F2 TOPICAL REVISION

PHYSICS

A SERIES OF TOPICAL QUESTIONS IN FORM 2 PHYSICS

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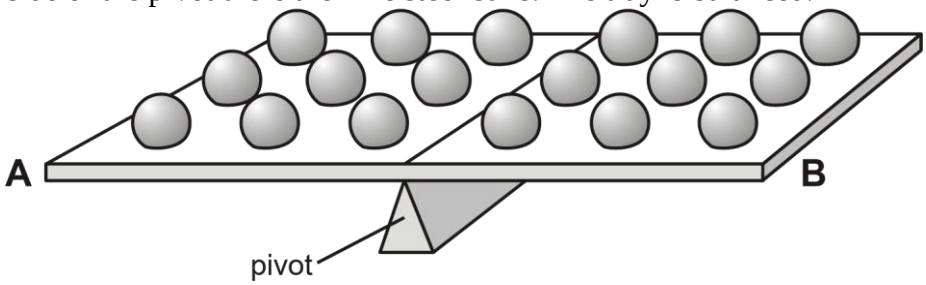
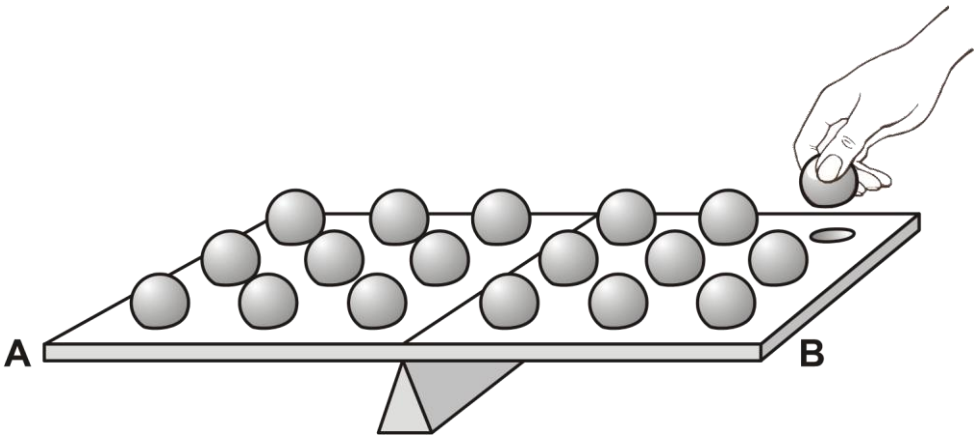
ELECTROMAGNETISM 1

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.



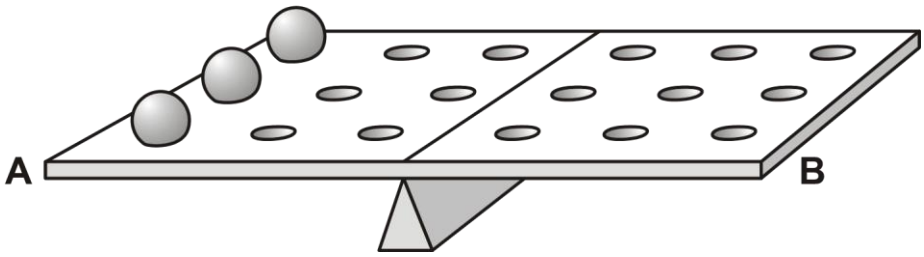
What will happen to end A?

.....

1 mark

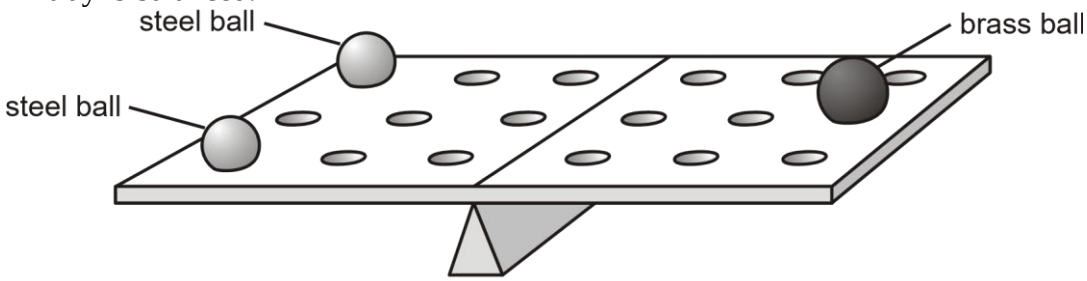
(b) There are three balls on side A as shown below.

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 ☐ ☐

ironzinc ☐ ☐

1 mark

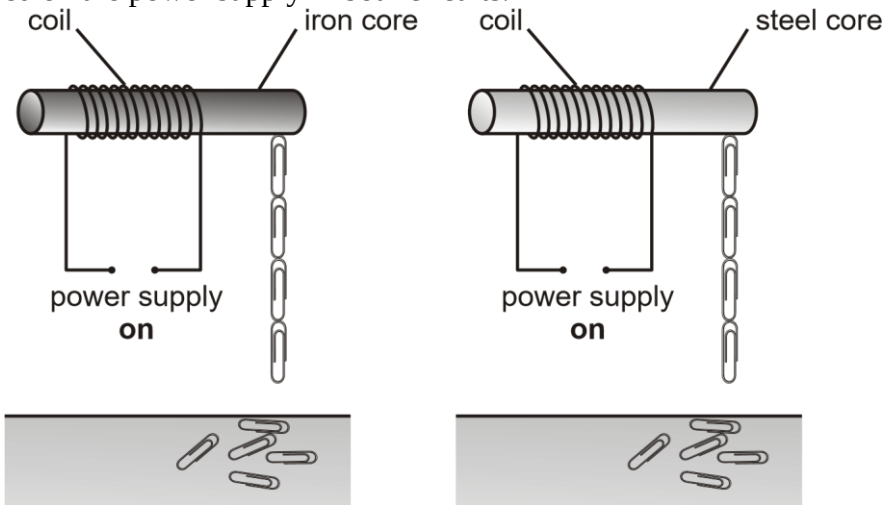
(ii) Look at the elements in the brass ball and the steel ball.

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?

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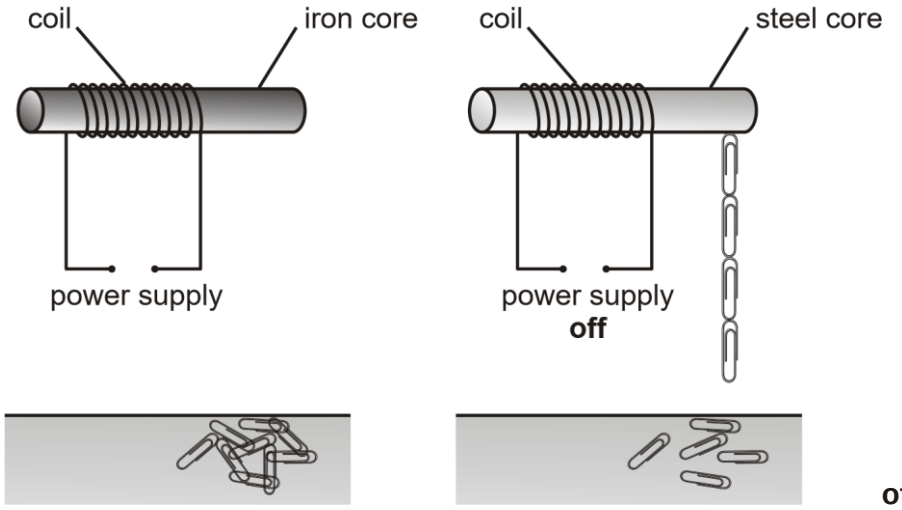
1 mark

(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.

.....

.....

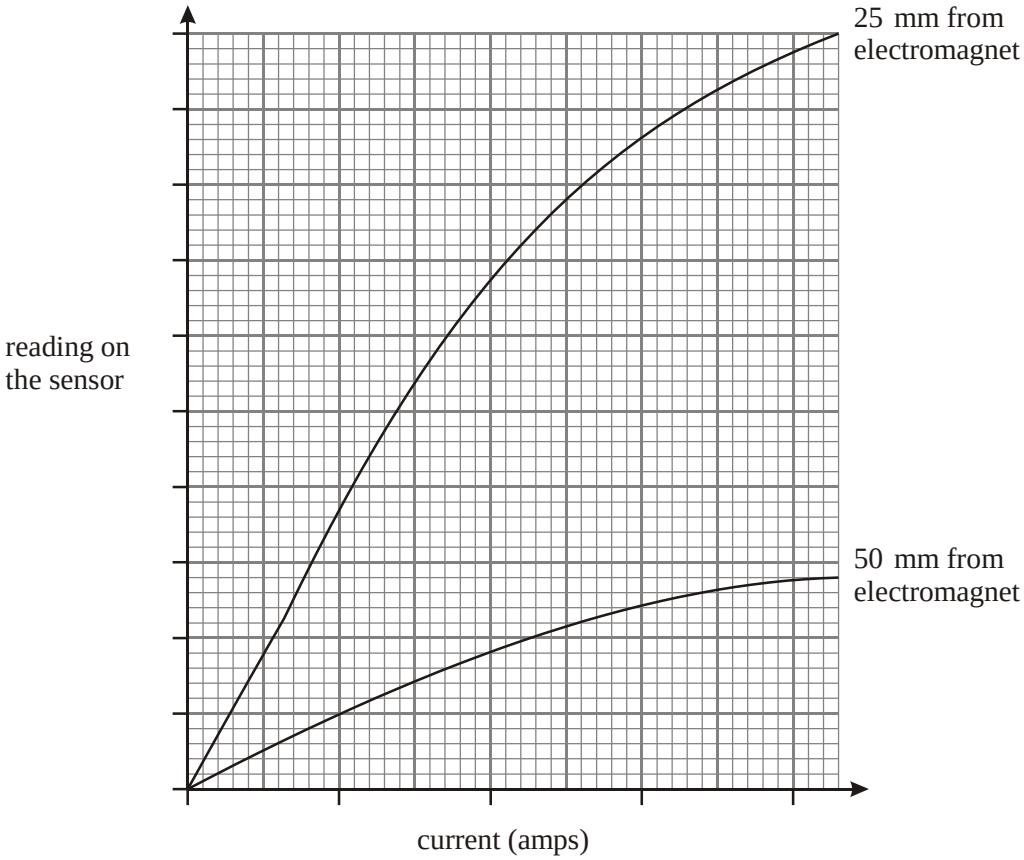
1 mark

(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?

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.....

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?

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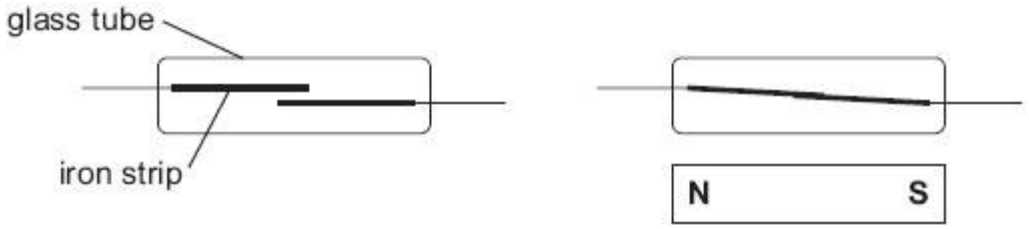
1

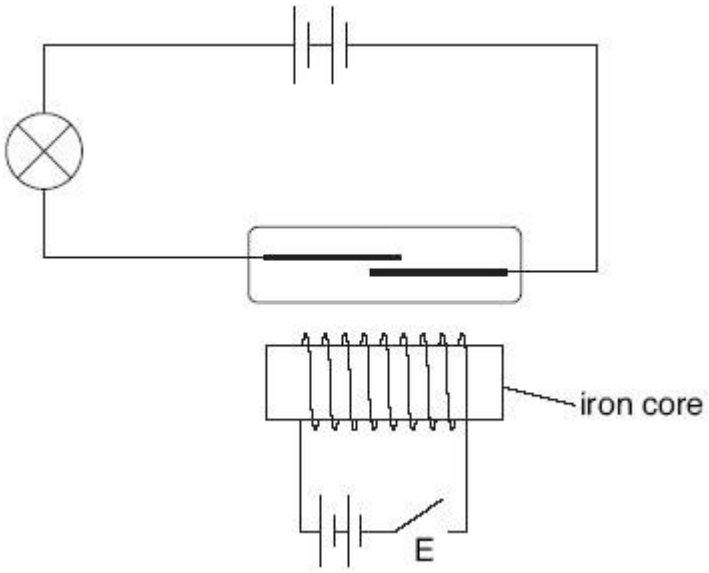
mark maximum

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.

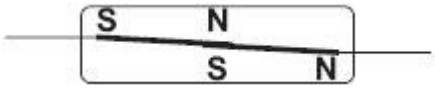
(i) Give **two** ways Hilary could increase the strength of the electromagnet.

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.

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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.

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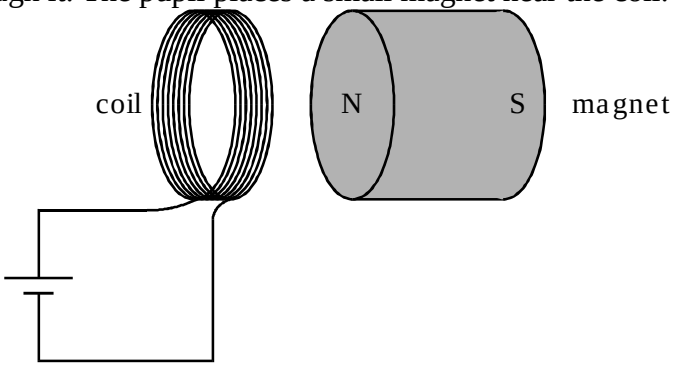
1 mark maximum

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?

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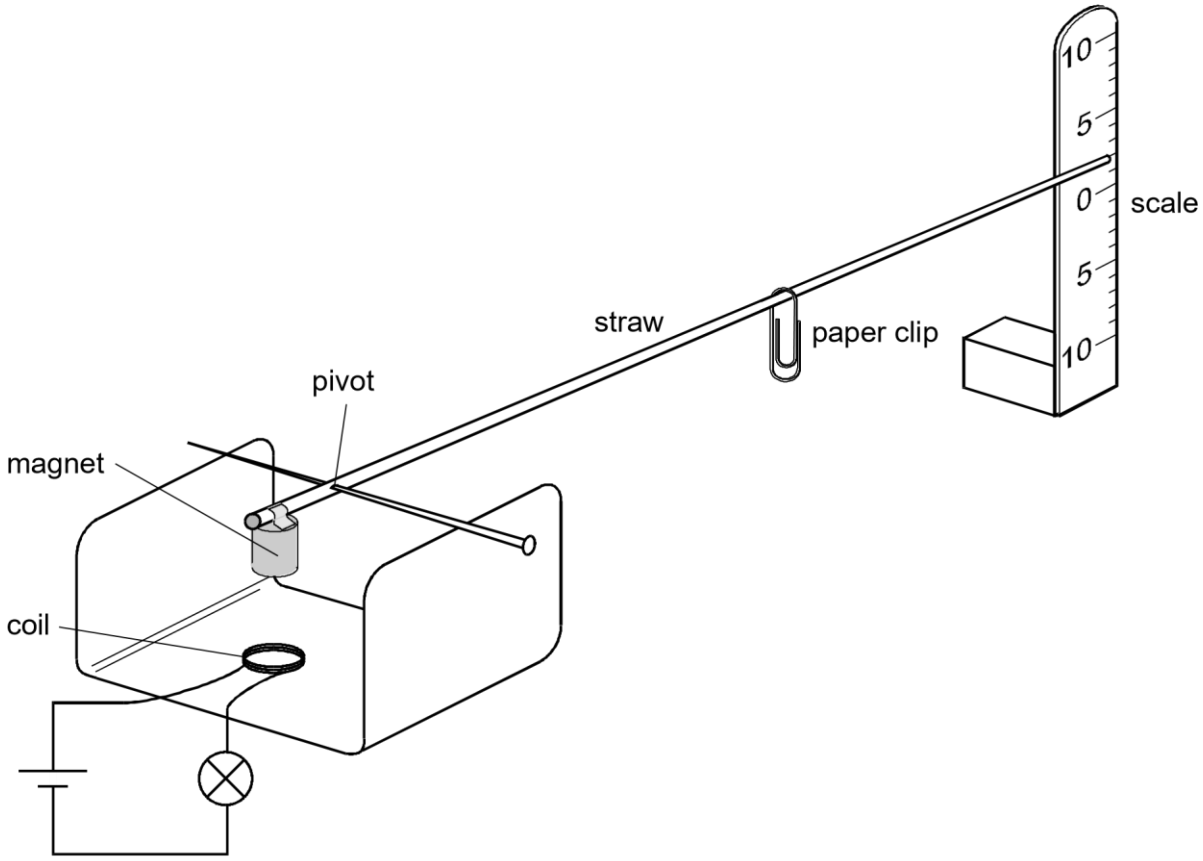
1 mark

(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?

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1 mark

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

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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.

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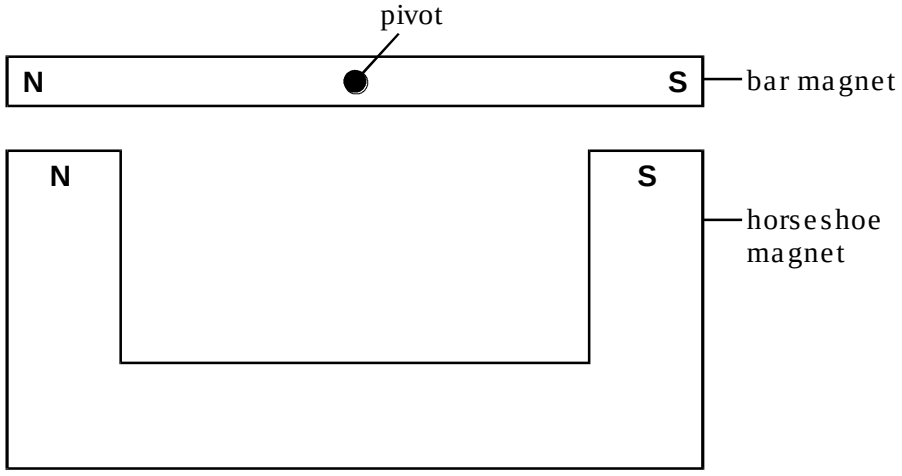
2 marks

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.

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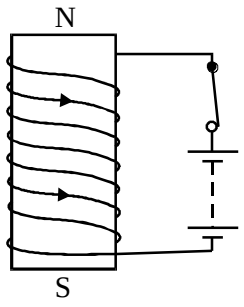
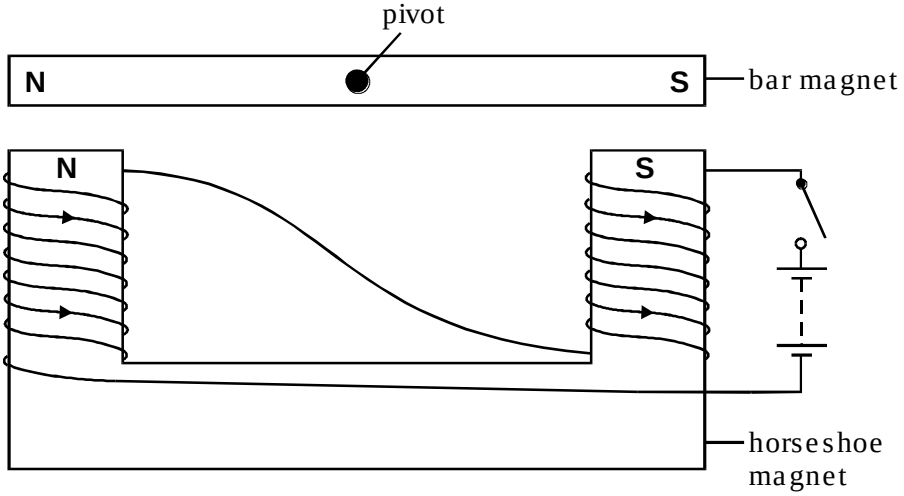
2 marks

(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.

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3 marks

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

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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.

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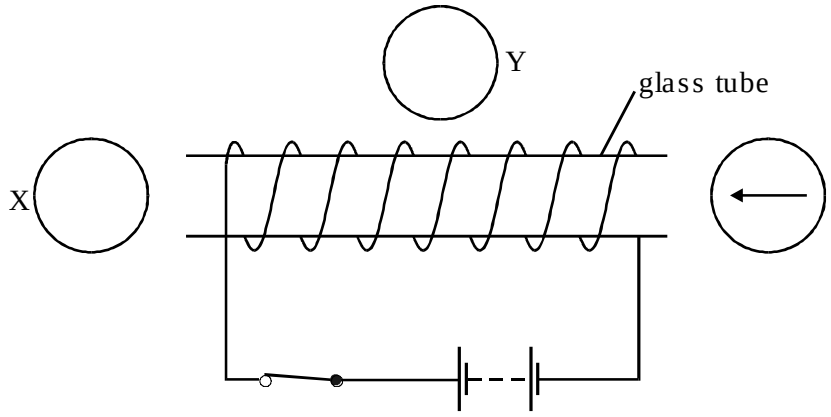
1 mark

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.



(a) (i) Complete the diagram by drawing arrows in compasses X and Y to show the direction of the magnetic field.

2 marks

(ii) Draw an arrow in the middle of the glass tube to show the direction of the magnetic field in the glass tube.

1 mark

(iii) When the switch is opened, in which direction will the three compass needles point?

.....

1 mark

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

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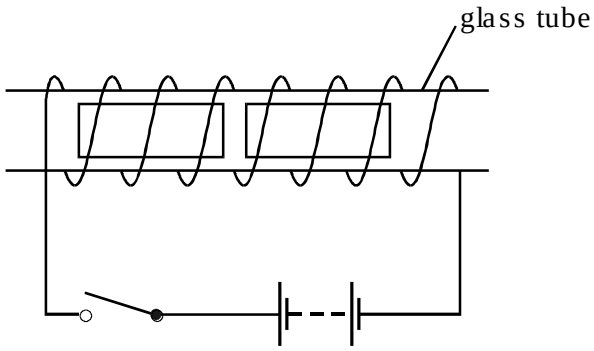
.....

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.

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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

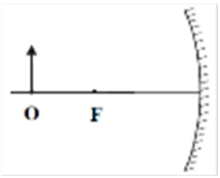
] (b) Image height

[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]

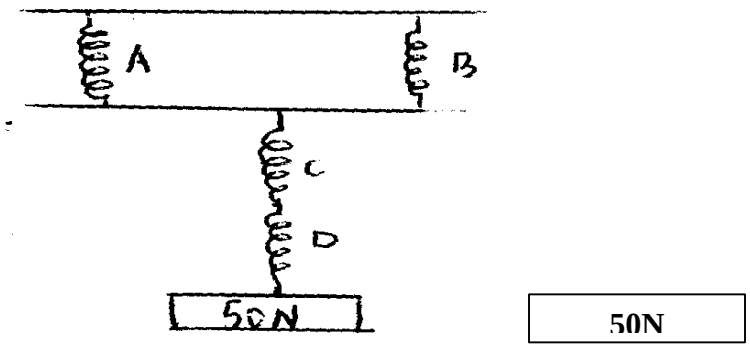
Measurement II

1. A ball bearing of mass 0.0015 kg is held between the anvil and spindle of a micrometer screw gauge. The reading on the gauge when the jaws are closed without anything in between is 0.11mm. Use this information and the position of the scale in the figure below to answer the questions **(a)** and **(b)** below:

a) What is the diameter of the ball bearing?

b) Find the density of the ball bearing giving your answer correct to three significant

2.



The springs **A, B, C** and **D** are identical and each extends by 2cm, when a force of 6N is suspended on the system. Determine the extension of the system

3. Water in a dam falls through a height 24.5m. If we assume that there are no energy losses,

calculate the new temperature of the water as it strikes the lower end, given that its initial temperature at the top of the dam is 18.9°C

4. Lycopodium powder is lightly sprinkled on a clean water surface in a large tray. A red hot needle is plunged at the centre of the water surface. State and explain the observation

5. A micrometer screw gauge has a negative zero error of 0.06mm. Show on a micrometer screw gauge, including the essential parts only a reading of 5.99mm

6. (a) The data below was obtained in an experiment to estimate the diameter of an oil molecule:-

- Level of oil in burette= 26cm^3
- Level of oil in burettes after adding 50drops of oil=25.2cm^3
- Diameter of oil patch= 7cm

(i) Determine the volume of one drop of oil

(ii) Calculate the thickness of a molecule

(iii) State any **two** assumptions made in this experiment

(iv) In the experiment **14.(a)** lycopodium powder is used on the water surface. What is the role of the lycopodium powder?

(b) A molecule of a liquid occupies a space about 1.5 x 10^{-9}m high and about 0.6 x 10^{-9}m in thickness and breadth. Calculate the number of molecules in a litre of the liquid

7. The vernier calipers shown below have a zero error of -0.06 cm

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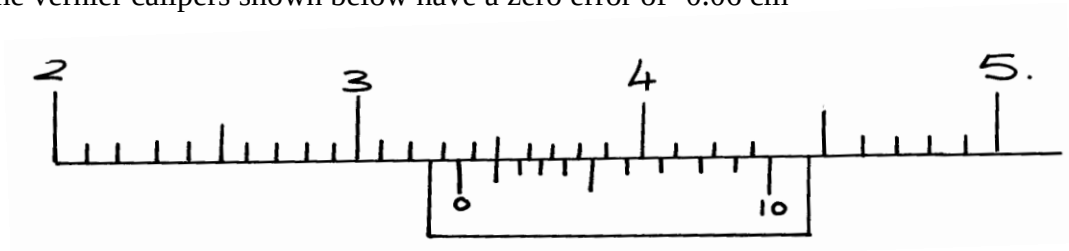


Figure 1

State the actual reading on the instrument.

8. A micrometer screw gauge with zero error of -0.01mm is used to determine the diameter of a marble whose diameter is 2.32mm.

(i) State the reading taken when the cylinder is grasped by the jaws

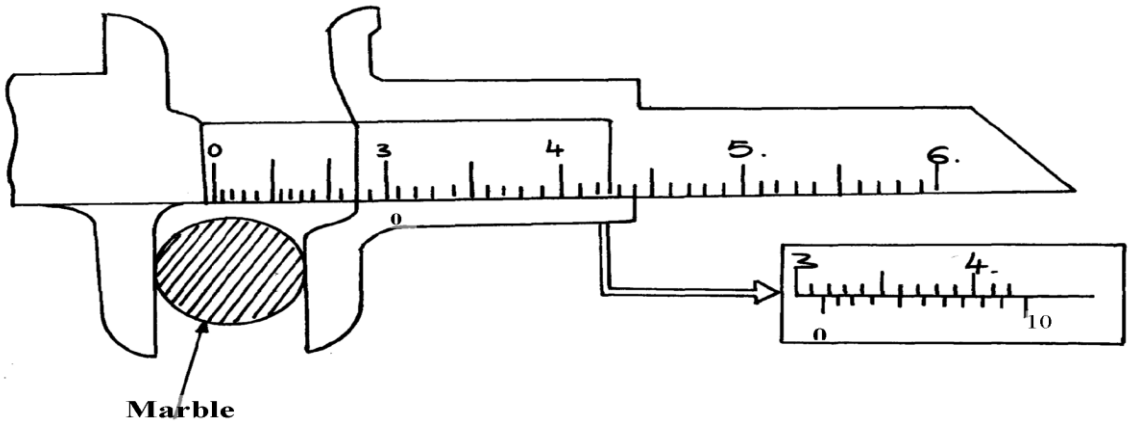
(ii) In the space below, sketch the scale that gives the reading in **(a)** above if it has a pitch

9. Figure 1 below shows an object of volume $300cm^3$ placed on the pan of a beam balance. The pointer was initially at the zero mark

Determine the density of the object in Kgm^{-3}

10. Figure 1 shows marble of mass 2.0g placed between the jaws of Vernier calipers. The magnified section is also shown. The reading of the gauge when the jaws were fully closed without the marble was 0.01cm. Use this information and the figure to answer questions 1 and 2.

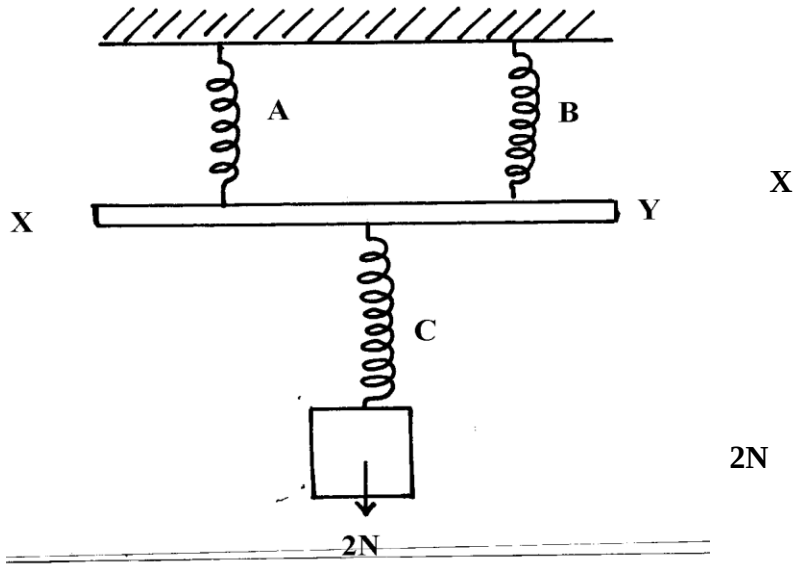
fig. 1



What is the diameter of the marble?

11. Determine the density of the marble give your answer to three significant figure (assume that the marble is spherical)

12. Three identical springs **A, B** and **C** of negligible weight are arranged as shown below;

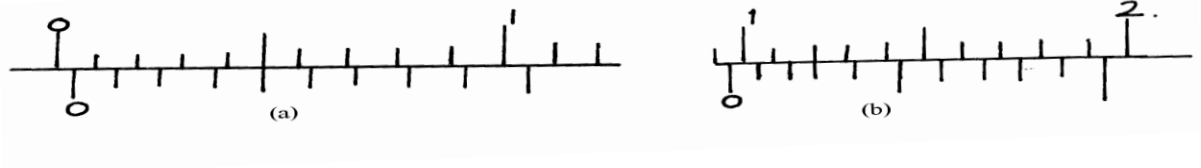


If C stretches by 3cm, and bar XY is assumed to be weightless, determine the extension in **A**

13. When a drop of olive oil of radius 1.36mm is placed on the surface of water, it spreads out to form a circular film of diameter 40cm. Calculate;

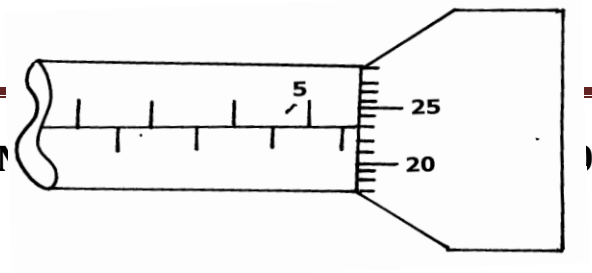
(a) The volume of the olive oil drop in m^3 (Take $\pi = {}^{22}/_{7}$)
(b) Using the value of **(a)** above, estimate the thickness of the film.
(c) Explain why lycopodium powder is sprinkled on the surface of water before the oil is dropped on it.
(d) State **two** assumptions made when finding the thickness of the film formed.

14. Figure **(a)** Shows vernier calipers with the jaws completely closed while **(b)** shows the same vernier calipers in use



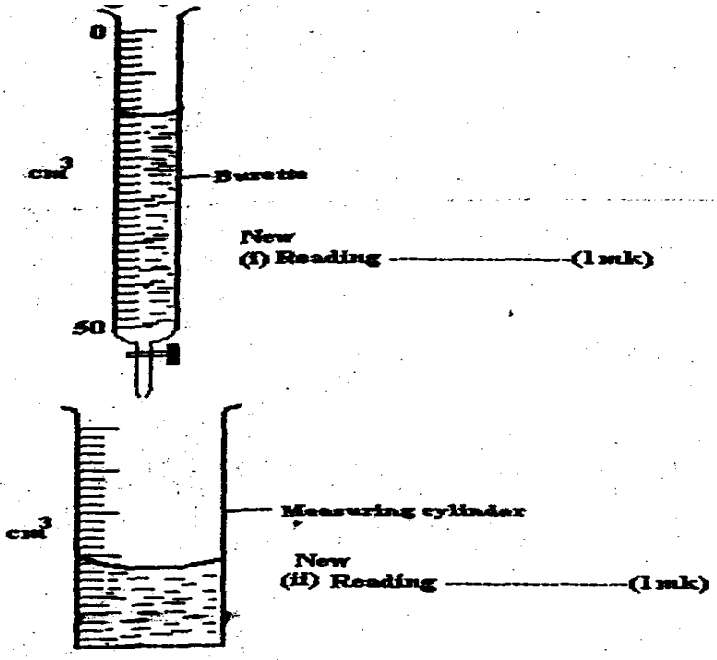
Determine the actual diameter of the coin

15. Give the reading on the micrometer screw gauge if it has a positive zero error of 0.01mm



16. Draw a sketch of a micrometer screw gauge showing a reading of 8.53mm.

17. The figure below shows a measuring cylinder containing some water.



0

Cm³ Burrette

50

Cm³

Measuring cylinder

Another 10cm³ of water was in to the cylinder from a burette delivering volumes from 0cm³ to 50 cm. Record in the spaces provided the **new reading** indicated on each vessel.

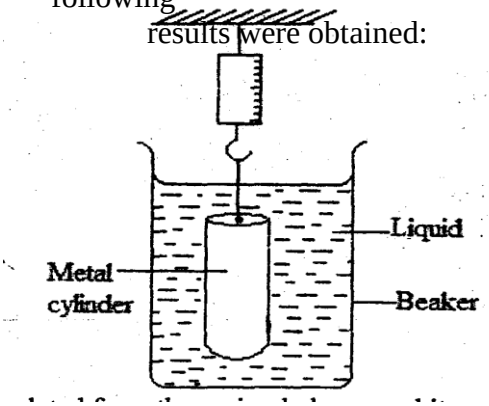
New
(i) Reading ……

18. Sketch a vernier calipers scale reading 3.41 cm.

19. In an experiment to determine a certain length '**L**' in a pendulum experiment the following results were obtained:

New
(ii) Reading ……..

6



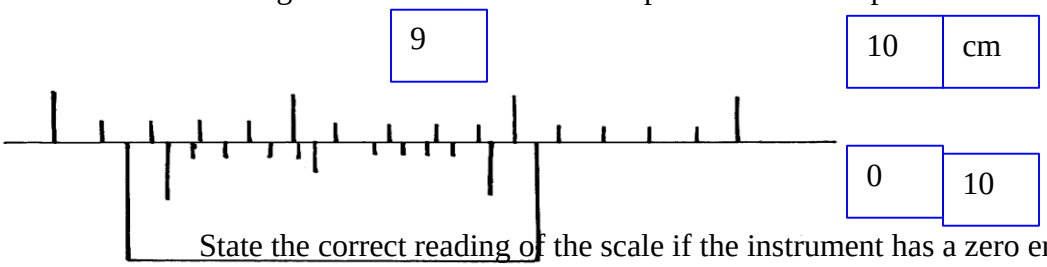
The up thrust was calculated from the spring balance and it was found to be 0.5N when the cylinder was fully submerged. Determine:

(i) Volume of the metal cylinder.

(ii) Mass of the liquid displaced by the cylinder.

(iii) Density of the liquid

20. The figure below shows a scale of part of venier caliper



State the correct reading of the scale if the instrument has a zero error of -0.02cm.

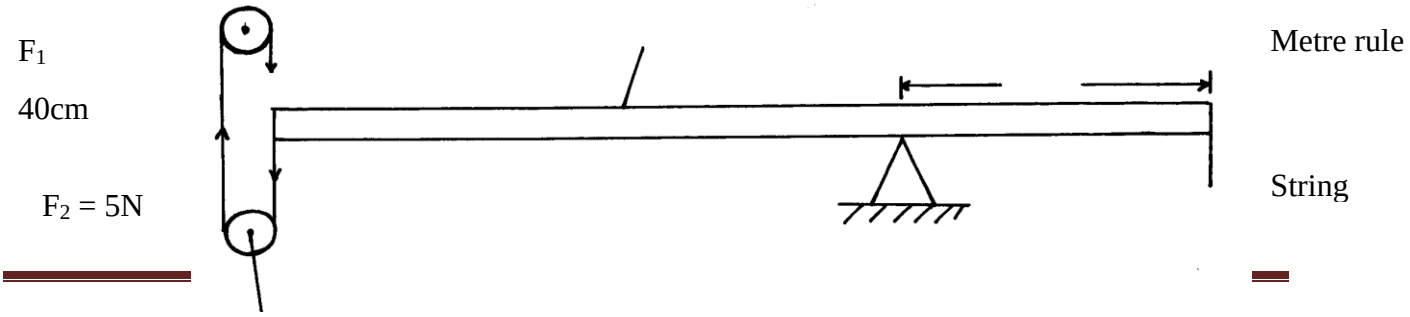
Turning effect of a force

1. Figure 4 below shows a uniform metre rule in equilibrium under the forces shown

Determine the weight of the metre rule

2. The diagram below shows a uniform meter rule of mass 300g balanced by two forces F_1 and F_2.

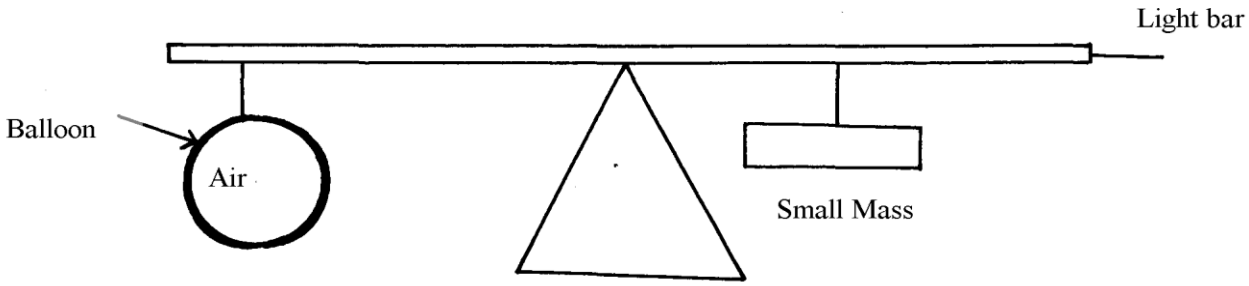
Force F_2 is 5N. Assuming there is no frictional force on the pulleys,



Pulley Calculate the force F_1

3. (a) The figure below shows a system in equilibrium at room temperature. The system is taken outside where the temperature is 20°C higher for sometime.

Figure 9



Explain why it tips to the right when it is taken outside the room.

(c) (i) State the law of floatation.

(ii) The fig. below shows a floating object of volume 40,000 cm^3 and mass 10g. It is held as shown in water of density 1.25g/cm^3 by a light cable at the bottom so that ¾ of the volume of the object is below the water surface. (Assume that up thrust due to air is negligible)

Figure 11

(iii) (I) Calculate the volume of the object under water.

*

(II) State the volume of water displaced by the object.

(III) Calculate the weight of water displaced.

(iv) Determine the tension in the cable

(v) Calculate the density of the object.

4. State the principle of moments.

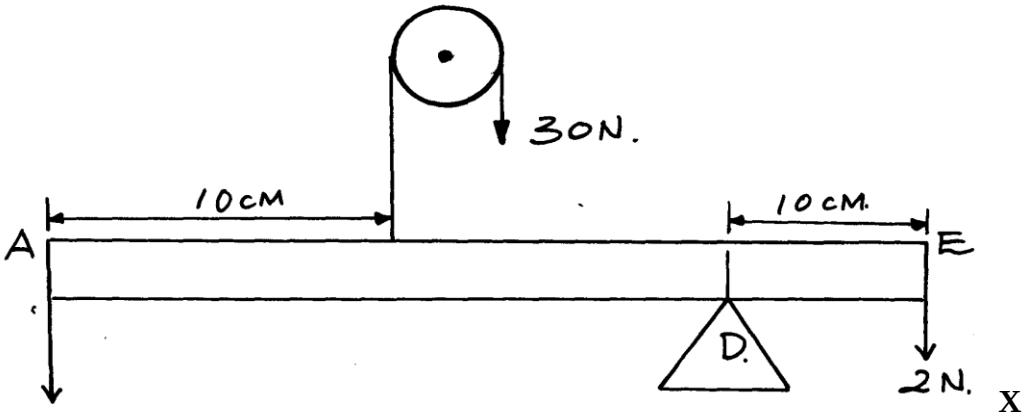
5. Figure 4 shows a uniform wooden plank which weighs 10N. The plank is balanced at 0.8m from one end by a mass of 2.5kg

fig. 4

What is the length of the wooden plank in metres?

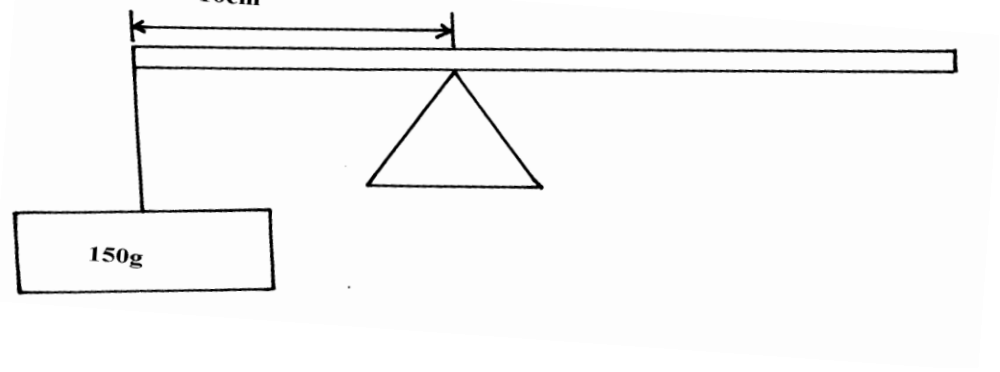
6. ***Figure 4*** shows a uniform rod **AE** which is 40cm long. It has a mass of 2kg and pivoted at **D**. If 2N is acting at point **E**, and 30N force is passed through a frictionless pulley

fig 4



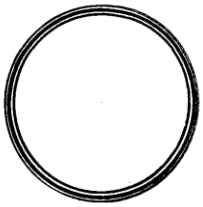
Find the force (**x**) acting at end **A**

7. A uniform half metre long beam, pivoted at the 10cm mark, balances when a mass of 150g is suspended at the 0cm mark as shown below:



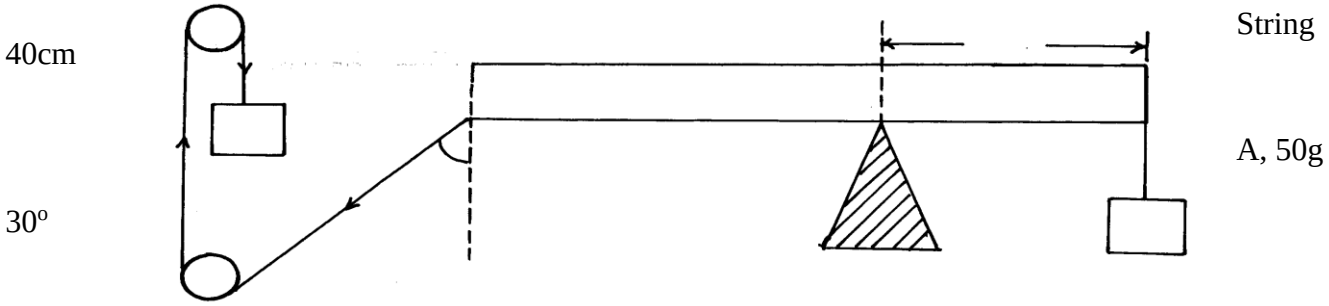
Calculate the weight of the beam

8. The figure below shows a ring of a thin steel washer.



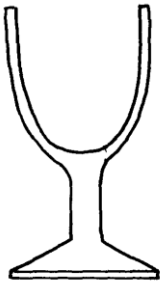
Determine the centre of gravity of the washer.

9. The diagram below shows a uniform metre rule balanced by two forces A and B. If force B is 5N,
assuming that there no frictional force on the fixed pulley, calculate the weight of the metre rule.



EQUILIBRIUM AND CENTRE OF GRAVITY

1. a) Define centre of gravity
b) The figure below shows a wine glass



State how the stability of the glass is affected if it is filled with wine

2. The diagram below shows an empty wine glass.

Figure 3

State and explain the effect on its stability when wine is put into the glass.

3. State **two** ways in which stability of a body can be increased

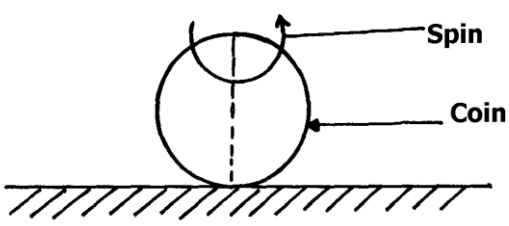
4. In the set up in figure 5, the metre rule is in equilibrium

Fig. 5

Given that the metre rule is uniform, determine its weight

5. ***Figure 6*** shows a spring coin which tends to remain vertical but topples immediately it stops

Direction of spin



spinning

fig. 6

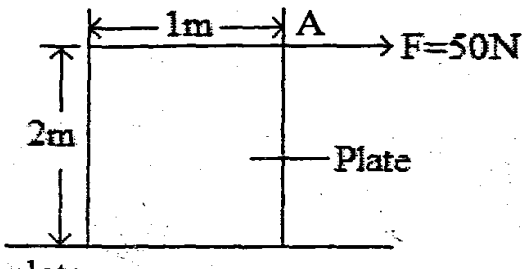
Explain this observation

6. In the thin triangular laminar ABC shown in figure below, determine geometrically the centre of gravity

7. A uniform metre rule is balanced at its centre. It is balanced by the 30N, 5N and the magnetic
force between **P** and **Q**. **P** is fixed and **Q** has a weight of 5N

Ignoring the weight of the metre rule, calculate the value of the magnetic force between **Q** and **P**

8. (a) Use simple sketches to show the three states of equilibrium. Name the states.
(b) Define center of gravity of a body.
(c) State **two** factors affecting stability of body
(d) The figure below shows a metal plate 2 m long, 1M wide and negligible thickness. A horizontal force of 50 n applied at point 'A' Just makes the plate tilt.



Calculate the weight of the plate.

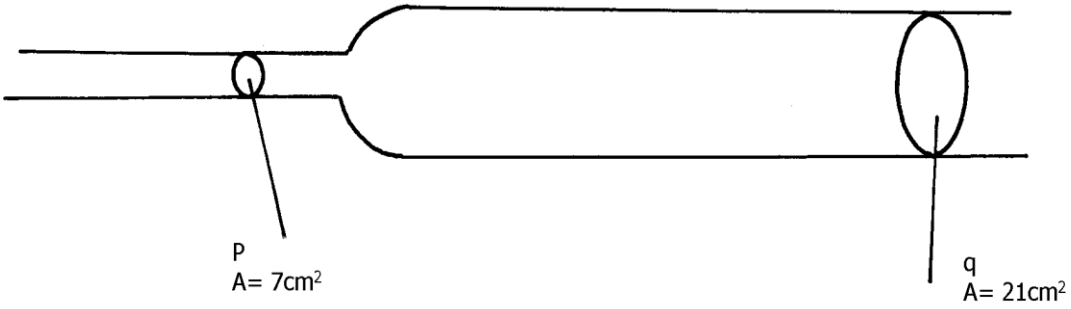
Fluid flow

1. Figure 5 below shows the cross-section of an aerofoil, with the aeroplane moving in the direction shown by the arrow.

Sketch the streamlines to show how air flows past the wing as the aeroplane moves

2. State Bernoulli's principle
3. The diagram below shows a section of a pipe with different cross – sectional area.

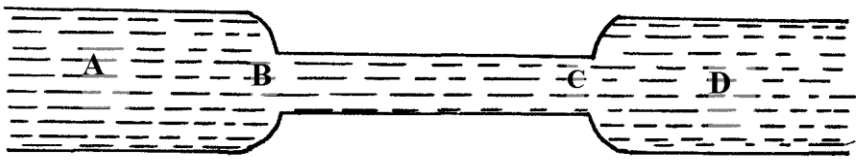
Figure 4



If water flows with a velocity of $5ms^{-1}$ in section **P**, what would be the velocity of water in section **Q** if the cross sectional areas are as shown?

4. In the diagram in ***figure 3***, water flows through a section of a pipe whose diameter changes as shown

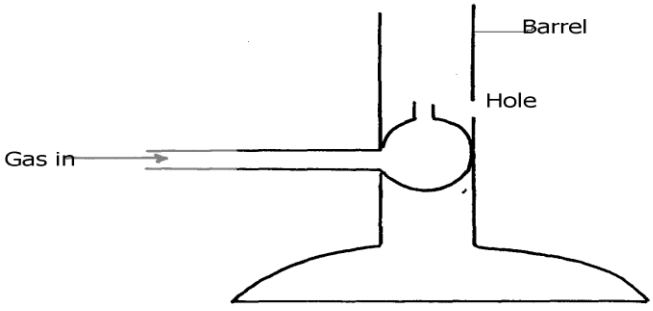
figure 3



Sketch a graph of the variation of pressure along the line **ABCD**

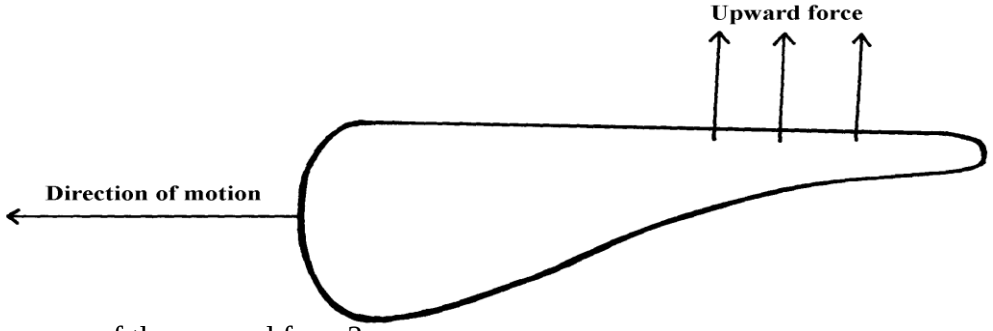
5 (i) State Bernoll'su principle

(ii)



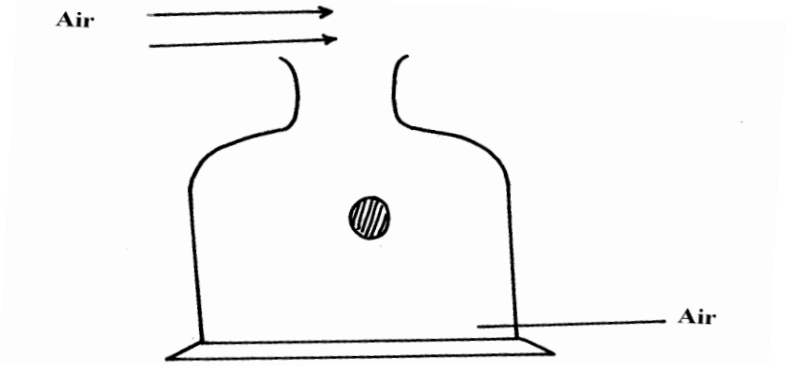
Explain how air is drawn into the barrel

6. The diagram below (figure 6) shows a cross- section of an aeroplane wing. When the aeroplane is moving at a constant height and constant speed, an upward force is exerted on its wing



What is the cause of the upward force?

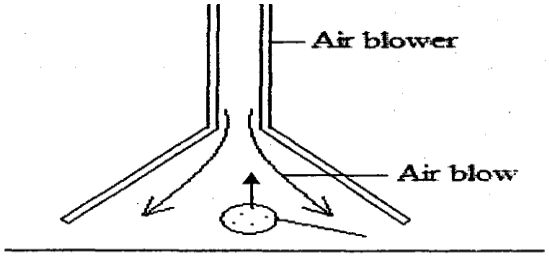
7. The figure below shows a light body floating in a container



State and explain the observation when a stream of air is blown over the mouth of the container as shown

8. Sea water of density **1.04g/cm^3** is being pumped into a tank through a pipe of uniform cross-sectional area of 3.142cm^2. If the speed of water in the pipe is 5m/s, determine the volume flux in S.I units

9. The figure below shows a pith ball being lifted in to a funnel end of a blower.



Explain this observation

10. (a) Define turbulent flow in fluids .
(b) The diagram below shows an obstacle placed in front of flowing water.

Complete the diagram to show how the water flows around the obstacle.

11. Water flows in a horizontal pipe of varying cross –sectional area and diameter and shown in the figure below.

If the cross-sectional area of A is $5cm^2$ and that of B is $4{,}5cm^2$ and also the rate at which the water flows from A is 100m/s,. Calculate the speed water through B.

(d). Given the apparatus, density bottle, beam balance, granular solid, water and blotting paper, describe the measurement on the experiment that can enable one to determine the relative density of the granular solid.

(e).Draw a single pulley with a velocity ratio of 2.

HOOKE'S LAW

1. The following results were recorded in an experiment where different masses were hung on the end of a long spring whose other end was firmly fixed. The length of the spring and the mass hanging from it were recorded as below. Original length of spring was 40cm.

Length of spring (cm)	44	48	52	56	60	65	70	74
Mass attached (kg)	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20
Force (load) on the spring (N)								
Extension of spring (m)								

(a) Complete the table for load and corresponding extensions
(b) Plot a graph of extension of the spring against load on the spring on the grid provided
(c) Determine the spring constant using the linear section of the graph
(d) Give an explanation why the slope of the graph changes when a mass greater than 0.75kg is attached to the spring
(e) From the list of quantities below, select quantities that are vector quantities:-
speed, density, force, acceleration and current

2. Sketch a graph of length of a helical spring against compressing force until the coils of the spring are in contact

3. The three springs shown in figure 2 are identical and have negligible weight. The extension produced on the system of springs is 20cm

fig. 2

Determine the constant of each spring

4. The graphs in figure 8 represents the relations between extension **e** and mass, **m** added on two springs x and y

Fig. 8

Given that the two springs are made from the same material, give a reason why the graphs are different

5. A single light spring extends by 3.6cm when supporting a load of 2.5kg. What is the total extension in the arrangement shown below. (**Assume the springs are identical)**

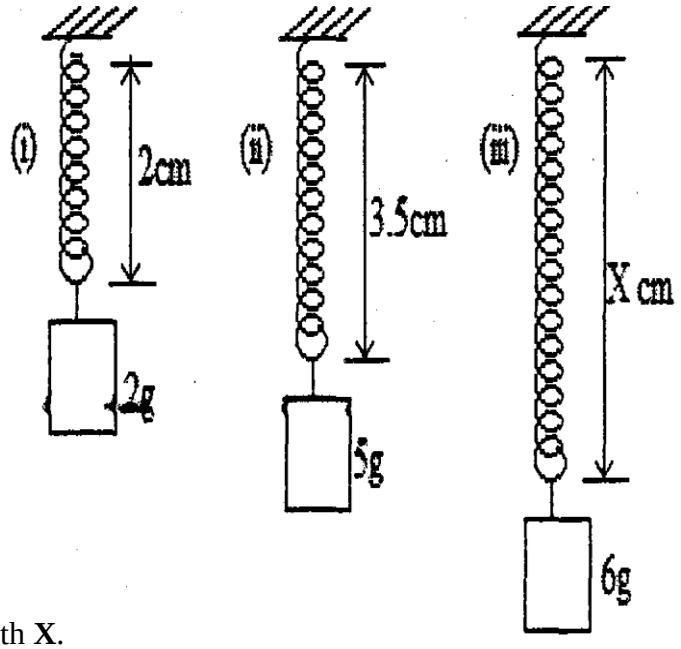
6. Three identical springs with proportionality constant of 50N/m. each are connected as shown below and support a load of 60N

Calculate;
(a) The extension in one spring
(b) The extensive proportionality constant of the springs

7. When a load of 20N is hung from a spring, the spring has a length of 15 cm. The same spring has a length of 17 cm when supporting a load of 25N. Determine the spring length when supporting no load.

The figure below shows a U-tube manometer. Use it to answer question 5 and 6. Density of water = 100 kg^{m-3}.

8. The diagram below shows three identical springs which obey Hooke's law.



(i) Determine the length **X**.