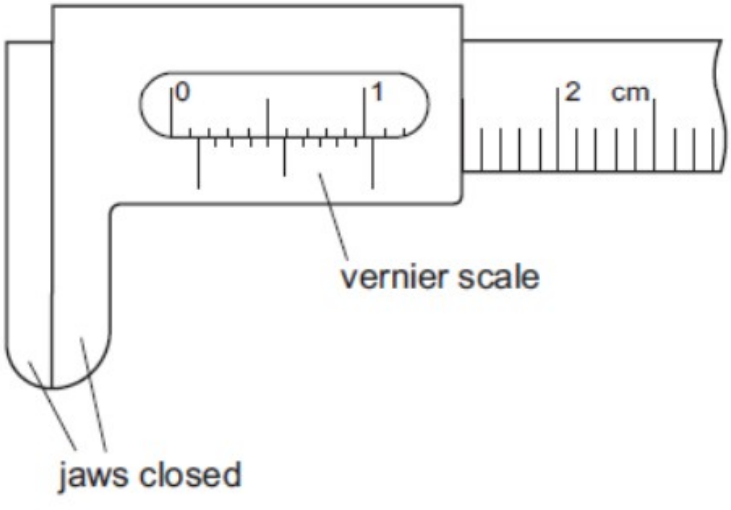
1. A micrometer is used to measure the diameter of a uniform wire.



What is done to obtain an accurate answer?

A. Find the reading and add or subtract the zero error.
B. Make the micrometer horizontal.
C. Subtract the fixed scale reading from the rotating scale reading.
D. Subtract the rotating scale reading from the fixed scale reading.

2. Vernier calipers are shown with the jaws closed.



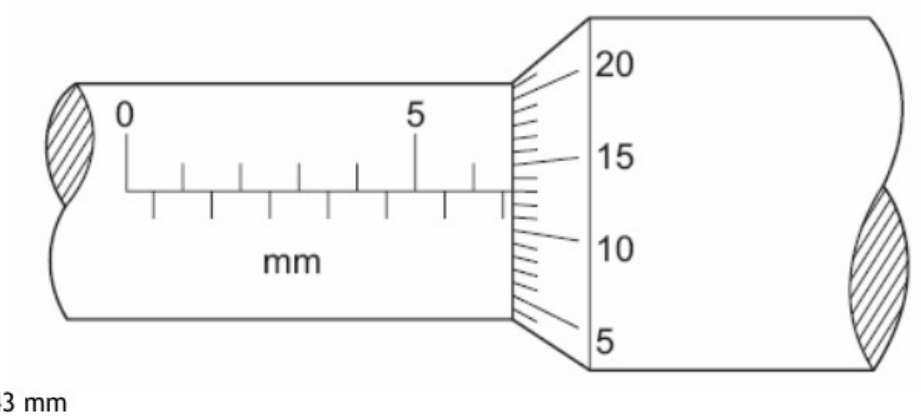
What is the zero error?
A 0.04 cm

B 0.05 cm
C 0.14 cm
D 0.15 cm

3. Sub-multiples of units may be expressed using a prefix. Which **one** of the following lists the prefixes in **decreasing** order of magnitude?

A.	centi-	micro-	milli-	nano-
B.	milli-	centi-	nano-	micro-
C.	centi-	milli-	micro-	nano-
D.	milli-	micro-	centi-	nano-

4. What is the reading on this micrometer?



A 5.43 mm
B 6.63 mm
C 7.30 mm
D 8.13 mm

5. Fig. 3.1 shows a micrometer screw gauge.

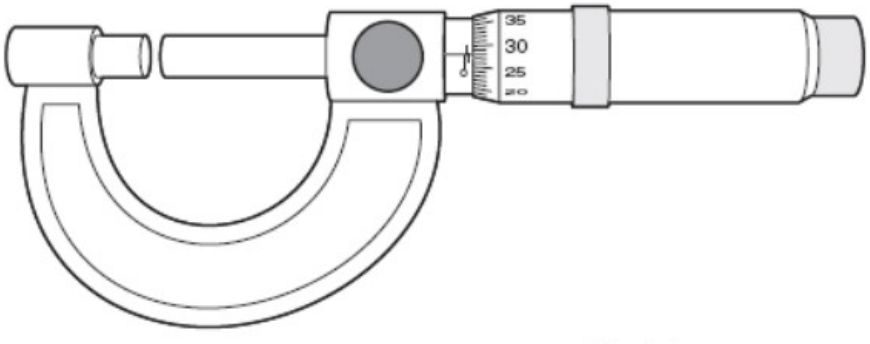


Fig. 3.1

(a) A student checks that there is no zero error on this micrometer.
Explain what is meant by a zero error on a micrometer.

[1]

(b) The student uses the micrometer to determine the thickness t of a sheet of paper. The student folds the paper in half three times and measures the total thickness of the folded paper. The micrometer is shown in Fig. 3.2.

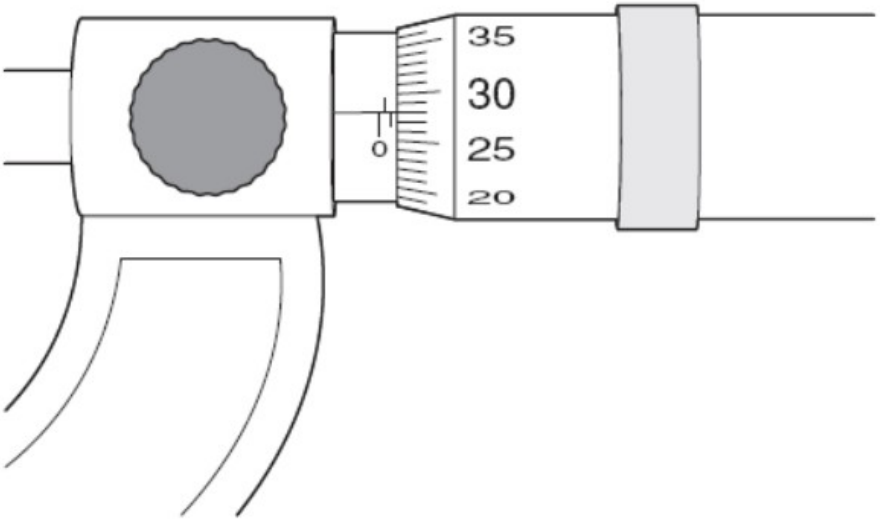


Fig. 3.2

Use Fig. 3.2 to find t. Show your working.

t = ... mm [3]

(c) Some modern micrometers are digital, as shown in Fig. 3.3.

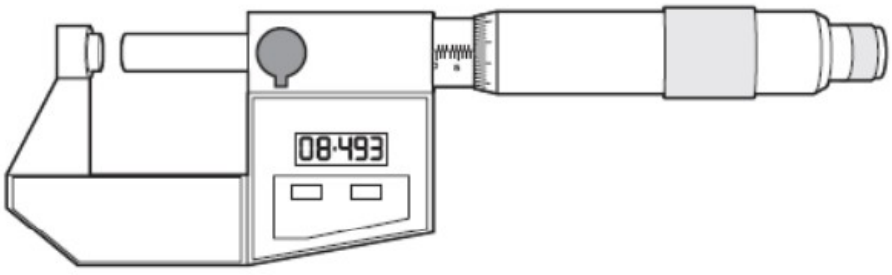


Fig. 3.3

(i) Suggest one advantage of a digital micrometer.

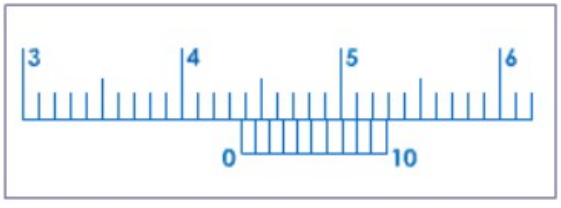
..... [1]

(ii) Suggest one disadvantage of a digital micrometer.

..... [1]

[Total 6m]

6. The diagram shown is a section of Vernier Calliper.



Find;

(i) The least count of the instrument

[2m]

(ii) The final reading, which is the thickness of a metal sheet.

[2m]

[Total 4m]

7. A micrometer screw gauge is used to measure the diameter of a copper wire. The reading with the wire in position is shown in diagram 1. The wire is removed and the jaws of the micrometer are closed. The new reading is shown in diagram 2.

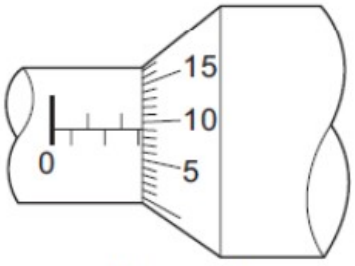


diagram 1

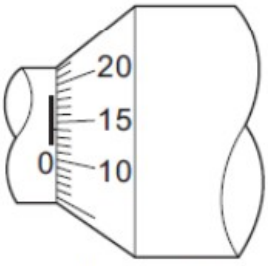
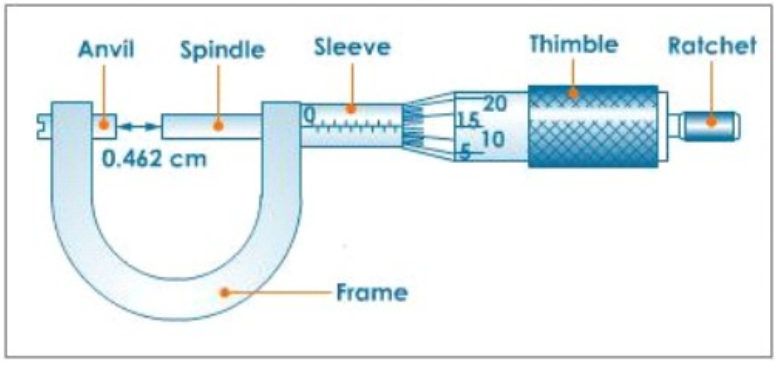


diagram 2

What is the diameter of the wire?

[3m]

8. The figure below shows a micrometer screw gauge.



(i) Explain how you would use it to measure the diameter of a wire

.....

.....

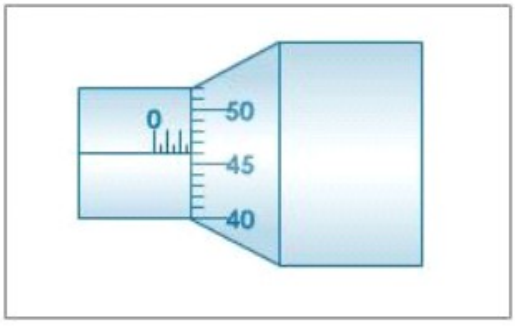
.....

..... [3m]

(ii) What do you understand by **least count** of a measuring instrument?

..... [1m]

(iii) The sketch below shows one such reading of the diameter of a given wire.



Read-off the diameter of this new wire.

[2m]
[Total 7m]

TURNING EFFECT OF A FORCE

1. The weight of an object is to be found using the balance shown in the diagram.

Weights in the right-hand pan	Effect
0.1 N, 0.1 N, 0.05 N, 0.02 N	balance tips down slightly on the left-hand side
0.2 N, 0.1 N, 0.01 N	balance tips down slightly on the right-hand side

What is the best estimate of the weight of the object?

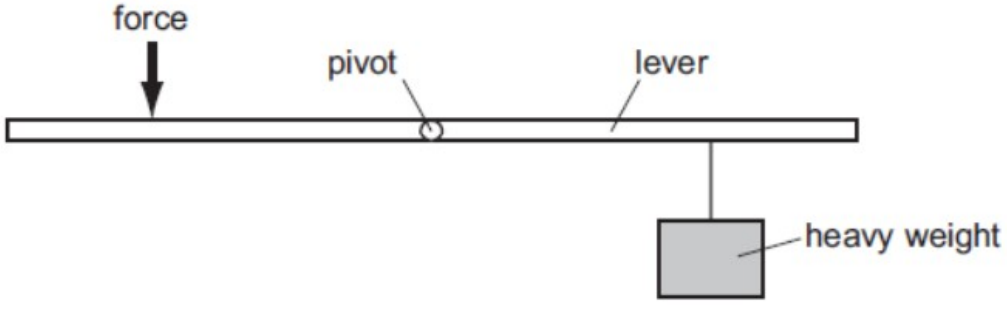
A. 0.27 N

B. 0.29 N

C. 0.31 N

D. 0.58 N

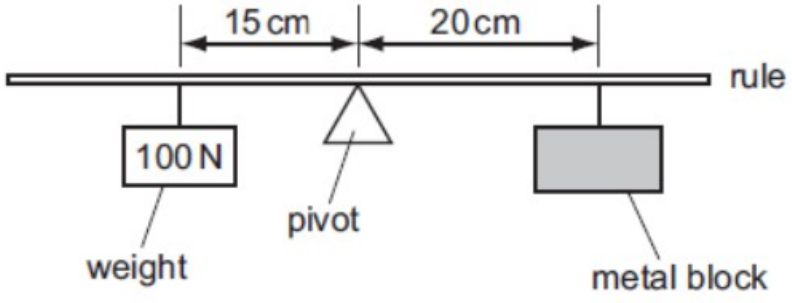
2. The diagram shows a force being applied to a lever to lift a heavy weight.



Which change would enable the heavy weight to be lifted with a smaller force?

A. Move the force to the right.
B. Move the heavy weight to the right.
C. Move the force to the left.
D. Move the pivot to the left.

3. The diagram shows a uniform half-metre rule balanced at its mid-point.



What is the weight of the metal block?

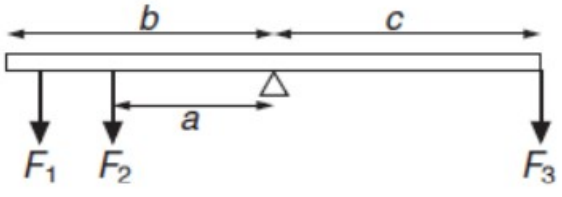
A. 50 N

B. 75 N

C. 100 N

D. 150 N

4. A beam is pivoted at its centre. Three forces, *F*1, *F*2 and *F*3, act on the beam as shown in the figure below.



When the beam is released, the right-hand side of the beam starts to go down.
Which of the three distances, *a*, *b* or *c*, should be decreased in order to balance the beam? Explain your answer.

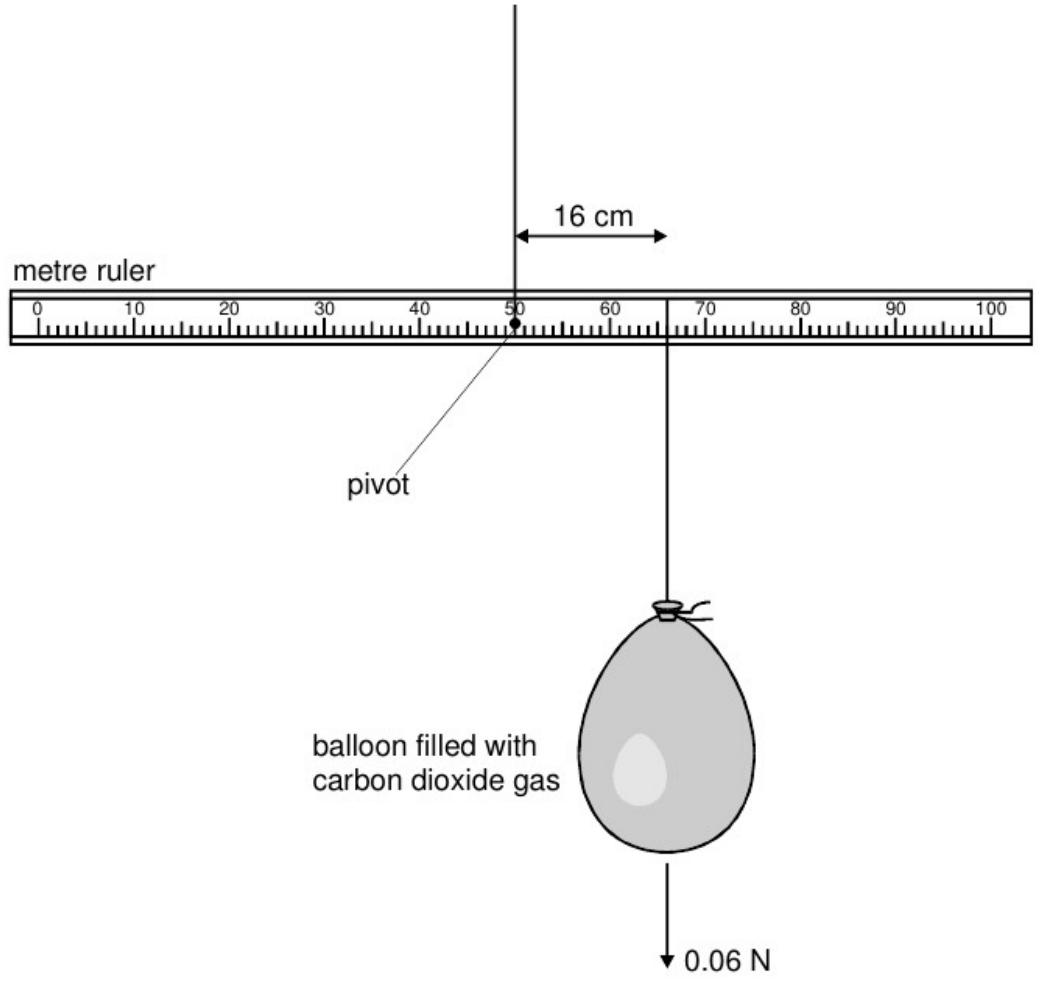
Which distance? .....

Explanation

[3]

5. Alex has a 100 cm ruler pivoted at the centre. She ties a balloon filled with carbon dioxide 16 cm from the pivot, as shown below.

The total weight of the balloon and carbon dioxide is 0.06 N.



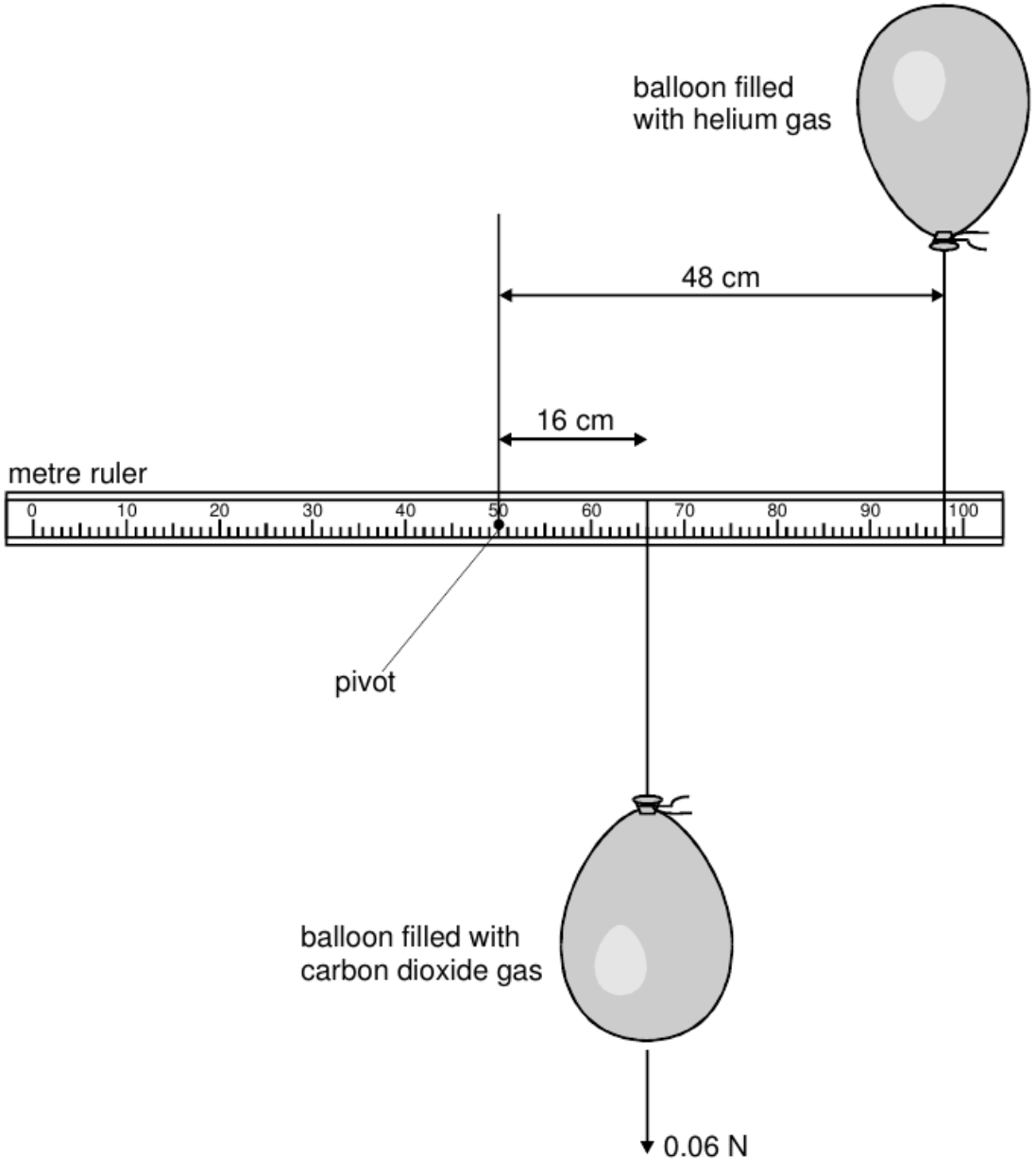
(a) The ruler becomes unbalanced.
Calculate the turning moment the balloon produces about the pivot on the ruler.
Give the unit.

.....

.....

2 marks

(b) Alex ties another similar balloon, filled with helium, 48 cm from the pivot.
The helium balloon exerts an upward force on the ruler.
The ruler is balanced as shown below.



(i) When the ruler is balanced, what turning moment must the helium balloon

produce about the pivot?

.....

1 mark

(ii) Calculate the upward force exerted by the helium balloon on the ruler.

.....

.....

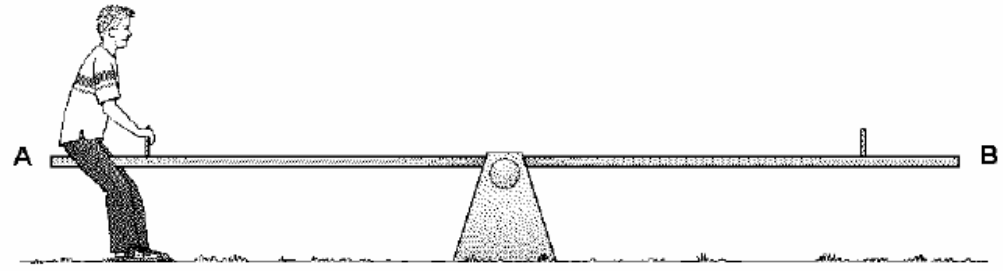
1 mark

Maximum 4 marks

6. Five people take it in turns to sit on a see-saw. The table gives the weight of each person.

person	weight, in N
Jack	510
Ellie	540
Rosie	490
Maggy	540
Andy	560

(a) Andy sits at one end, but there is nobody on the other end.



Andy sits on the see-saw.
In which direction does his end of the see-saw move?

.....

1 mark

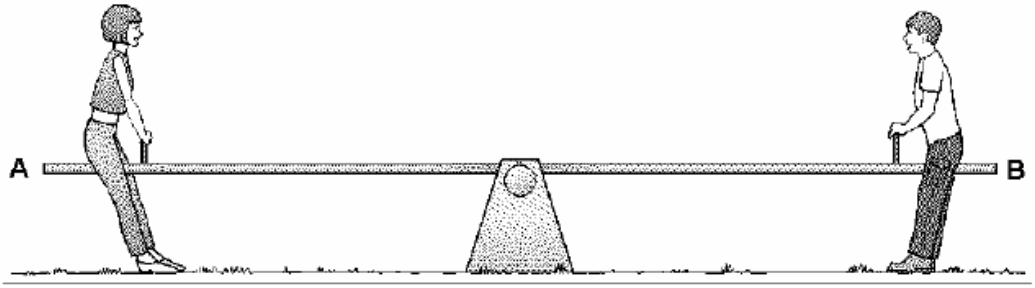
(b) Which **two** people in the table above could make the see-saw balance?

……..…….…..…..and……..…….……..…..

1 mark

Use information in the table to help you answer parts (c) and (d).

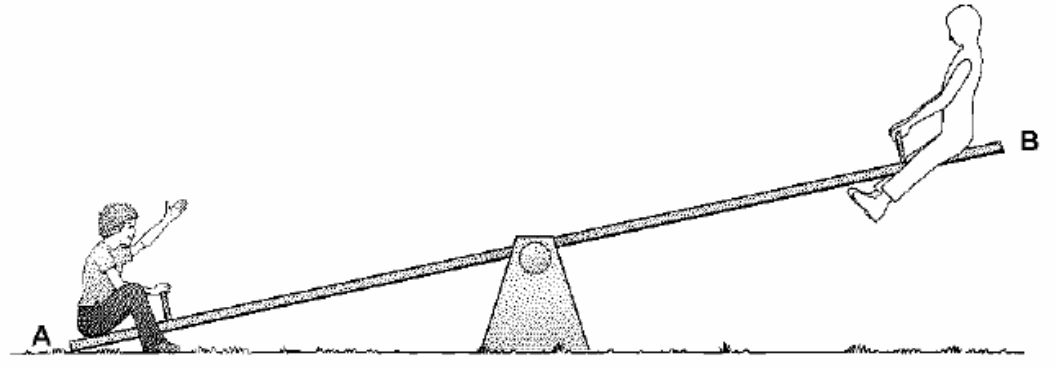
(c) Rosie sits on end A, and Jack sits on end B.



They lift their feet.
What happens to each end of the see-saw?
Write **up** or **down** in the boxes under Rosie and Jack.

1 mark

(d) Ellie sits on end A, and another of the group sits on end B.
Ellie's end stays down.



Who could be on end B?

……

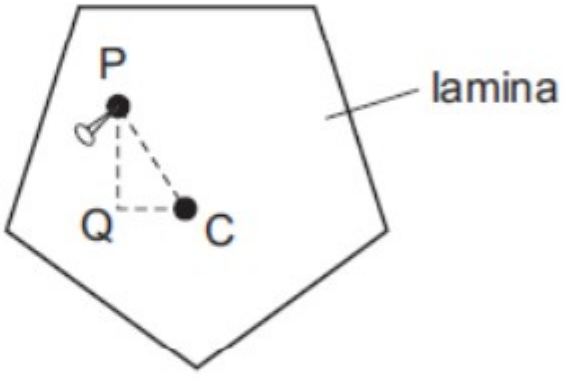
1 mark

Maximum 4 marks

EQUILIBRIUM AND CENTRE OF GRAVITY

1. A flat lamina is freely suspended from point P.
The weight of the lamina is 2.0 N and the centre of mass is at C.

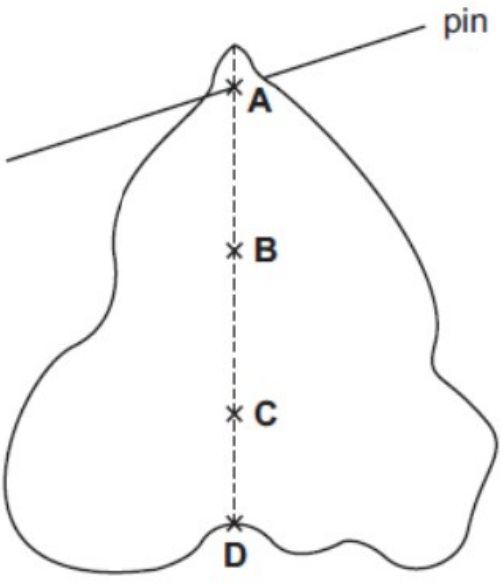
PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m



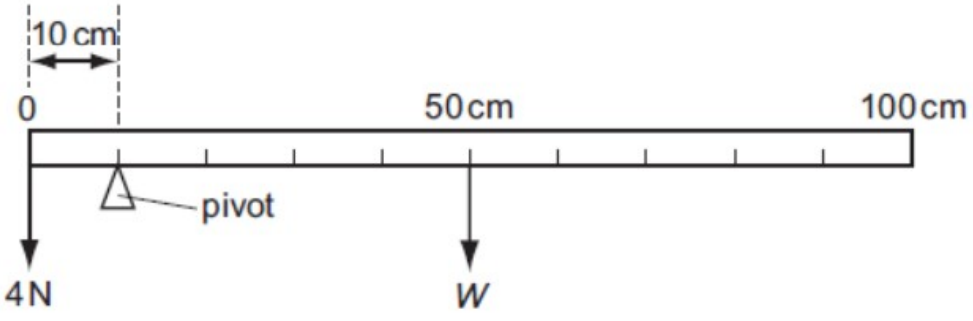
The lamina is displaced to the position shown.
What is the moment that will cause the lamina to swing?

A 0.60 N m clockwise
B 0.80 N m anticlockwise
C 1.0 N m clockwise
D 1.0 N m anticlockwise

2. A piece of uniform card is suspended freely from a horizontal pin.
At which of the points shown is its centre of gravity?



3. A uniform metre rule is balanced by a 4 N weight as shown in the diagram.



What is the weight W of the metre rule?

A 1 N
B 4 N
C 16 N
D 40 N

4. (a) Masses are hung from the end of a helical spring and the following results are obtained.

Mass/g	0	50	100	150	200	250
Length of spring/cm		5.0	6.0	7.0	8.0	9.0

(i) What is the length of the unstretched spring?

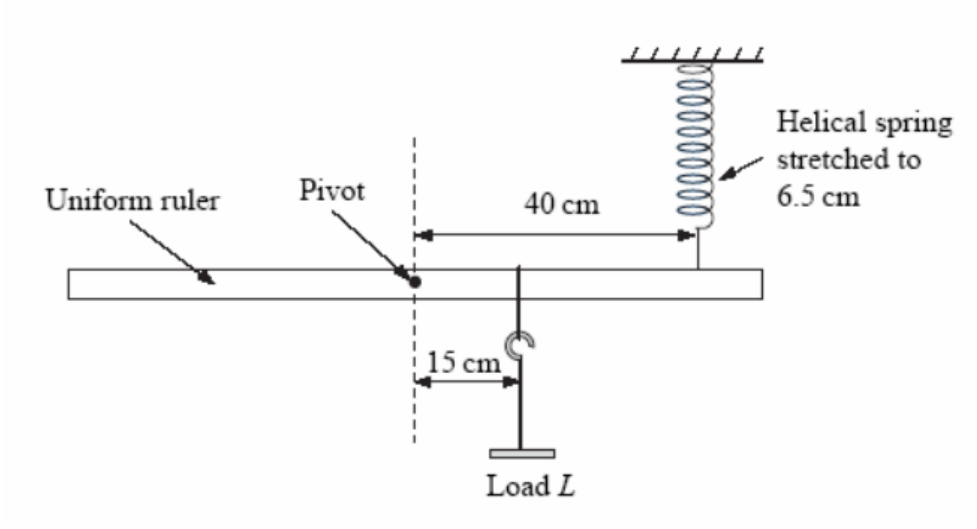
..... (1)

(ii) What force is needed to stretch the spring to a length of 6.5 cm?

.....

..... (2)

(b) A uniform ruler is pivoted at its centre of mass. The same spring is attached to a point 40 cm from the pivot as shown. A load L is hung on the ruler at a point 15 cm from the pivot. This stretches the spring to a length of 6.5 cm. The ruler remains horizontal.



Use the information provided to calculate the mass of the load L.

.....

.....

.....

..... (3)

[Total 6m]

5. (a) State the two conditions required for the equilibrium of a body acted upon by a number of forces.

1. .....

.....

2. .....

.....[2]

(b) Fig. 3.1 shows a diagram of an arm with the hand holding a weight of 120 N.

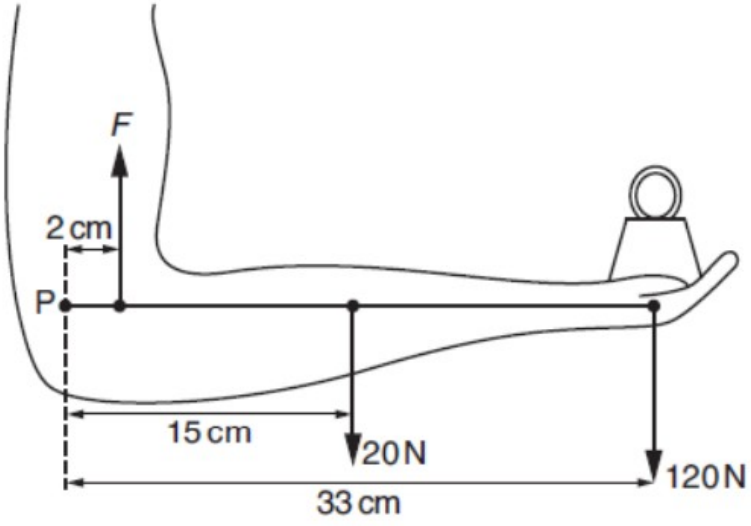


Fig. 3.1

The 20 N force is the weight of the forearm, acting at its centre of mass. F is the force in the muscle of the upper arm. P is the point in the elbow about which the arm pivots. The distances of the forces from point P are shown.

(i) By taking moments about point P, calculate the force **F**.

force *F* = ...[3]

(ii) A force acts on the forearm at point P. Calculate this force and state its direction.

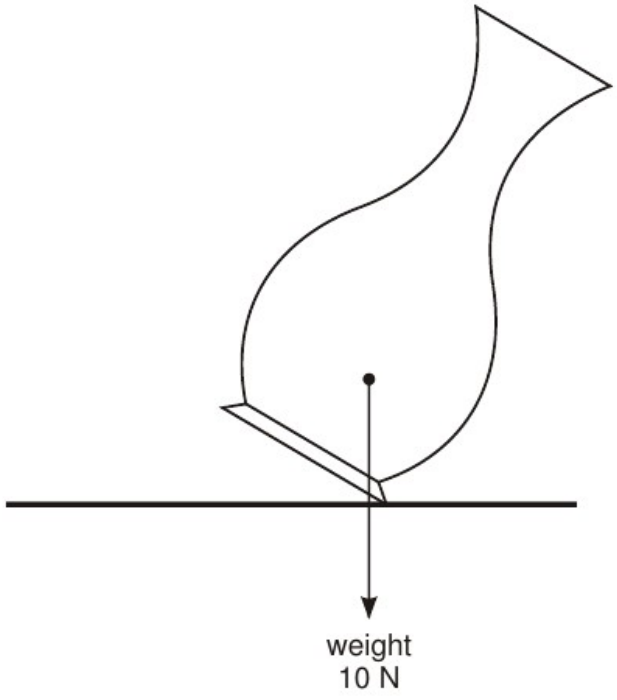
force = ...

direction = ...[2]

[Total: 7]

6.

(a)



A vase is held at an angle as shown in the diagram above. When it is released it falls back on its base.

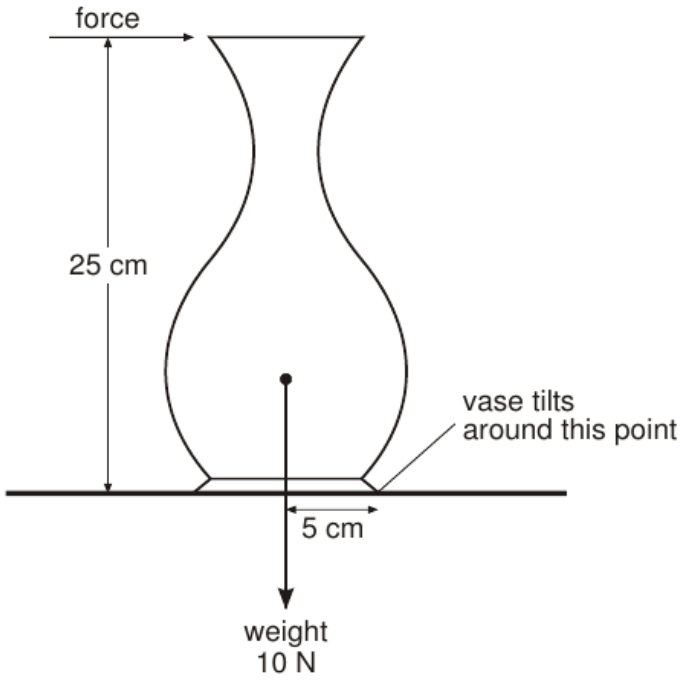
Explain why, in terms of moments.

……

……

1 mark

(b)



In the diagram above, the top of the vase is being given a push.
The force is just large enough to make the vase start to tilt.

(i) Calculate the size of the force. Show your working and give the correct unit.

.....

.....

.....

.....

.....

3 marks

(ii) If the base of the vase were wider, a larger force would be needed to make the vase start to tilt. Explain why, in terms of moments.

.....

.....

1 mark

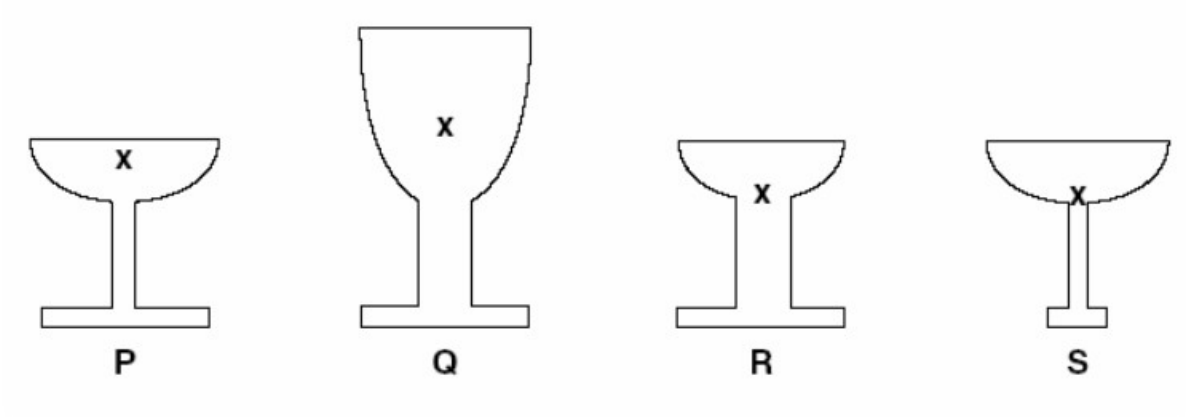
Maximum 5 marks

7. (a) An athlete wins a trophy for completing a 200 m race in a time of 25 s. Calculate the average speed of the athlete.

Show your working and state the unit.

speed = ... [3]

(b) Fig. 5.1 shows four designs for the trophy, **P**, **Q**, **R** and **S**. The position of the centre of mass of each trophy is marked with an **X**.



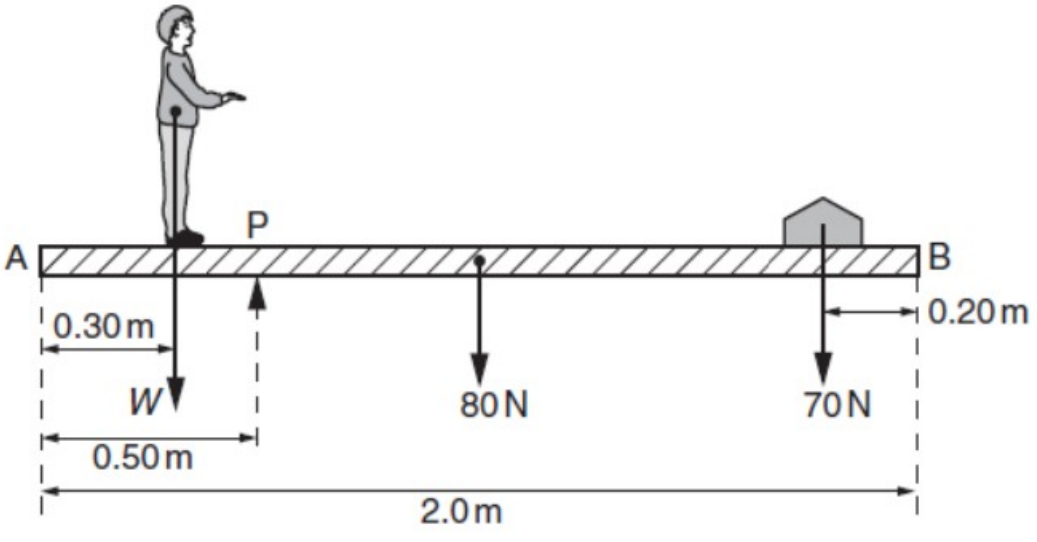
State and explain which trophy would be the most stable.

.....

.....

..... [3]

8. A student is being weighed. The student, of weight W, stands 0.30 m from end A of auniform plank AB, as shown in Figure below.



The plank has weight 80 N and length 2.0 m. A pivot P supports the plank and is 0.50 m from end A. A weight of 70 N is moved to balance the weight of the student. The plank is in equilibrium when the weight is 0.20 m from end B.

(i) State the two conditions necessary for the plank to be in equilibrium.

1

2

[2]

(ii) Determine the weight W of the student.

W = ... N [3]

(iii) If only the 70 N weight is moved, there is a maximum weight of student that can be determined using the arrangement shown in Fig. 3.1. State and explain one change that can be made to increase this maximum weight.

[2]

RRFLECTION AT CURVED SURFACES

1. Most U.S. passenger cars manufactured in recent years have slightly convex side mirrors on the right side.
Suppose your car is equipped with a convex mirror that has a radius of curvature of 7.24 m. How far away will a following car appear to be if it is actually 15.5 m away?

[4m]

2. A candle is placed 15 cm from the vertex of a concave mirror that has a focal length of 10 cm.

a) Locate the position of the image [1m]

b) Find the magnification of the image. [1m]

c) Describe the characteristics of the image.[2m]

[Total 3m]

3. A baby mouse 1.2 cm high is standing 4.0 cm from a converging mirror having a focal length of 300 cm.

a) Locate the position of the image by means of [1m]

b) Determine the height of its image. [1m]

[2m]

4. Determine the image distance and image height for a 5.00-cm tall object placed 45.0 cm from a concave mirror having a focal length of 15.0 cm.
(a) The image distance

[2m]

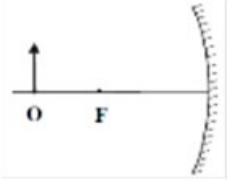
(b) Image height

[1m]

5. Use a ray diagram to show the formation of a real image by a concave mirror.

[3m]

6. Complete the following diagram to show how a concave mirror forms an image of an object O, which is placed outside the focus F of the mirror.



[3m]

7. A 60 cm tall red rose is placed 40 cm from a large convex mirror of focal length 20 cm.
a) Locate the position of the image [1m]

b) Find the magnification of the image. [1m]

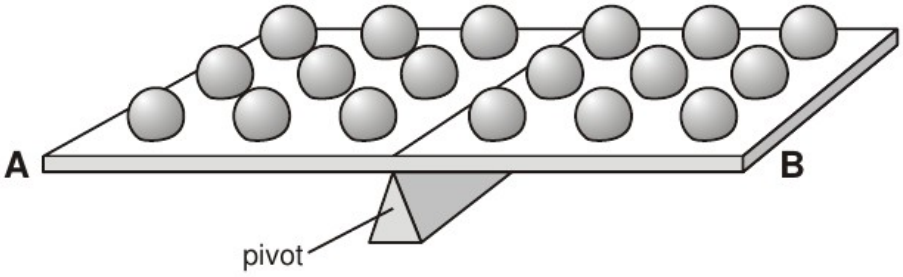
c) What is the height of the image? [1m]

d) Describe the characteristics of the image.[1m]

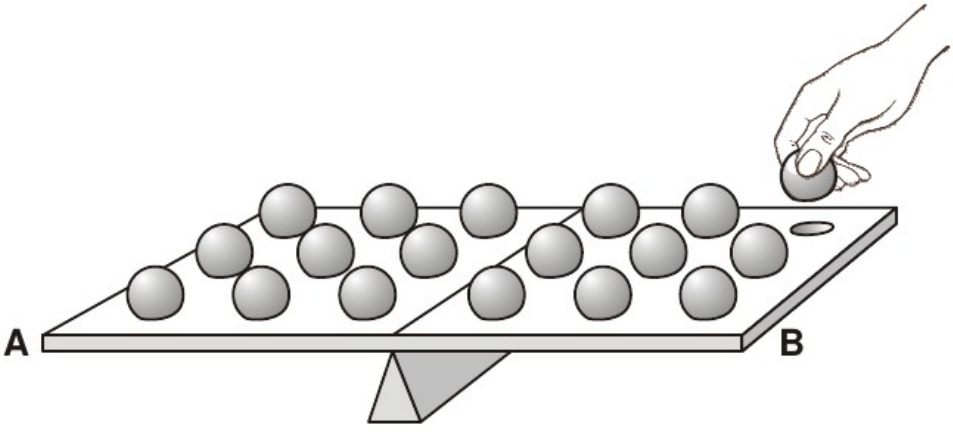
[4m]

ELECTROMAGNETISM 1

1. Fran has a balancing game.
On each side of the pivot there are nine steel balls. The tray is balanced.



(a) Fran removes one of the steel balls as shown below.



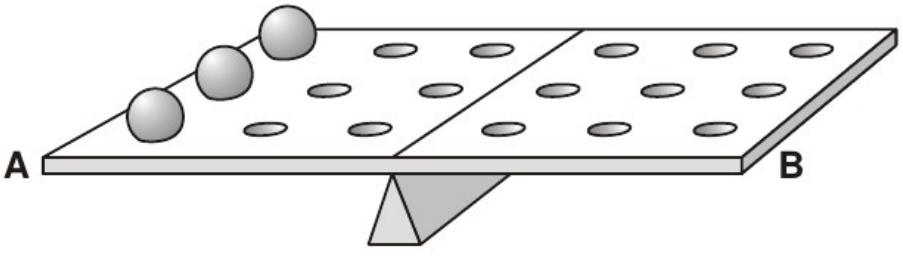
What will happen to end A?

.....

1 mark

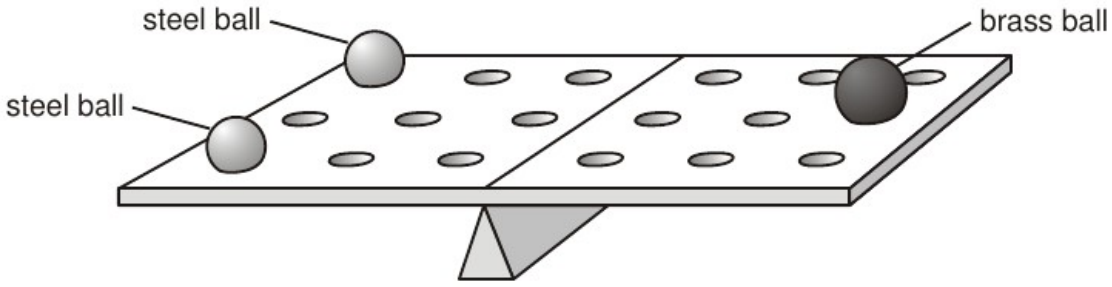
(b) There are three balls on side A as shown below.

Draw three other balls in the correct positions to balance the tray.



1 mark

(c) Fran puts two steel balls on one side and one brass ball on the other side.
The tray is balanced.



The mass of each steel ball is 50 g.

What is the mass of the brass ball

..... g

1 mark

(d) The table below gives information about the brass and steel balls.

	Is it attracted to a magnet?	elements in the ball
brass	no	copper and zinc
steel	yes	iron and carbon

(i) Which element is **not** a metal?
Tick the correct box.

carbon ☐ copper ☐

iron ☐ zinc ☐

1 mark

(ii) Look at the elements in the brass ball and the steel ball.

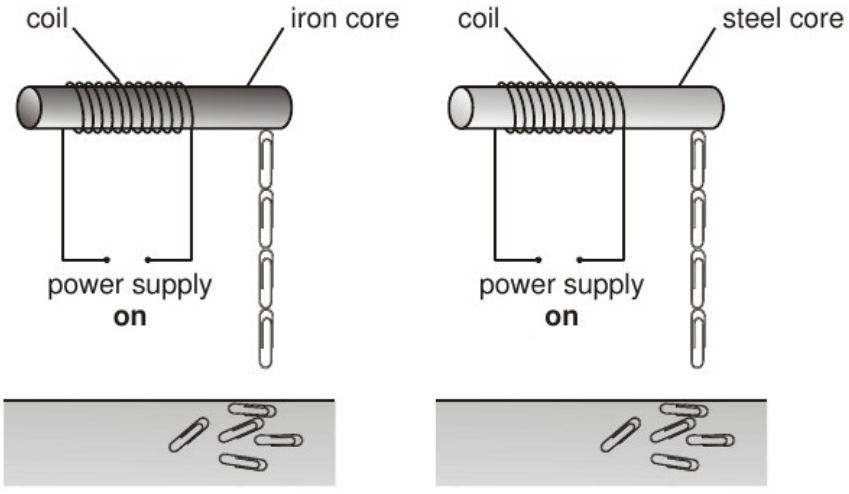
Why is steel attracted to a magnet but brass is **not**?

.....

1 mark

maximum 5 marks

2. David made two electromagnets as shown below.
He used paper-clips to test the strength of each electromagnet.
He switched on the power supply in both circuits.



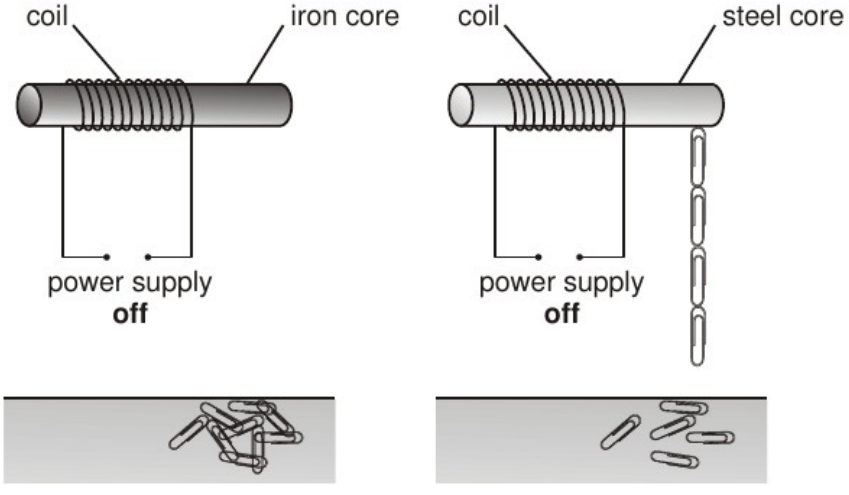
(a) How can you tell that the strength of both electromagnets is the same?

.....

.....

1 mark

(b) David switched off the power supply in both circuits.
The paper-clips fell off the iron core, but **not** off the steel core.



Why is iron used, rather than steel, for the core of an electromagnet?
Use the diagrams above to help you.

.....

.....

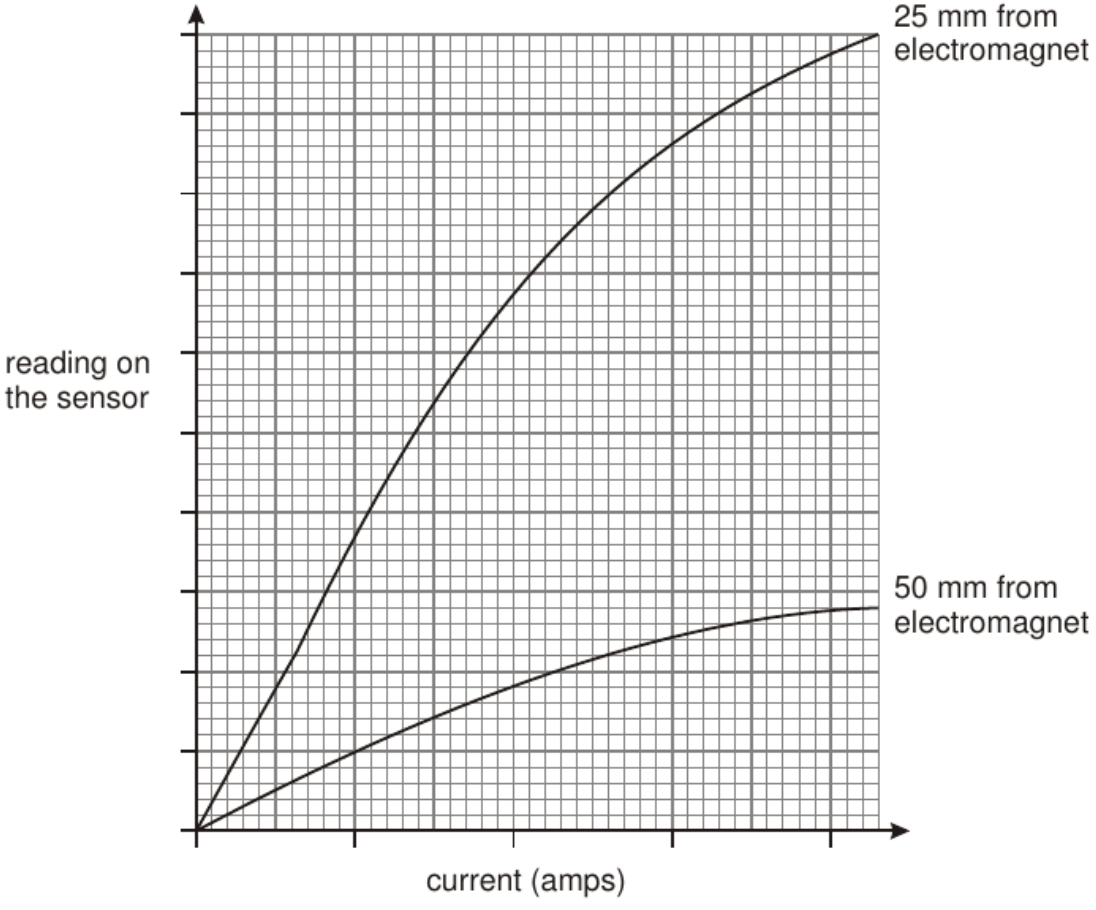
1 mark

(c) David used a sensor to measure the strength of an electromagnet.

He placed the sensor 25 mm from the electromagnet and increased the current in the coil.

He repeated the experiment with the sensor 50 mm from the electromagnet.

The graph below shows his results.



(i) How did the distance of the sensor from the electromagnet affect the reading on the sensor?

.....

.....

1 mark

(ii) How did the size of the current in the coil affect the strength of the electromagnet?

.....

.....

1 mark

(iii) What else could David do to an electromagnet to change its strength?

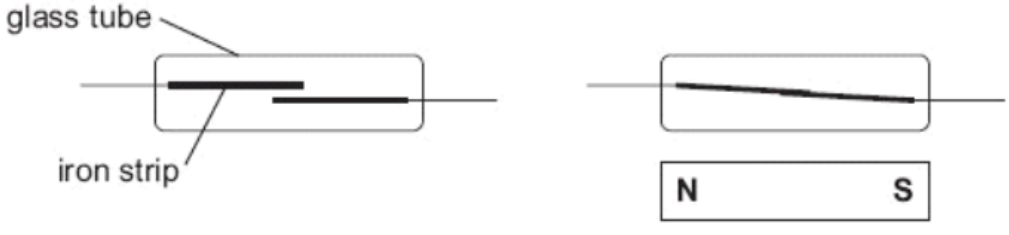
.....

.....

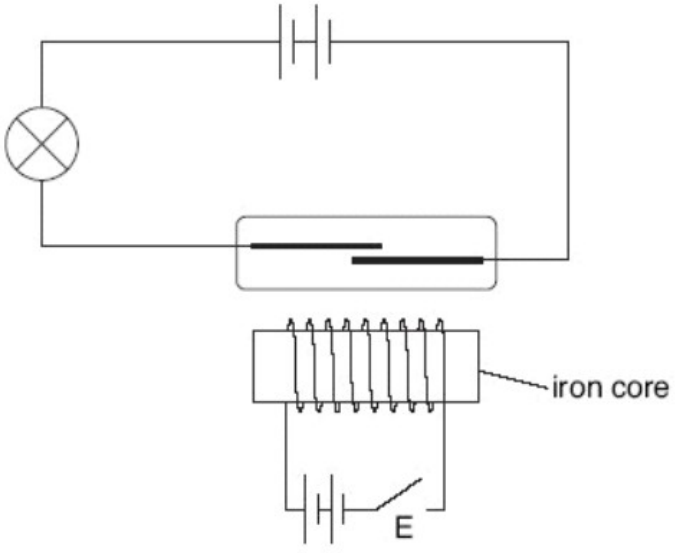
1 mark

maximum 5 marks

3. A reed switch is made of two iron strips inside a glass tube.
The iron strips close together when a magnet is brought near.
They spring apart again when the magnet is removed.



(a) Hilary set up the circuit shown below.
She tried to close the reed switch using an electromagnet.



She closed switch E but the electromagnet was **not** strong enough to close the reed switch.

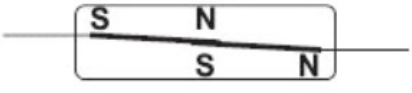
(i) Give **two** ways Hilary could increase the strength of the electromagnet.

1. .....

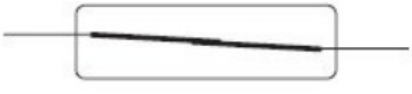
2. .....

2 marks

(ii) Hilary increased the strength of the electromagnet.
The reed switch closed.
The iron strips were magnetised as shown below.



She reversed the current in the coil of the electromagnet.
On the diagram below, label the poles of the iron strips when the current was reversed.



1 mark

(b) (i) Iron and steel are both magnetic materials.
Explain why the strips must be made of iron and **not** steel.

.....

.....

1 mark

(ii) She replaced the reed switch with a piece of copper wire.
The current through the bulb increased.

Explain why more current flowed through the bulb when the reed switch was replaced with copper wire.

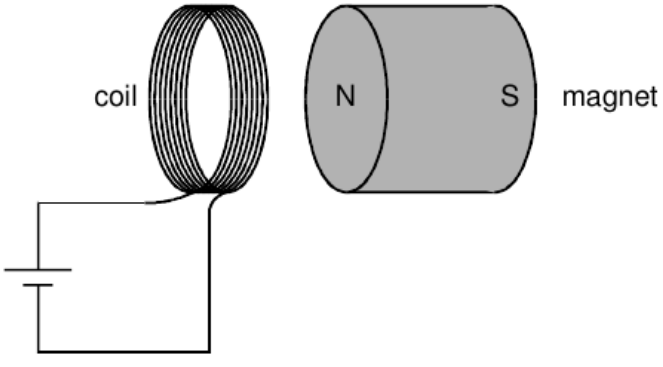
.....

.....

1 mark

maximum 5 marks

4. (a) A pupil makes a small coil of copper wire and passes an electric current through it.
The pupil places a small magnet near the coil.



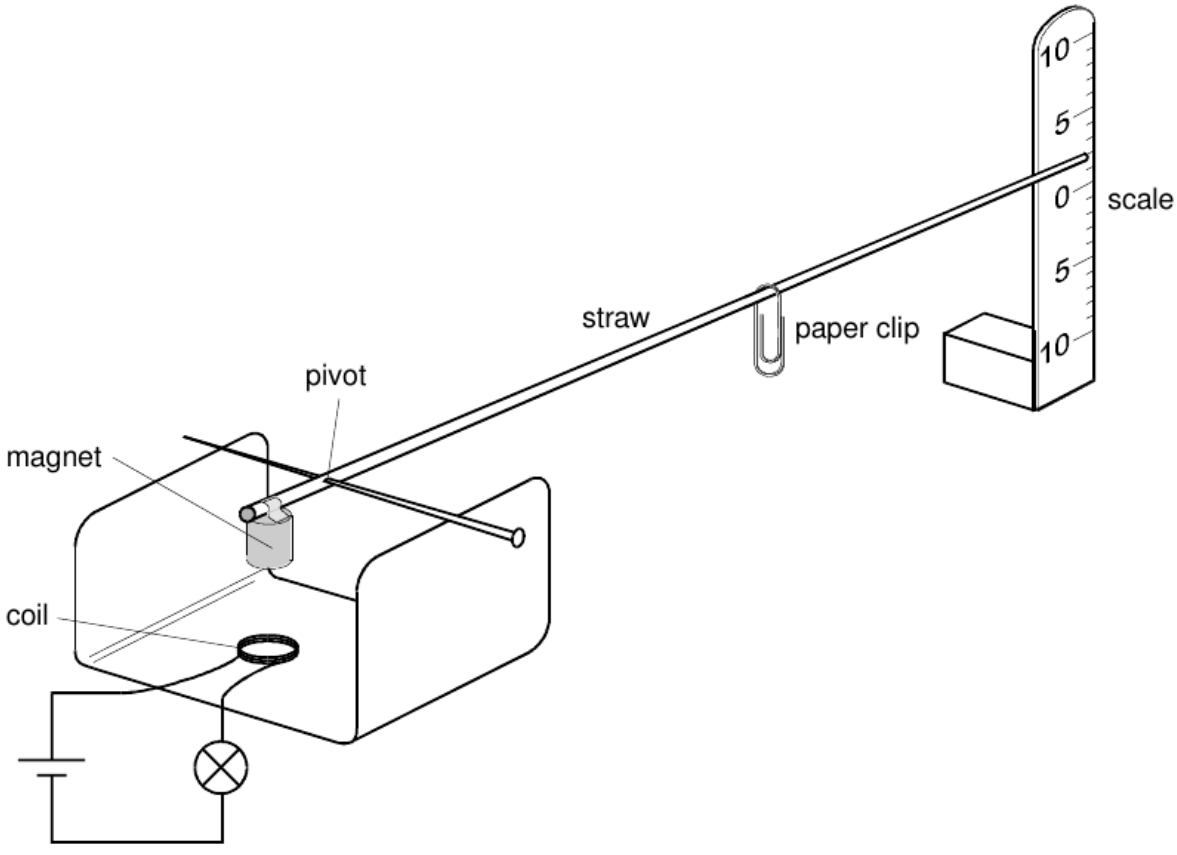
The magnet is attracted towards the coil. The pupil turns the magnet around so that the South pole is nearest the coil.
What effect, if any, will this have?

.....

.....

1 mark

(b) The pupil uses the coil and the magnet to make a simple ammeter to measure the current through a bulb.



not to scale

(i) The paper clip is used to balance the weight of the magnet.
Why is the paper clip further away from the pivot than the magnet is?

.....

.....

1 mark

(ii) Explain how a current in the coil makes the straw pointer move.

.....

.....

.....

2 marks

(iii) The pupil places a piece of soft iron in the middle of the coil. Describe and explain how this will affect the reading on the scale when the same current flows through the coil.

.....

.....

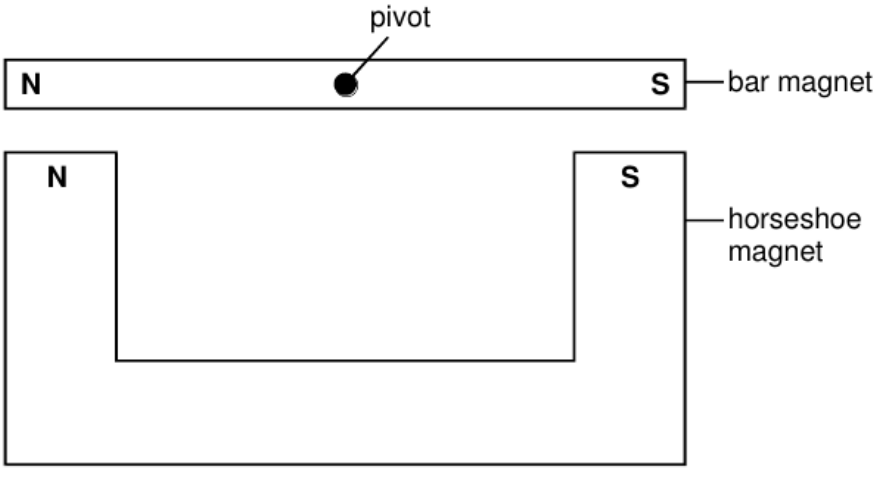
.....

.....

2 marks

Maximum 6 marks

5. Anita has arranged a horseshoe magnet with a long bar magnet pivoted above it.



(a) Whenever Anita tips the bar magnet, it always moves back to the position shown in the diagram. Explain why this happens.

.....

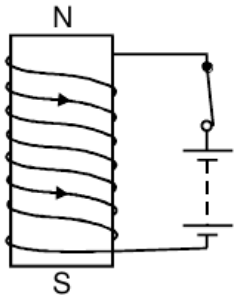
.....

.....

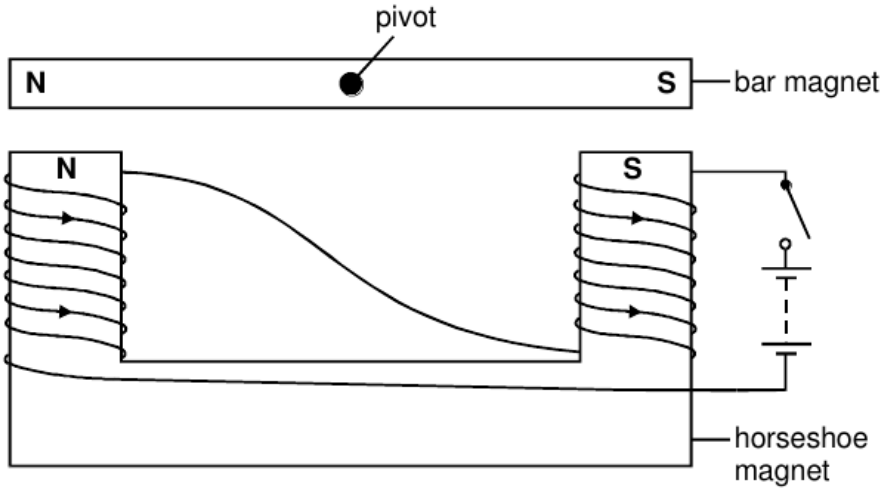
.....

2 marks

(b) When a current is passed through a coil, it produces magnetic poles as shown in the diagram below.



Anita winds a coil around each end of the horseshoe magnet as shown below.



(i) Describe what will happen to the bar magnet when she closes the switch. Explain your answer.

.....

.....

.....

.....

.....

.....

3 marks

(ii) Anita reverses the battery. Suggest what happens to the bar magnet.

.....

.....

1 mark

(iii) Anita replaces the battery with a power supply which changes the direction of the current every second. Suggest what happens to the bar magnet.

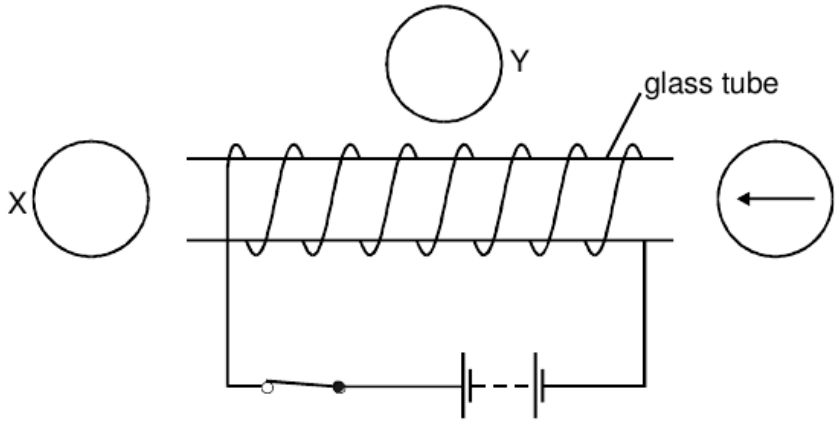
.....

.....

1 mark

Maximum 7 marks

6. A pupil wound a coil of copper wire around a glass tube and connected the wire to a battery. She placed a compass at each end of the tube and one compass beside the tube as shown.



(ii) When the switch was closed, the pieces of iron moved.
Explain why they moved.

.....

.....

1 mark

Maximum 7 marks

.....

1 mark

(b) Give **one** way to reverse the magnetic field around the glass tube

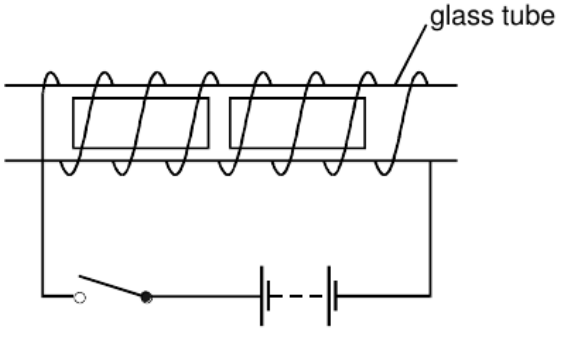
.....

.....

1 mark

(c) Two pieces of iron are placed inside the glass tube.

(i) When the switch is closed, the magnetic field is the same as in the diagram opposite. The pieces of iron become magnetised.
Label the **four** poles on the pieces of iron.



1 mark'

(ii) When the switch was closed, the pieces of iron moved.
Explain why they moved.

.....

.....

1 mark

Maximum 7 marks

HOOKE'S LAW.

1. Define **Hooke's Law**

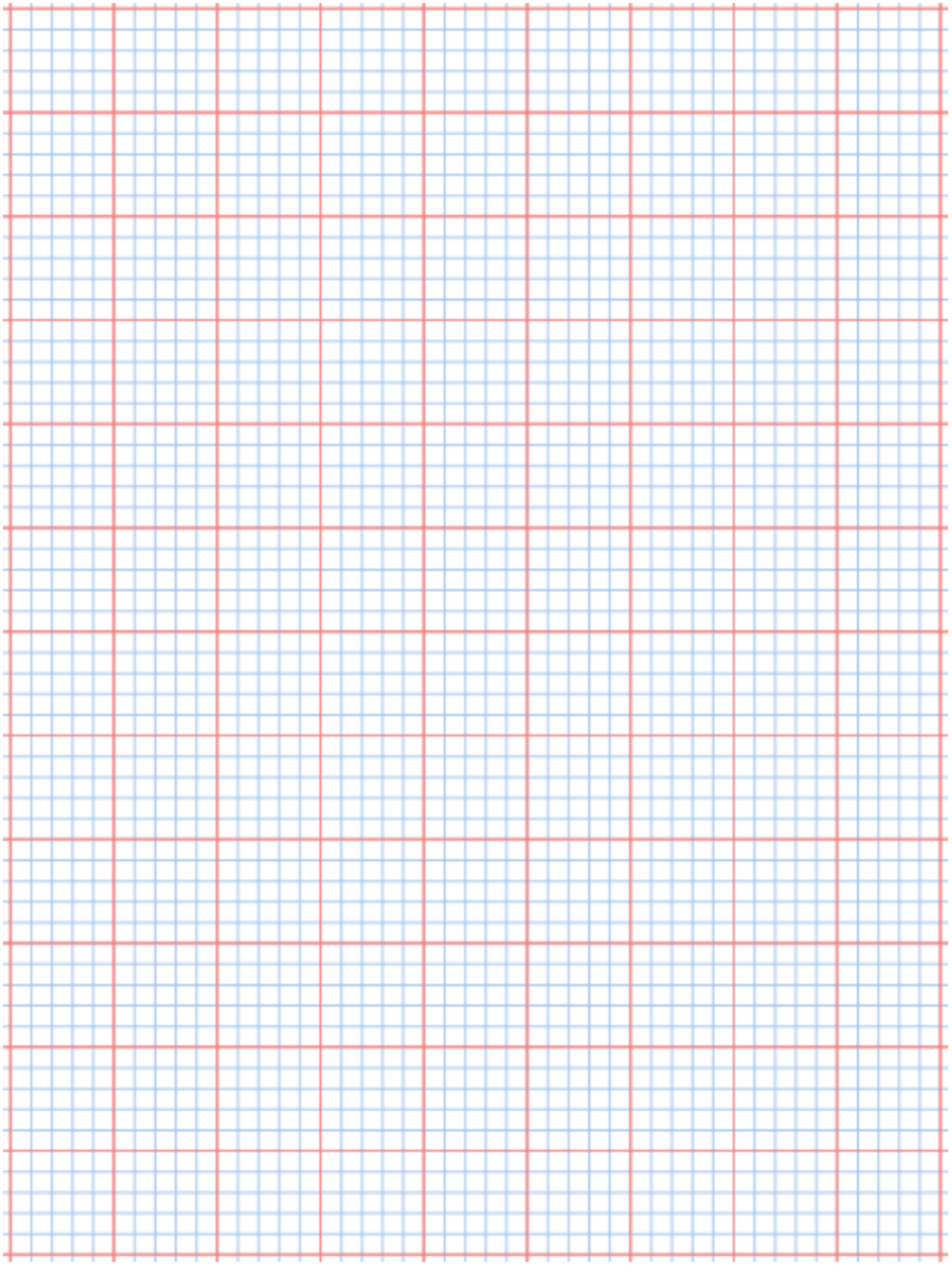
2. **In a Hooke's Law experiment, the following results were obtained.**

Load/N	Extension/cm
0.0	0.0
1.0	1.0
2.0	2.0
3.0	3.0
4.0	4.0
5.0	5.0
6.0	6.4

Plot a graph of **Load against Extension**

On your graph, show
a) Region where Hooke's Law is obeyed
b) The elastic limit

How would the spring constant be determined?

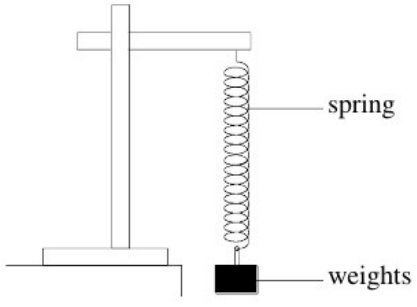


3. Sketch a diagram showing how you would arrange your apparatus to investigate the Force-extension relationship of a spring

4. (a) A spring extends by 10 cm when a mass of 100 g is attached to it. What is the spring constant?

(b) What will be the extension of this spring if the load is 75 g?
(c) If an identical spring were connected in parallel (do a sketch), what mass would need to be attached to produce an extension of 15 cm?
(d) What mass would be needed if two of these springs were placed in series (do a sketch) and an extension of 30 cm was required?

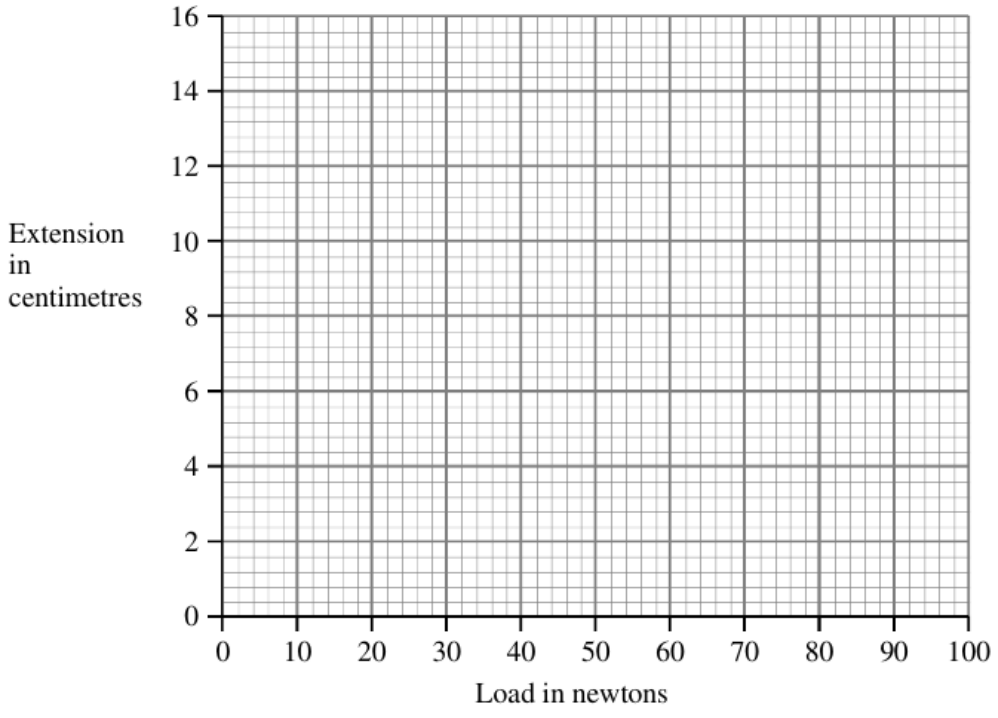
5. The load on a spring is increased by adding weights.



The extension for each load is shown in the table.

Load (N)	0	10	20	30	40
Extension (cm)	0	2	4	6	8

(a) Use the information in the table to draw a graph on the grid below.



(2)

(b) More weights are added to the spring.

(i) Continue the line on your graph to show the shape when more weights are added.

(1)

(ii) Explain why the graph is the shape you have drawn.

.....

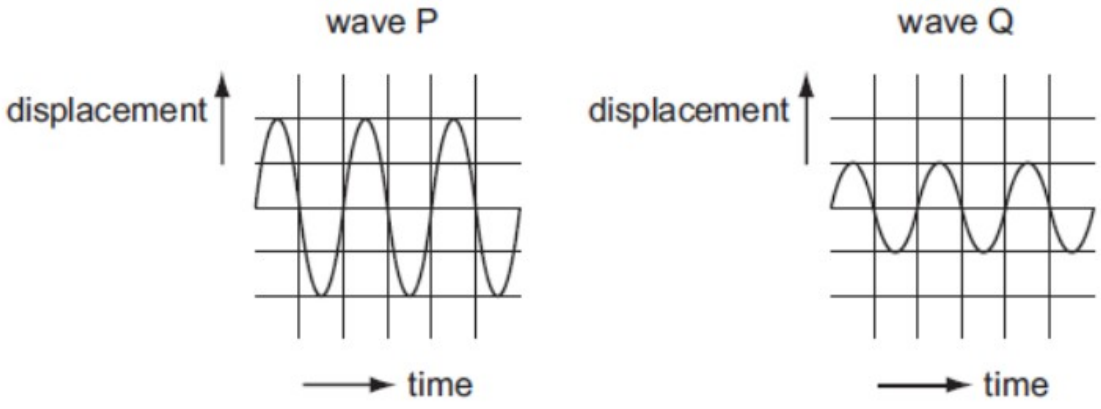
.....

(1)

(Total 4 marks)

SOUND

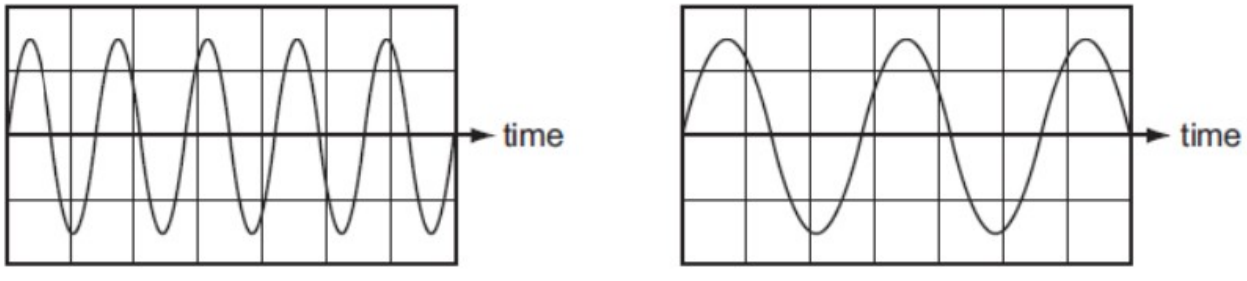
1. The diagrams represent two different sound waves.



How do the frequency and pitch of P compare with the frequency and pitch of Q?

	frequency of P	pitch of P
A	greater than Q	higher than Q
B	greater than Q	same as Q
C	same as Q	higher than Q
D	same as Q	same as Q

2. The diagrams show the wave shapes of two different sounds. The scales are the same in each diagram.



sound 1 sound 2

How does sound 2 compare with sound 1?

A. Sound 2 is louder than sound 1.
B. Sound 2 is quieter than sound 1.
C. Sound 2 has a higher pitch than sound 1.
D. Sound 2 has a lower pitch than sound 1.

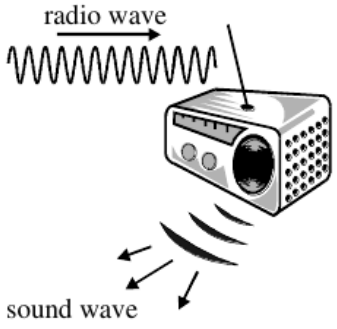
3. A student wishes to measure the speed of sound in air. She plans to measure the time between making a sound and hearing the echo from a cliff.

She will use the equation: speed = Distance/time

Which type of sound should she make and which distance should she use in her calculation?

	type of sound	distance to use
A	continuous sound	$\frac{\text{distance to cliff}}{2}$
B	continuous sound	distance to cliff × 2
C	short, sharp sound	$\frac{\text{distance to cliff}}{2}$
D	short, sharp sound	distance to cliff × 2

4. The diagram shows how two different waves are involved when listening to a radio.



(a) Complete the sentences that compare the radio wave and the sound wave.

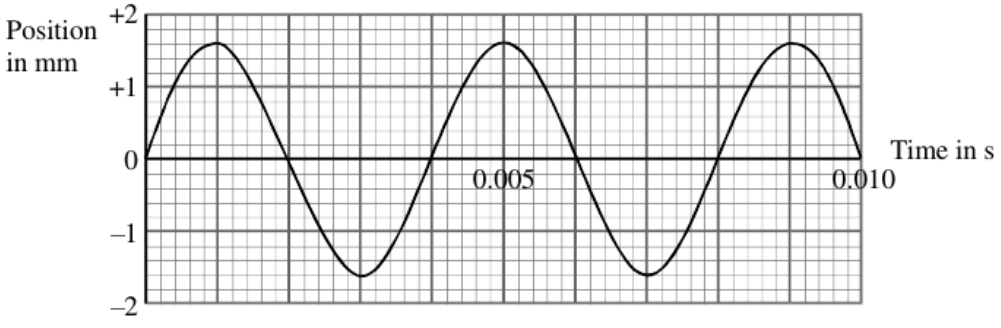
(i) The frequency of the radio wave is ..... than the frequency of the sound wave.

(1)

(ii) The radio wave is transverse; the sound wave is .....

(1)

(b) The graph shows how the position of the loudspeaker cone changes when it is reproducing a sound of frequency 250 Hz.



(i) Which word **best** describes the movement of the loudspeaker cone? Circle the word of your choice.

amplification gyration rotation vibration

(1)

(ii) Use the graph to write down the **amplitude** of the wave motion.

.... mm

(2)

(iii) Use the graph to write down the time taken to complete one cycle of the wave motion.

..... s

(1)

(c) The amplitude and frequency of the movement of the loudspeaker cone are both **reduced**.

(i) Sketch on the grid in part (b) a graph that shows the loudspeaker cone moving with reduced amplitude and frequency.

(2)

(ii) Give **two** ways in which the sound changes when the loudspeaker cone moves with reduced amplitude and frequency.

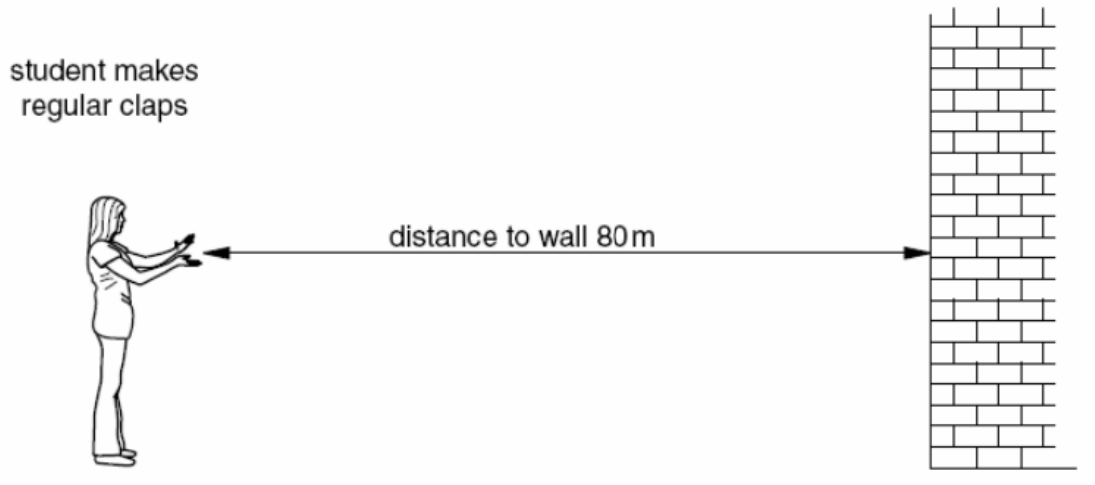
1 .....

2 .....

(2)

(Total 10 marks)

5. Fig. 4.1 shows a student clapping in front of a vertical wall. The wall reflects the sound.



The student changes the number of claps made in 1 minute until the reflection of each clap returns to her at exactly the same time as she makes the next clap.

The speed of sound in air is 330 m/s.

(a) Explain what is meant by *speed*.

.....

.....

.....[1]

(a) Calculate the time between claps.

Time = ... [3]

(b) Calculate the number of claps in 1 minute.

Number of claps = ... [2]

6. The figure below shows a bat.

Bats emit short bursts of ultrasound. The echoes of the ultrasound help the bat find insects and prevent the bat flying into objects.

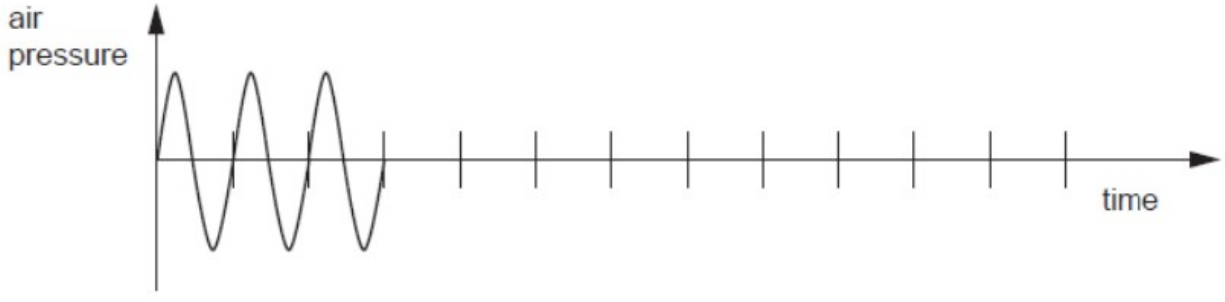
(a) State what is meant by an echo.

.....

.....

[1]

(b) Fig. 6.2 shows the variation with time of air pressure caused by a burst of ultrasound.



On Fig. 6.2, draw a possible echo formed by this burst of ultrasound. [2]

(c) State

(i) the approximate range of frequencies of sound audible to humans,

..... [1]

(ii) how the frequency of ultrasound differs from frequencies in this audible range.

.....

.....

[1]

[Total 5m]

FLUID FLOW

1. Bernoulli's principle describes the property of a .....

A. fluid in motion
B. fluid at rest
C. object submerged in a fluid.
D. object floating in a fluid.

2. According to Bernoulli's principle if velocity increases pressure _____.

A. Increases
B. Decreases
C. Stays the same
D. None of the Above

3. According to Bernoulli's principle, if pressure increases then velocity must _____.

A. Decrease
B. Increase
C. Does Nothing.
D. None of the Above

4. If the pressure under the wing of an airplane is greater than the pressure on top of the wing, the airplane should _____.

A. Fall
B. Land
C. Lift
D. A and B

5. a) What is meant by?
(i) Streamline flow [1m]

(ii) Turbulent flow [1m]

b) (i) State the equation of continuity. Define any symbols used. [1m]

(ii) In deriving the equation of continuity, what three assumptions are made? [3m]

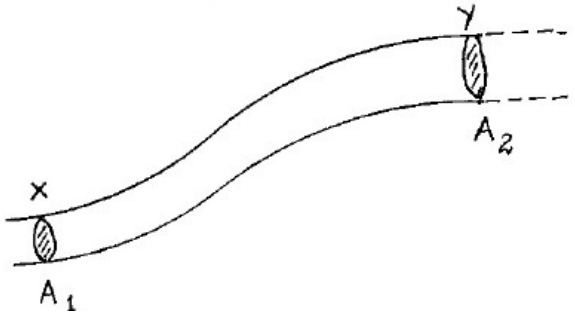
(iii) Water flows along a horizontal pipe of cross sectional area $48cm^2$ which has a constriction of cross sectional area $12cm^3$ at one place. If the speed of the water at the constriction is $4ms^{-1}$, calculate the speed in the wider section. [2m]

c) (i) State Bernoulli's effect. [1m]

(ii) Give three examples of Bernoulli's effect in air.

6.

Figure **below** shows a section of a pipe XY. A constant pressure difference maintains a streamline flow of a liquid in the pipe.



If the cross-sectional area A_1 at X is less than A_2 ay Y, state how the liquid velocity V_2 at Y compares with V_1 at X.

WAVES I

1. Here is some information about ultrasound.

Human ears can detect sounds with frequencies in the range 20 Hz to 20 000 Hz. Frequencies above this range are called ultrasound.

Short bursts of ultrasound waves can be used to measure the depth of the sea. The waves are produced by a crystal vibrating at a very high frequency.

(a) Which of the following frequencies could be ultrasound?

Circle the correct answer.

15 Hz 250 Hz 15 000 Hz 25 000 Hz

(1)

(b) Why can humans **not** hear ultrasound?

.....

.....

(1)

(c) The crystal vibrates at a very high frequency.
Which is the best description of the frequency of vibration?

A The distance the crystal vibrates in a second.

B The number of vibrations of the crystal in a second.

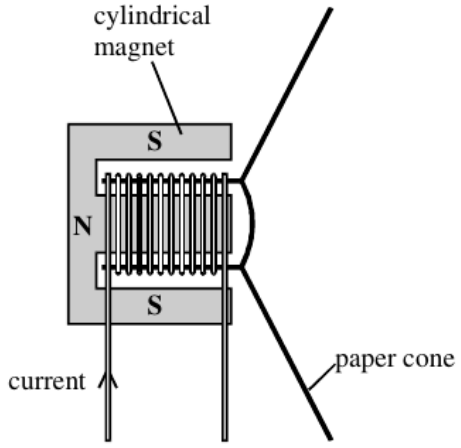
C The time it takes for the crystal to complete one vibration.

Write the correct answer (**A, B** or **C**) in the box. ☐

(1)

(Total 3 marks)

2. The diagram shows a moving coil loudspeaker.



(a) (i) When the current is in the direction shown in the diagram, the paper cone moves to the right.

Describe the movement of the paper cone when the direction of the current is reversed.

.....

.....

(1)

(ii) Explain why the paper cone moves when a current passes in the coil.

.....

.....

.....

.....

(2)

(b) An alternating current passes in the coil.

Describe the movement of the paper cone.

.....

.....

(1)

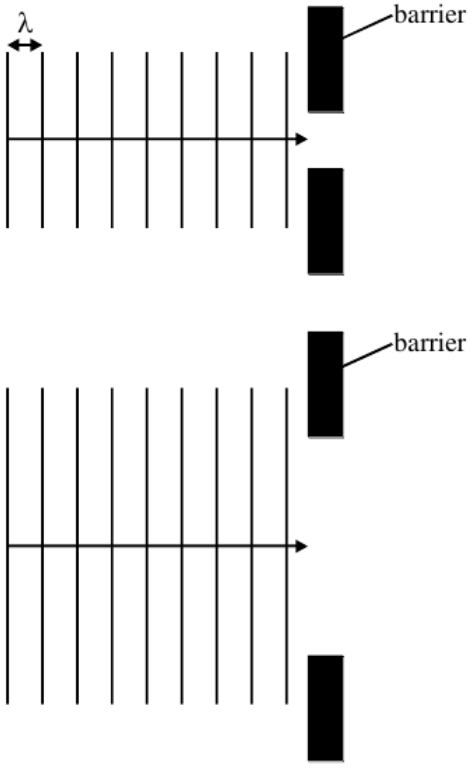
(c) The loudspeaker is used to produce a sound that has a frequency of 800 Hz.
The wavelength of the sound as it leaves the loudspeaker is 0.40 m.
Calculate the speed of the sound in air.

.....

.....

3. Sound waves are diffracted when they pass through a gap in a barrier.

(a) (i) Complete the diagrams below to show how the effect of diffraction depends on the size of the gap.



(5)

(ii) What other factor affects the diffraction that occurs when a wave passes through a gap?

.....

(1)

(b) When a person speaks into a loudhailer, the sound is first amplified before passing out through a cone.

A typical frequency of sound used for speech is 1000 Hz. The speed of sound in air is 330 m/s.

(i) Show that sound with a frequency of 1000 Hz has a wavelength of 0.33 m in air.

.....

.....

.....

(2)

(ii) The diameter of the loudhailer cone is 0.30 m.
Explain whether it is suitable for a person speaking to a crowd of people.

.....

.....

.....

.....

(2)

(iii) When listening to music, the ear needs to detect frequencies over a wide range. A typical frequency of a high-pitched sound is 4000 Hz. Explain why the loudhailer is not suitable for use by a female singer who is singing to an audience.

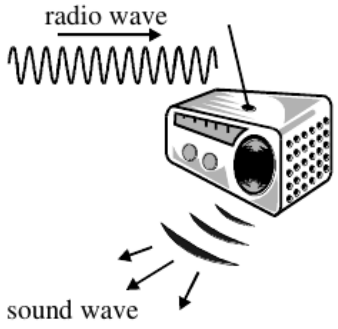
.....

.....

.....

(2)
(Total 12 marks)

4. The diagram shows how two different waves are involved when listening to a radio.



(a) Complete the sentences that compare the radio wave and the sound wave.

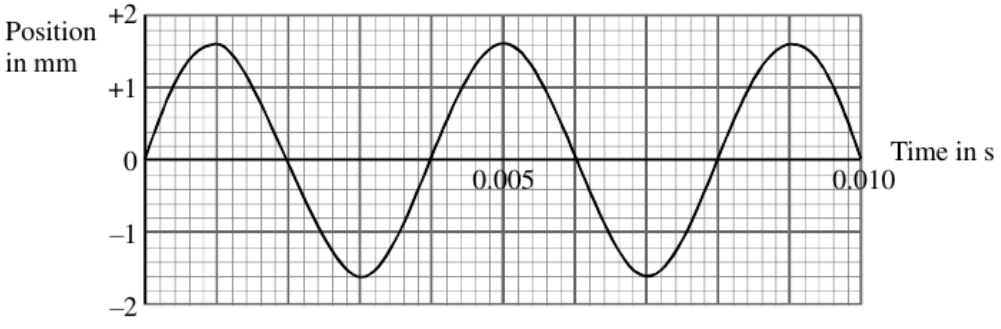
(i) The frequency of the radio wave is ..... than the frequency of the sound wave.

(1)

(ii) The radio wave is transverse; the sound wave is .....

(1)

(b) The graph shows how the position of the loudspeaker cone changes when it is reproducing a sound of frequency 250 Hz.



(i) Which word **best** describes the movement of the loudspeaker cone? Circle the word of your choice.

amplification gyration rotation vibration

(1)

(ii) Use the graph to write down the **amplitude** of the wave motion.

..... mm

(2)

(iii) Use the graph to write down the time taken to complete one cycle of the wave motion.

..... s

(1)

(c) The amplitude and frequency of the movement of the loudspeaker cone are both **reduced**.

(i) Sketch on the grid in part (b) a graph that shows the loudspeaker cone moving with reduced amplitude and frequency.

(2)

(ii) Give **two** ways in which the sound changes when the loudspeaker cone moves with reduced amplitude and frequency.

1 .....

2 .....

(2)

(Total 10 marks)

5. The table gives information about some waves used for radio broadcasting.

	Modulation	**Range**	**Amount of information carried**	**Frequency**
long wave	amplitude	hundreds of km	low	200 kHz
medium wave	amplitude	50 km	medium	1 MHz
VHF	frequency	50 km	high	100 MHz

Use the information in the table to answer the questions below.

(a) (i) Which wave has the highest frequency?

.....

(1)

(ii) Which wave is used to broadcast weather information to ships?

.....

Why is this wave used?

.....

.....

(2)

(iii) Which wave is used for high-quality music broadcasts?

.....

Why is this wave used?

.....

.....

(2)

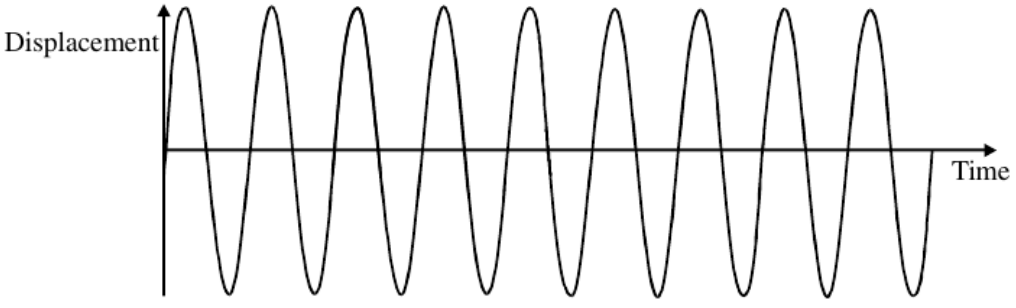
(iv) Noise affects the amplitude of a wave but not its frequency.

Which **two** waves are most affected by noise?

..... and .....

(1)

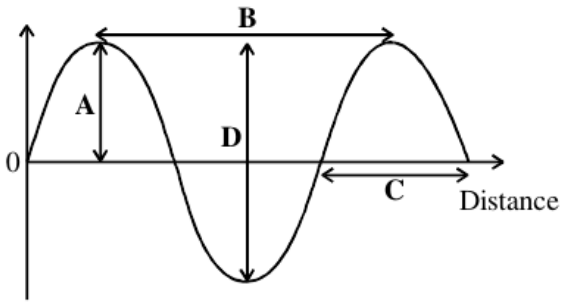
(b) The diagram shows a radio wave that is not carrying a signal.



Draw a similar diagram, on the axes below, to show an amplitude modulated radio wave.

(2)
(Total 8 marks)

6. (a) The diagram shows part of a wave.



(i) Which letter (**A**, **B**, **C** or **D**) shows the wavelength of the wave?

.....

(1)

(ii) Which letter (**A**, **B**, **C** or **D**) shows the amplitude of the wave?

.....

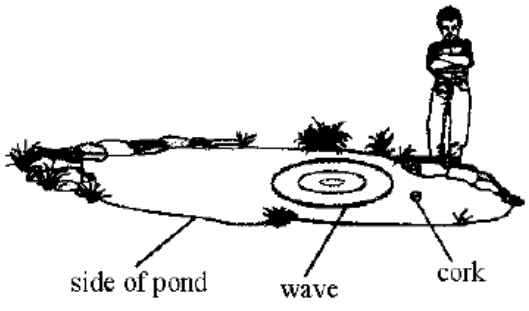
(1)

(b) Circle the correct unit for the frequency of a wave.

m/s km/s Hz W

(1)

(c) The diagram shows a wave on a pond.



When the wave reaches the cork, the cork bobs up and down but does not move nearer to the side of the pond.

(i) Explain why the cork only bobs up and down.

.....

.....

(2)

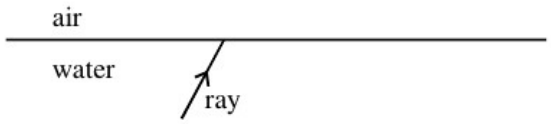
(ii) What does the wave transfer to the side of the pond?

.....

(1)

(Total 6 marks)

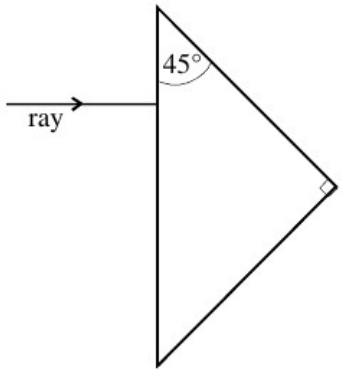
7. (a) The diagram shows a ray of light travelling through water, towards the surface.



Complete the diagram, showing the ray leaving the water.

(2)

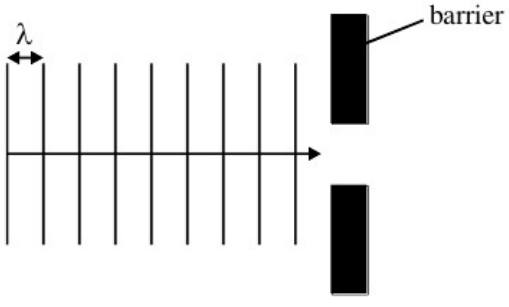
(b) The diagram shows a ray of light approaching a 45° glass prism.



Complete the diagram, showing the path of the ray through the prism.

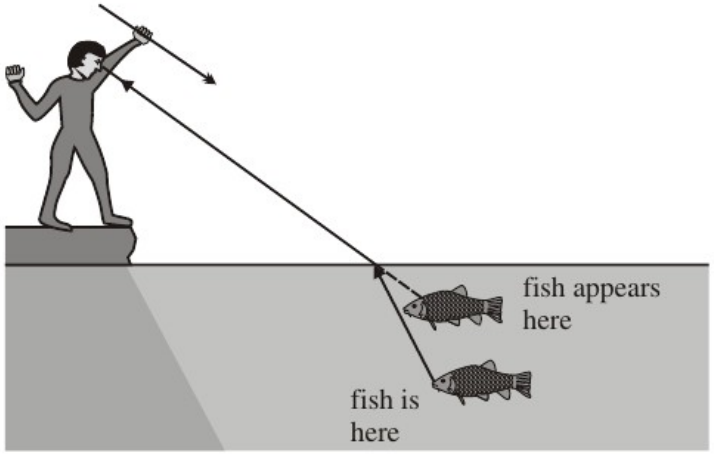
(3)

(c) Water waves are diffracted when they pass through a gap in a barrier.
Complete the diagram below to show this effect.



(3)
(Total 8 marks)

8. (a) The diagram shows a ray of light from a fish in a river as it passes from the water into the air and enters the eye of the person on the bank.



(i) What name is given to the bending of the ray of light as it passes from the water into the air?

.....

(1)

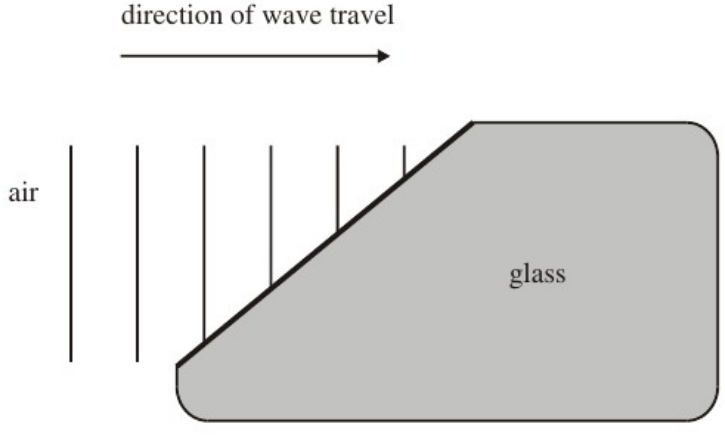
(ii) Use the diagram to explain why the fish appears to be above the place where it actually is.

.....

.....

(2)

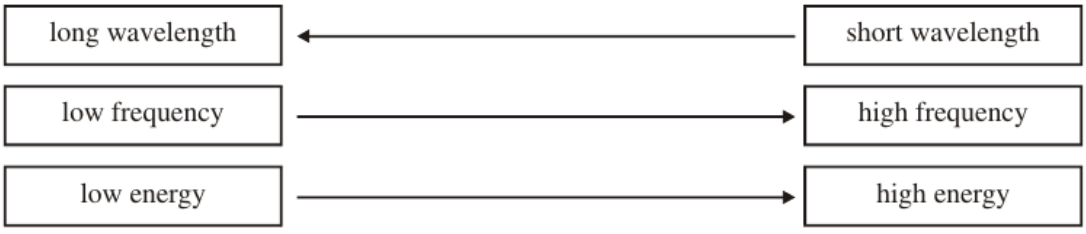
(b) The diagram shows wavefronts of light arriving at the boundary between air and glass. Complete the diagram to show the wavefronts inside the glass.



(2)
(Total 5 marks)

9. (a) The diagram shows the various parts of the electromagnetic spectrum.

radio	microwave	infra-red	visible	ultraviolet	X-ray	gamma ray



(i) Describe the relationship shown between the energy carried by an electromagnetic wave and its frequency.

.....

.....

(1)

(ii) Explain why waves with high energy are more dangerous to humans than those with low energy.

.....

.....

.....

(2)

(iii) Describe the relationship shown between the wavelength and frequency of the waves.

.....

.....

(1)

(b) Ultrasounds are also waves.

State **two** differences between ultrasound waves and radio waves.

1 .....

.....

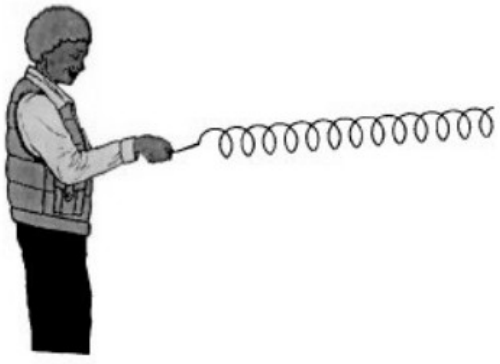
2 .....

.....

(2)

(Total 6 marks)

10. (a) Chris is just about to send a transverse wave along the stretched spring.



Draw **two** arrows on the diagram to show the directions in which she has to move her hand.

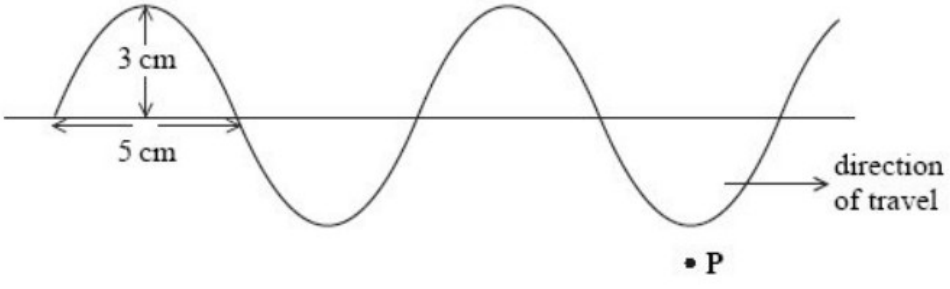
(2)

(b) Give **one** example of a longitudinal wave.

.....

(1)

(c) The diagram shows a wave.



(i) The amplitude of this wave is ..... cm.

(1)

(ii) The wavelength of this wave is ..... cm.

(2)

(iii) In 7 seconds, 14 complete waves pass the point **P**.

Calculate the frequency of this wave.

.....

.....

.....

(3)

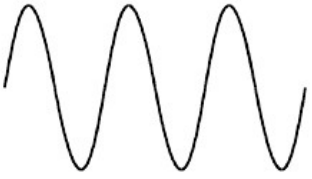
(Total 9 marks)

11. (a) Outside a shop is a security light. This switches on at night when it detects body heat. Which type of electromagnetic wave does the security light detect?

.....

(1)

(b) The diagram represents a light wave.

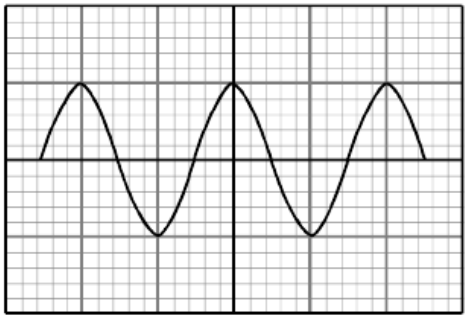


Draw a line to link each property of a wave to its description.

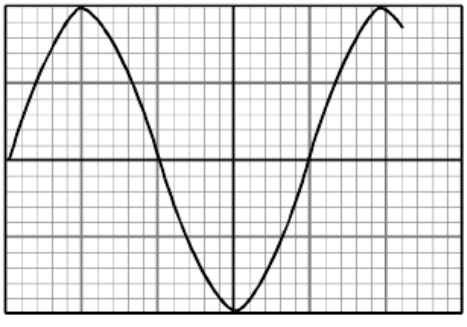
property of wave	description
frequency	the distance between two crests or troughs
wavelength	the number of waves passing every second
amplitude	the height of a wave crest

(2)
(Total 3 marks)

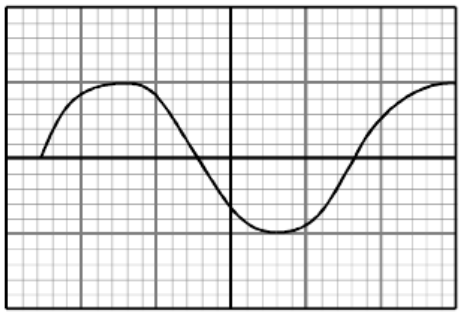
12. (a) Four sound waves were displayed on an oscilloscope screen. The same oscilloscope settings were used each time.



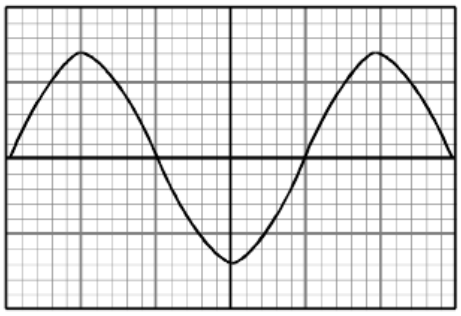
A



B



C



D

(i) Which sound was the loudest? .....

Give a reason for your choice.

.....

(1)

(ii) Describe how sound waves are transmitted through air.

.....

.....

.....

(2)

(b) Sound with a frequency greater than 20 000 Hz is known as ultrasound.
State two different medical uses of ultrasound.

1. .....

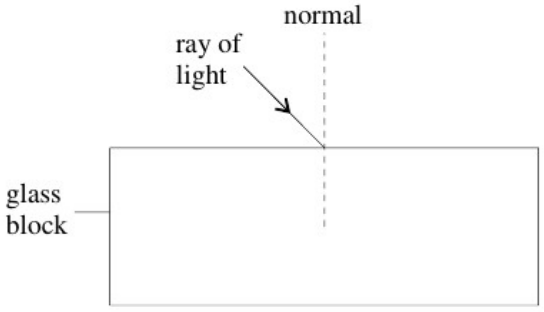
.....

2. .....

.....

(2)
(Total 7 marks)

13. (a) A light ray travels through air and strikes a glass block.



Use a ruler to draw the paths of the refracted ray as it passes through and out of the block.

(2)

(b) This is part of a newspaper article

> **Ditch those glasses - in 15 minutes**
>
> Using computer technology and a thin invisible beam of ultraviolet radiation, microscopic amounts of eye tissue can be removed to correct visual impairment.

(i) Suggest another use for ultraviolet radiation.

.....

.....

(1)

(ii) Visible light and ultraviolet light are parts of the electromagnetic spectrum. Two features of an electromagnetic wave are its wavelength and frequency. Use these features to compare ultraviolet radiation and visible radiation.

.....

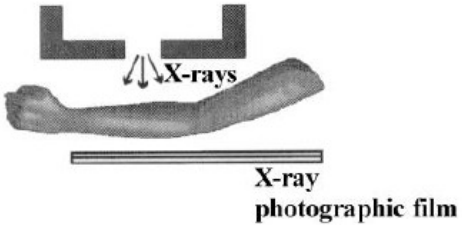
.....

.....

.....

(2)

(c) Nicola has a suspected broken arm.
She is taken to hospital for an arm X-ray.



(i) Explain how the properties of X-rays make them suitable for making an X-ray photograph of the suspected broken arm.

.....

.....

.....

.....

.....

.....

(3)

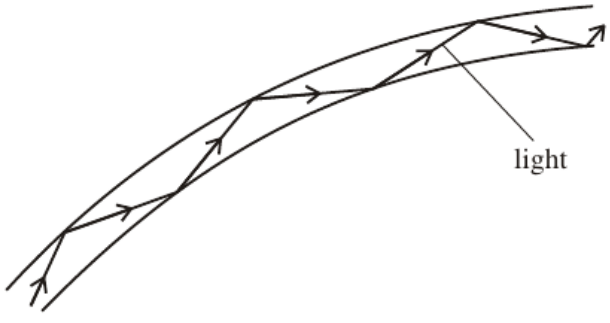
(ii) Why can exposure to X-rays be harmful to the body?

.....

.....

(1)
(Total 9 marks)

14. The diagram shows how light can travel in an optical fibre.



(a) Use words from the box to complete the sentences.

critical	**crucial**	**diffracted**	**incidence**
internal	**reflected**	**refraction**	

At the inner surface of the glass fibre light is ..... .

This happens because the angle of ..... is greater

than the ..... angle.

(3)

(b) Suggest **one** reason why optical fibres are used to transmit light.

.....

.....

(1)
(Total 4 marks)

15. Sound waves can be diffracted.

(a) How is the frequency of a wave calculated from its wavelength and speed?

frequency =

(1)

(b) Explain why the open door of a music room diffracts lower frequency sounds more than higher frequency sounds.
(You may choose to draw a diagram to help your explanation.)

.....

.....

.....

.....

.....

(2)
(Total 3 marks)