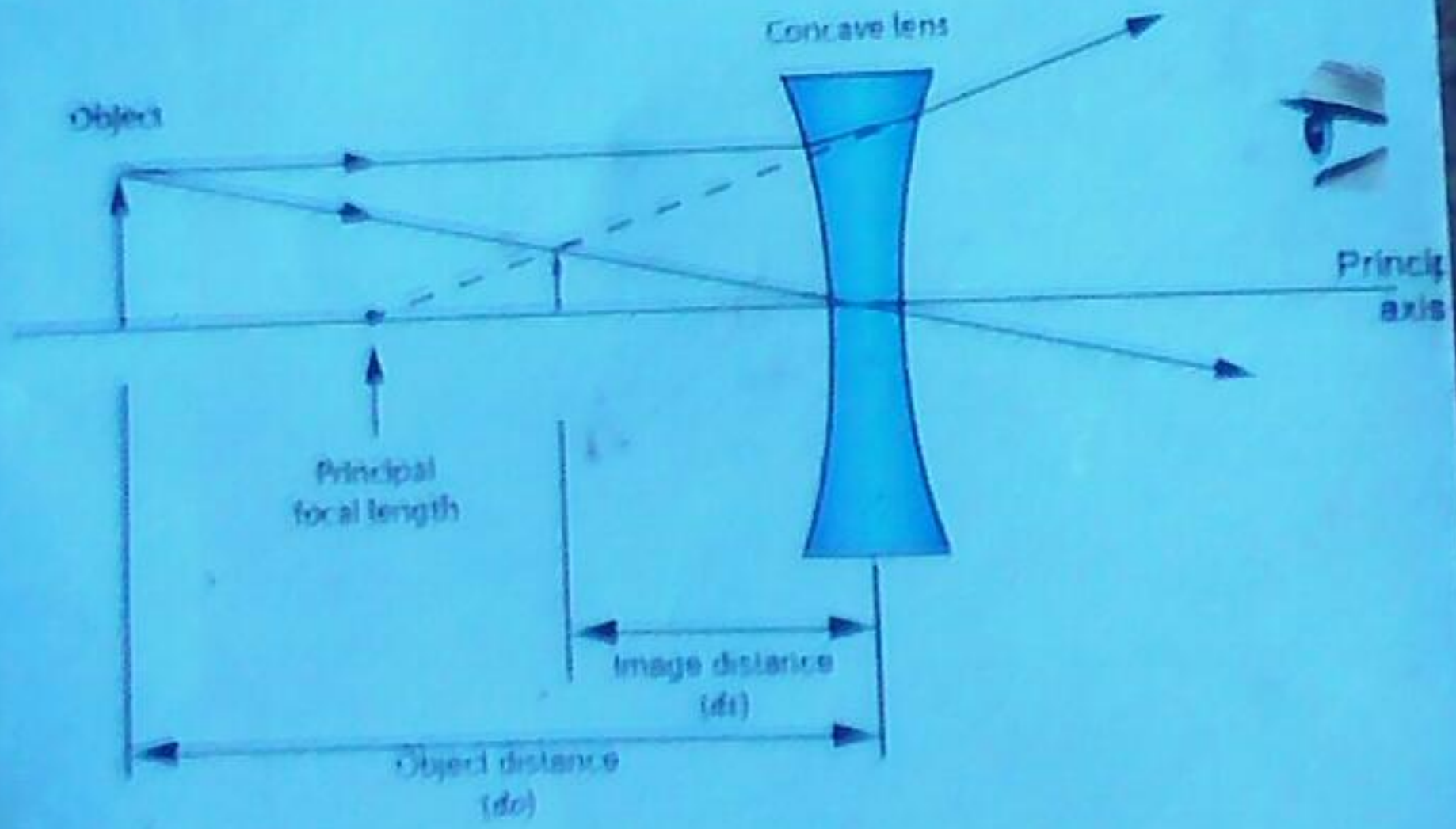
MSCE Past Papers

Physics

Questions & Answers



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- Past papers -

Physics

Questions and Answers

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MALAWI NATIONAL EXAMINATIONS BOARD

2019 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

Wednesday, 26 June

PAPER I

(100 marks)

SECTION A (70 marks)

1. (a) State any two methods of studying physics (2 marks)

Answer

— Through laboratory experiments

— Through scientific research

(b) Explain any one application of physics in medicine (2 marks)

Answer

— Nuclear physics is applied in medicine when gamma radiation is used to kill cancer cells

— Ultrasound machine uses principles of physics

— X-ray machine uses principles of physics

(c) Describe how the speed of a moving object can be measured using a tape measure and a stop watch. (3 marks)

Answer

— Using a measuring tape, measure a distance between point A and B.

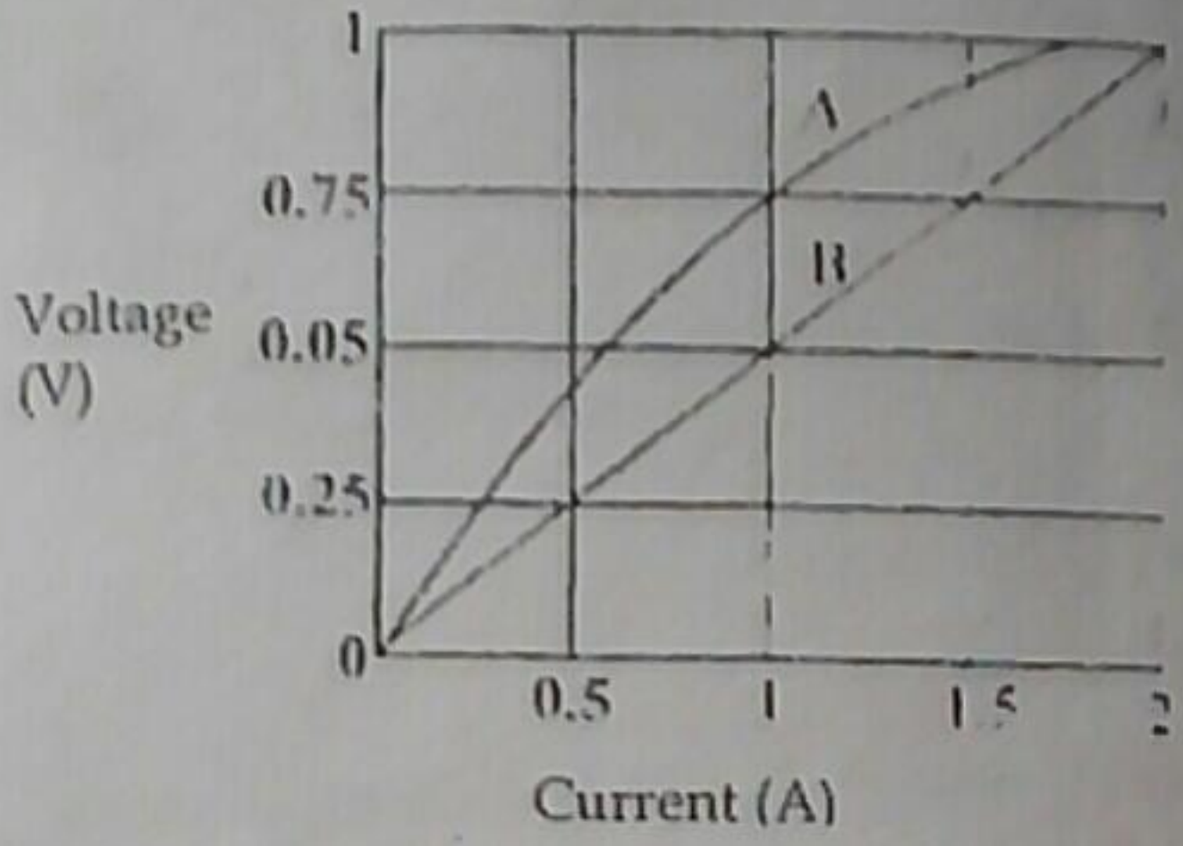
— Let the object start moving from A and start the stop watch instantly.

— Stop the stop watch once the object reaches point B.

— Record time taken by the moving object

— Speed of the object will be found by dividing distance between A and B by time taken

2. (a) Figure 1 is a graph of voltage against current for two conductors A and B. Use it to answer the questions that follow.



(i) Which conductor obeys ohms law? (1 mark)

Answer

— Conductor B

(ii) Calculate the resistance of conductor A (2 marks)

Answer

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

$$= \frac{1V}{1.75A}$$

$$= 0.57 \text{ ohms}$$

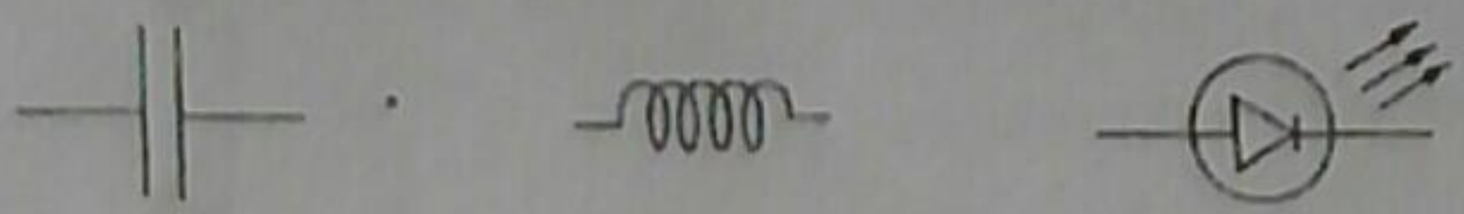
(b) Explain any **two** factors that determine the amount of heat produced when current flows through a conductor (4 marks)

Answer

— Type of conductor material: Conductors made up of materials with high electrical resistance like nichrome have a high amount of heat produced than materials made of copper.

— Amount of current: High current passing through the material produces a lot of heat as compared to small amount of current.

3. (a) Figure 2 is a diagram showing symbols for electrical components. Use it to answer the questions that follow.



W X Y

(i) Identify the component labelled W and X (2 Marks)

Answers

W: Capacitor

X: Inductor

(ii) What is the function of the component labelled Y? (1 Mark)

Answers

— Used in flat screen televisions

— Used as indicator

— Used in torches

(b) Give any one characteristics of a digital signal.

Answer

— It is discontinuous

— It is represented by square waves

— Has constant amplitude

(c) Explain how temperature affects resistance of a wire (3 marks)

Answer

— The wire with high temperature has a larger resistance because of increased vibration of the atomic lattice. When a material gets hotter the atoms in the lattice vibrate more. This makes it difficult for the electrons to move without interaction with an atom and increases resistance.

4 (a) State any two effects of force (2 marks)

Answer

— Force changes direction of a moving object

— Force changes speed of a moving object

— Force causes wear and tear

(b) A machine with a velocity ratio of 5 requires 5000J of energy to lift a load of 800N through a vertical distance of 5m. Calculate:

(i) the efficiency of the machine (2 marks)

Answer

Work = force × distance

= 800N × 5m

= 4000J

$$\text{Efficiency} = \frac{\text{Output energy}}{\text{input energy}} \times 100\%$$

$$= \frac{4000J}{5000J} \times 100\%$$

= 80%

The efficiency of the machine is 80%

(ii) the mechanical advantage of the machine (3 marks)

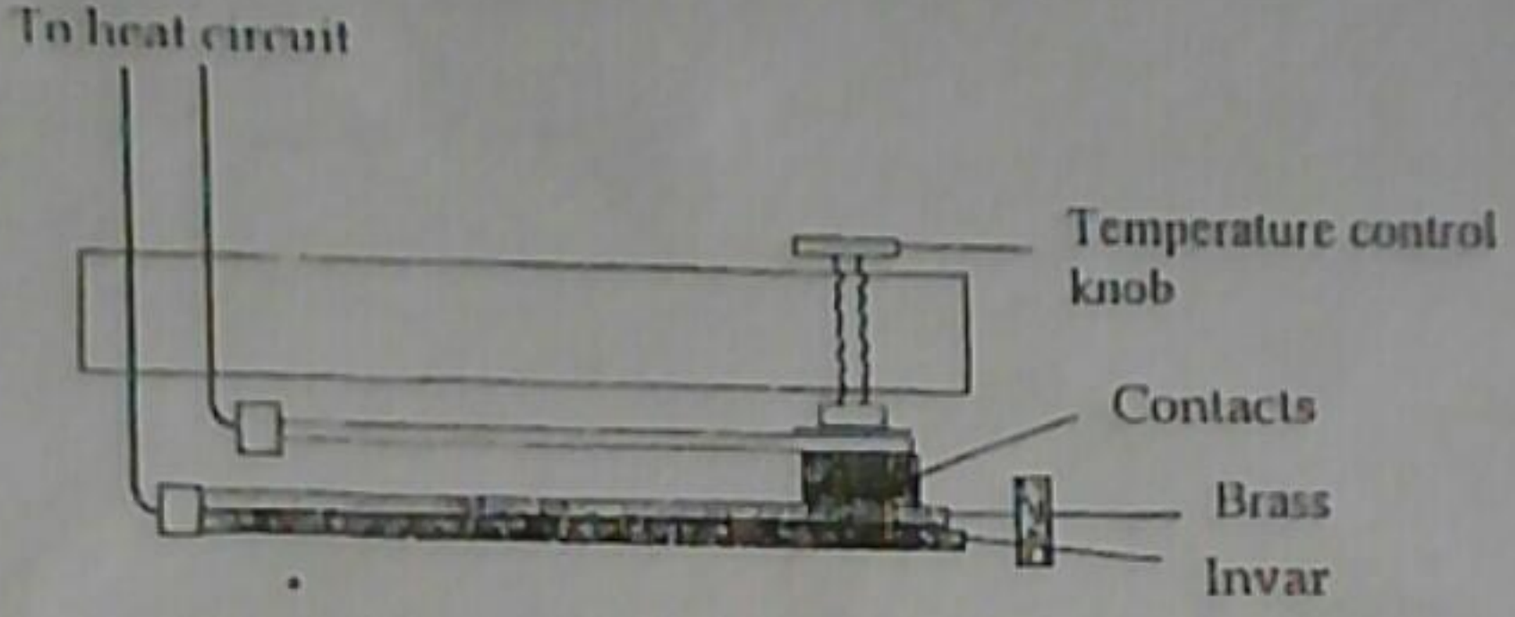
Answer

Mechanical advantage = Velocity ratio × Efficiency

= 5 × 0.8 (80% ÷100% = 0.8)

= 4

5. Figure 3 is a diagram showing a device which switches on and off electricity automatically in an electric appliance. Use it to answer the questions that follow.



(a) Name the device (1 mark)

Answer

— Thermostat ✓

(b) Explain how the device works (3 marks)

Answer

Thermostat has two pieces of different metals bolted together to form what is called a bimetallic strip (or bimetal strip). The strip works as a bridge in an electrical circuit connected to heating system. When the strip gets hot, one of the metals expands more than the other so the whole strip bends very slightly. Eventually, it bends so much that it breaks open the circuit. The "bridge is up", the electricity instantly switches off, the heating cuts out. Wen temperature cools, the strip cools too and bends back to its original shape. Sooner or later, it snaps back into the circuit and makes the electricity flow again, so the heating switches back on.

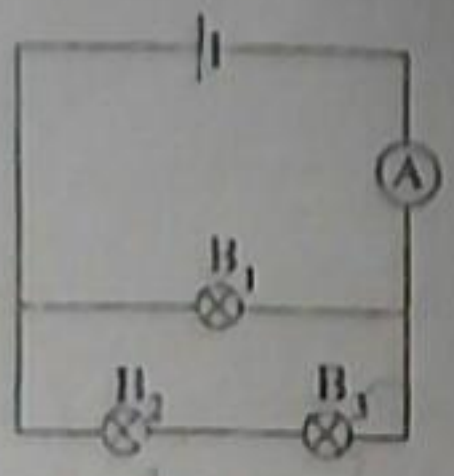
(c) Mention any **two** electrical appliances which use the device (2 marks)

Answer

— Electric kettle

— Electric iron

6. Figure 4 is a circuit diagram with three identical bulbs of resistance 1 ohm each



(a) Calculate:

(i) the electric current passing through B_1 (2 marks)

Answer

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

$$= \frac{1.5V}{1\Omega}$$

$$= 1.5A$$

(ii) the total resistance in the circuit (3 marks)

Answer

Total resistance of B_2 and $B_3 = 1\Omega + 1\Omega = 2\Omega$

$$\text{Total resistance of circuit} = \frac{B_1 \times 2}{B_1 + 2}\Omega$$

$$= \frac{1 \times 2}{1+2}$$

$$= 0.7\ \Omega$$

(b) With the aid of a diagram, describe the arrangement of dipoles in a fully magnetized steel bar (2 marks)

Answer

It consists of two equal and opposite magnetic poles separated by a finite distance. The magnetic dipole consists of two equal and opposite magnetic charges having pole streneth $+m$ and $-m$ separated by a finite distance

7. (a) Give two properties of lenses (2 marks)

Answer

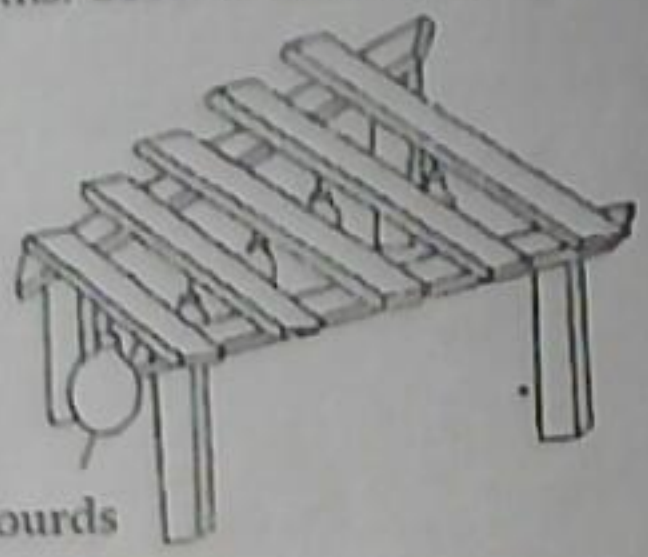
— They focus light

— They bend light

(b) An object 1 cm high is placed 20cm in front of a convex lens with a focal length of 10cm. using a ray diagram, find the image distance. (5 marks)

Answer

8. (a) Figure 5 is a diagram showing a traditional musical instrument which consists of wooden bars of different lengths. Use it to answer the questions that follow.



Gourds

(i) Name the instrument (1 mark)

Answer

— Xylophone

(ii) How does the instrument produce sound? (1 mark)

Answer

— When the mallet hits the bars, it makes the bars vibrate. From that vibration, it creates waves in the surrounding air, and finally, these waves are recognized as sound by the brain

(iii) Why are wooden bars made of different lengths? (1 mark)

Answer

— Bars of the xylophone are created with different lengths, which produce different sounds. Shorter xylophone bars produce high notes and longer xylophone bars produce lower notes

(iv) What is the purpose of putting gourds under each wooden bar? (1 mark)

Answer

— To amplify sound

9. (a) The following equation shows decay of sodium (Na) into magnesium and other nuclear radiations:

$$^{24}_{11}Na \longrightarrow {}^{24}_{12}Mg + x + y \text{ radiation}$$

(i) Name the particle X (1 mark)

Answer

— Electron (beta particle)

(ii) State any one property of X radiation (1 mark)

Answer

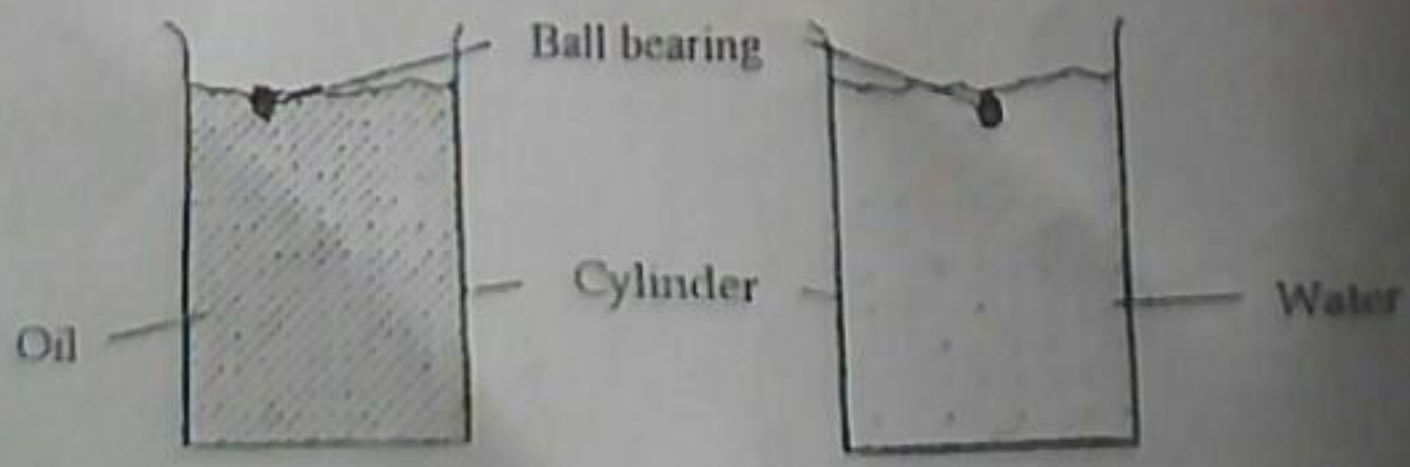
— Has a negative charge

(b) Explain how nuclear radiations can be used to trace brain tumors (2 marks)

Answer

— A small radioactive tracer is injected into the blood vessels leading to the brain. It can take from a few seconds to several days for the tracer to collect in the part of the brain with tumors. Regions of the brain with tumors will have concentrated radioactive material.

(c) Figure 7 is a diagram showing a set-up of an experiment investigating the fluid resistance to motion of objects. The ball bearings were released into the fluids at the same time. Use it to answer the questions that follow



(i) Which ball bearing reached the bottom of the cylinder first? (1 mark)

Answer

— Ball bearing in water

(ii) Mention any **two** variables that were kept constant in the experiment (2 marks)

Answer

— Volume of water and oil
— Mass of ball bearing

10. (a) Define Centre of gravity (1 mark)

Answer

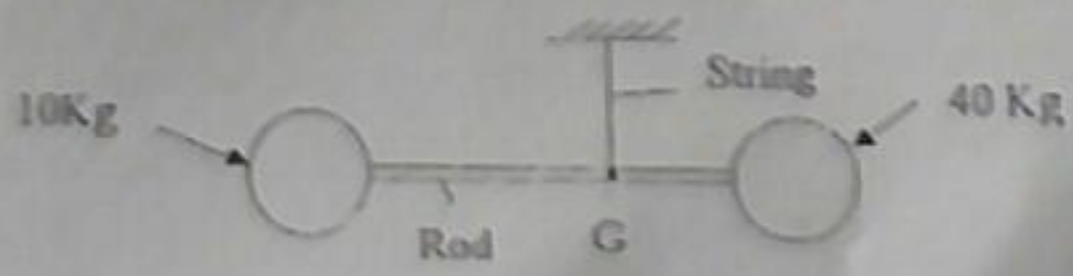
— It is the point where the mass of the body is concentrated.

(b) State any **two** ways of increasing mechanical advantage of an inclined plane (2 marks)

Answer

— Using rollers
— Decrease the angle to the horizontal

(c) **Figure 8** is a diagram showing two spheres connected by a straight rod of length 10cm and suspended in the air at the centre of gravity G



Answer

$R_m = MR/(M + m)$

$= 40kg \times 10cm / (40kg + 10kg)$

$= 8cm$

The centre of mass is 8cm from 10kg mass

SECTION B (30 marks)

11. (a) Explain how a terminal speed is reached by an object falling through a liquid (4 marks)

Answer

— Soon after being dropped into the fluid, the object will fall down with high speed due to force of gravity.

— As the object falls, the fluid resistance builds up which leads to reduction in the falling speed of the object in the fluid

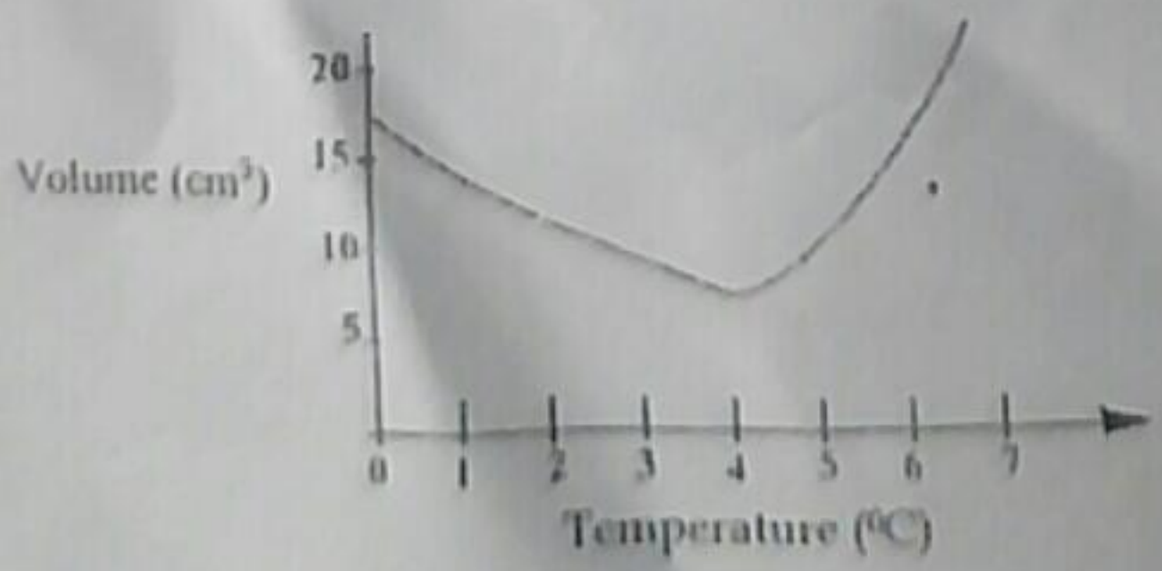
— The fluid resistance becomes big and balances with the weight of the object and the object falls with constant speed called terminal velocity

(b) Explain how the action of floating and sinking is achieved in submarine ships (6 marks)

Answer

Submarines are made of ballast tanks. When the tanks are empty, the submarine has less mass and it floats like a normal ship. As water is allowed into the tanks, the mass of the submarine increases, the downward gravitational force on the submarine increases and the submarine begins to sink. Careful balancing of the water ballast enables the craft to stay at any chosen depth.

12. (a) Figure 9 is a graph showing the behaviour of water when heated



Describe the behaviour of water according to the graph (5 marks)

Answer

— An increase in temperature from 0°C to 4°C, causes water to decrease in volume

— At 4°C water has the lowest volume

— Increasing temperature beyond 4°C makes water to increase in volume

(b) Explain the effect on magnetism when a magnet is heated to red hot and suddenly cooled down (5 marks)

Answer

A magnet subjected to heat experiences a reduction in its magnetic field as the particles within the magnet are moving at an increasingly faster and more sporadic rate. This jumbling confuses and misaligns the magnetic domains, causing the magnetism to decrease.

13. (a) Explain how a liquid in a glass thermometer works to determine temperature of a substance (4 marks)

Answer

Liquid-in-glass thermometers are based on the principle of thermal expansion of substances. A liquid in a glass tube (called a capillary) expands when heated and contracts when cooled. A calibrated scale can then be used to read off the respective temperature that led to the corresponding thermal expansion

(b) Describe an experiment that could be carried out in order to show that liquid pressure increases with depth (6 marks)

Answer

— Make two holes on a tall tin at different depth

— Pour water into the tin up the top

— Observe the pressure of water coming out from the holes

— It will be observed that water from bottom holes falls with high pressure and farther from the tin while water from top holes comes out with low pressure and water falls closer to the tin

— Thus shows that liquid pressure increases with depth

MALAWI NATIONAL EXAMINATIONS BOARD

2019 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

Friday, 21 June

PAPER II

(40 marks)

SECTION A (20 marks)

1 A student investigated whether the periodic time is affected by mass on an oscillating spring. The student recorded the data shown in table 1

Mass (g)	Time taken for 10 oscillation (s)	Periodic time (s)
100	10.4	
200	14.4	

Write a laboratory report on this investigation. In the report include the title for the report, aim of experiment, apparatus used, procedure followed, analysis of data collected and conclusion

Answer

Effect of mass on periodic time of an oscillating spring

Aim: To investigate the effect of mass on periodic time of an oscillating spring

Apparatus: clamp stand, spring, masses 100g and 200g, stopwatch, pen and notebook

Procedure

— Hang a spring on a clamp stand

— Put a 100g mass on a spring

— Pull the mass downwards to a specific amplitude and let it oscillate up and down

— Instantly start a stopwatch

— Count 10 complete oscillations

— Stop the stopwatch

— Note the time taken to complete 10 oscillations e. g 10.4 seconds

— Record the time in a table

— Put a 200g mass on the spring

— Pull the mass downward at same amplitude as that of 100g mass

— Let it swing and instantly start a stopwatch

— Note time taken for 10 complete oscillations e. g 14.4 seconds

Analysis

— Find the time period for each mass

Time period for 100g mass

Period = time taken ÷ number of oscillations

= 10.4s ÷ 10

= 1.04 s

Time period for 200 g mass

Period = 14.4s ÷ 10

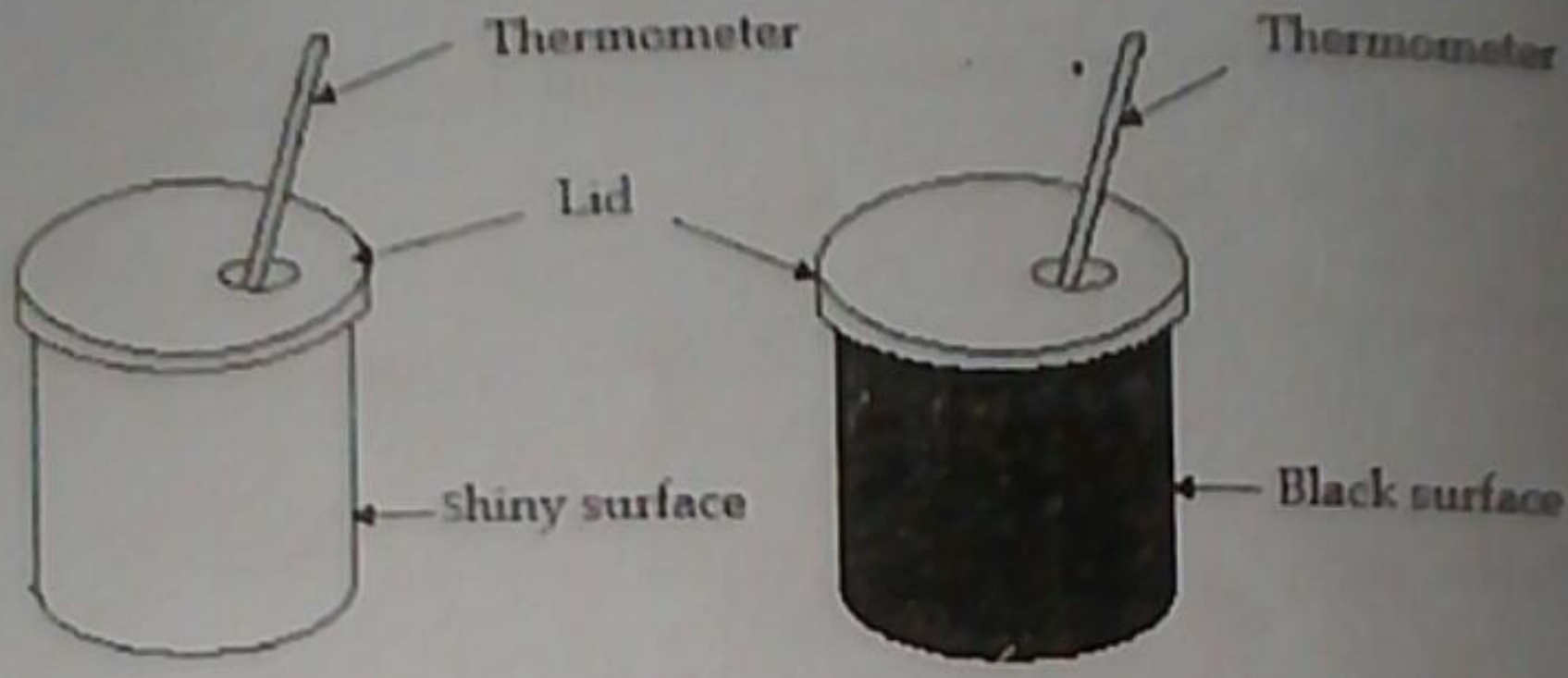
= 1.44 s

Conclusion

— An increase in mass of an oscillating spring increases the periodic time

2. With the aid of a well labelled diagram, describe an experiment to show that a black surface absorbs heat better than a shiny surfaces.

Answer



— Put water in a tin with a black surface

— Put equal volume of water in a shiny surface

— The tins should be made of the same metal types

— Place a cover on top of each tin

— Place thermometers through the holes of the covers

— Record the initial temperature of water

— Place the two tins under scotching sunshine

— Record the temperature of water in each tin at time interval of 5 minutes for 1 our

— Record values in a suitable table

— After 1 hour, evaluate results

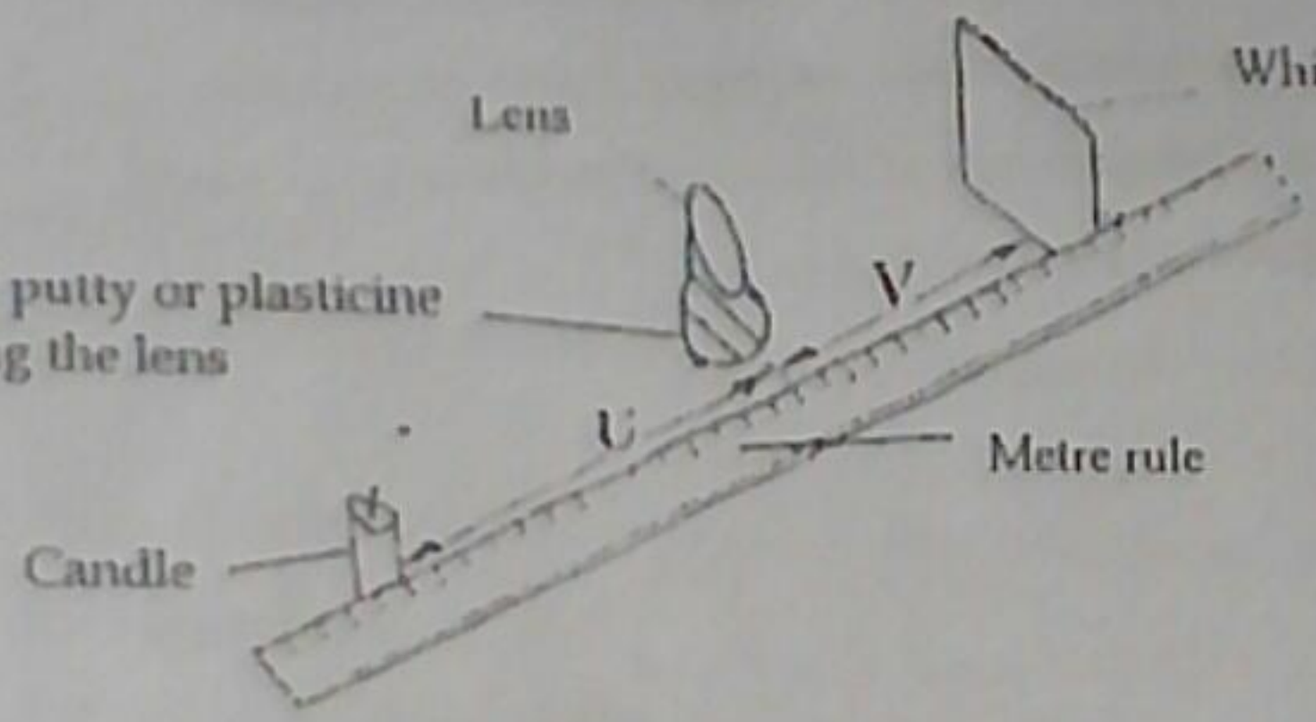
— It will be observed that a tin with a black surface as recorded a very high temperature rise compare to a tin with a shiny surface

— This shows that black surfaces have a good heat absorption rate than shiny surfaces

SECTION B (20 MARKS)

3. You are provided with a ball of putty/plasticine, convex lens, 1 meter rule, white cardboard, candle and matches.

   a. Arrange the apparatus as shown in figure 1



   b. Light the candle

   c. Adjust the position of the candle so that the distance from the candle to the centre of the lens (u) is 12 cm.

   d. Move the screen until you get a clear image of the candle flame on the screen

   e. Measure the distance from the screen to the centre of the lens (V) and record in the second column of **table 2**.

   f. Repeat steps c to e for object distances of 15cm, 20cm and 30cm

OBJECT DISTANCE (U) cm	IMAGE DISTANCE (V) cm	$\frac{1}{U}(cm)^{-1}$
12		
15		
20		
30		
40		

   g. Complete the third column of table 2.

   h. Plot a graph of V (cm) against $\frac{1}{u}(cm)^{-1}$

4. You are provided with distilled water, spirit burner, thermometer, glass beaker measuring cylinder, stop watch, glass stirring rod and matches

a. Measure 150 cm^3 of distilled water and pour it into a dry beaker

b. Measure the initial temperature of water and record in table 3 as T_1

c. Set up the experiment as shown in figure 2

d. Heat the water using the spirit burner for 5 minutes while constantly stirring

e. After 5 minutes measure the final temperature of distilled water and record in table 3 as T_2

Volume of water (cm^3)	Initial Temperature °C (T_1)	Final Temperature(T_2)	Temperature change ΔT (°C)
150			

f. Complete the fourth column of the table 3 (4 marks)

g. Calculate the amount of heat required to raise the temperature of 150 cm^3 of water using the formula $Q = MC\Delta T$. (Specific heat capacity of water 4200K/kg°C and density of water 1g/cm^3) (4 marks)

h. Differentiate heat capacity from specific heat capacity (2 marks)

Suggested answers

— There is single correct answer for this question. The information collected differs from one student to another. However, a common pattern of results is expected from students

b. The initial temperature of water is likely to be around 20 °C at room temperature

e. After heating for 5 minutes the temperature of water will rise e. g temperature will rise to 45 °C

f. Temperature change ΔT (°C) = 45 °C - 20 °C = 25°C

g. $Q = MC\Delta T$

$= 150\ cm^3 \times 1g/cm^3 * 0.001kg \times 4200J/kg°C \times 25°C = 15750J$

h. Specific heat capacity is amount of energy needed to change the temperature of 1kg of a substance by 1°C while heat capacity is the amount of energy needed to raise temperature of substance by 1°C

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2020 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

Monday, 25 January 2021

PAPER 1

(100 Marks)

SECTION A (70 Marks)

1. (a) (i) Define absolute zero (1 mark)

Answer

Absolute zero is the lowest temperature possible. At a temperature of absolute zero there is no motion and no heat.

(ii) Convert 45 Kelvins to degrees Celsius (2 marks)

Answer

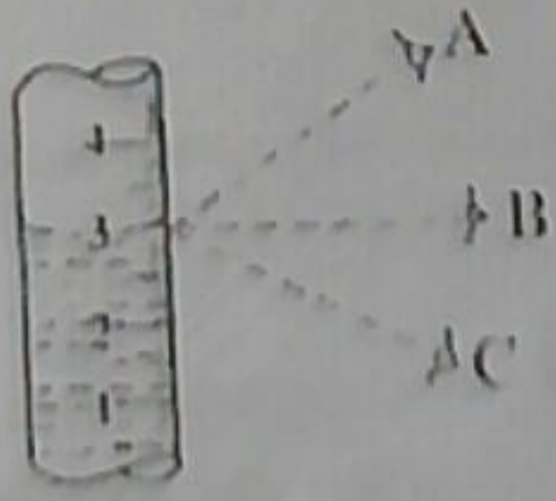
$K = 273 + {}^{0}C$

${}^{0}C = 45K - 273$

$= -228$

Therefore temperature is – 228 ^{0}C

(b) Figure 1 is a diagram illustrating three students A, B and C takin a reading from a measuring cylinder.



(i) Which student is likely to get a correct reading from the cylinder (1 mark)

Answer

— Student B

(ii) Name the type of error which students that get wrong readings are likely to make (1 mark)

Answer

— Random error

(iii) Calculate the relative error if student C gets a reading of 3.1 cm^3. (2 marks)

Answer

— Relative error $= \frac{\text{measured value} - \text{real value}}{\text{real value}}$

$= \frac{3.1-3}{3}$

$= 0.03$

2. (a) Figure 2 shows a hazard symbol indicated on some materials found in a physics laboratory

(i) Give the meaning of the symbol (1 mark)

Answer

— High voltage

(ii) State any two ways of handling a material with the symbol in figure 2 (2 marks)

Answer

— Turn off the power before touching equipment

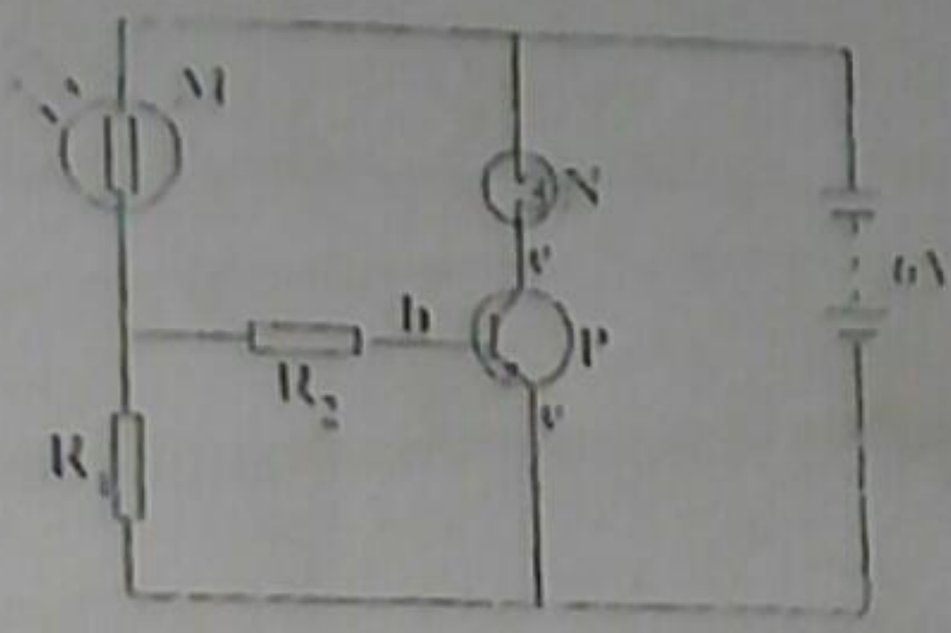
— Avoid water at all times when working with equipment

(b) Describe how atmospheric pressure is applied when using a drinking straw (4 marks)

Answer

— A drinking straw is used by creating suction with the mouth. This causes a decrease in air pressure inside the straw. Since pressure acting on the surface of the drink is equal to atmospheric pressure, so this greater pressure pushes the soft drink up the straw into the mouth

3. Figure 3 shows a circuit with some electronic devices in use



(a) Name the devices labelled M and N (2 marks)

Answer

M: Light dependent resistor

N: Bulb

(b) Explain how part p operates as a light operated switch in the circuit during bright light (4 marks)

Answer

— During bright light, part M (Light dependent resistor) will have low resistance which will make it to have low voltage. If voltage reaching part b is almost zero, part p (transistor) will switch off. Therefore the bulb will not hive light

(c) Name the logic gate which is also called the inverter (1 mark)

Answer

— NOT gate

4. (a) give any two types of nuclear radiations (2 marks)

Answer

— Alpha

— Beta

— gamma

(b) Explain how radioactivity is used in archaeology (2 marks)

Answer

— Archaeologists use radioactive carbon - 14 to determine the ages of fossils and other objects through a process called carbon dating

(c) Calculate the velocity with which a ball hits the ground when released from a roof 9m high. Hint: use $g = 10m/s^2$ (3 marks)

Answer

$H = \frac{1}{2} \times g \times T^2$ where, H =Height, T = Time and $g = 10m/s^2$

$9m = 0.5 \times g \times T^2$

$9m = 0.5 \times 10m/s^2 \times T^2$

$T^2 = 5s$

$T = \sqrt{5} = 2.2s$

Velocity = Time × Acceleration due to gravity

$= 2.2s \times 10m/s^2$

$= 22m/s$

5. (a) Table 1 shows atomic numbers and numbers of neutrons of different atoms W, X, Y and Z which are not their real chemical symbols

Atom	W	X	Y	Z
Atomic number	6	7	6	8
Number of neutrons	6	7	8	8

(i) Identify two atoms that are isotopes (2 marks)

Answer

— W and Y

(ii) Explain your answer (2 marks)

Answer

— W and Y have same number of protons but different number of neutrons

(iii) Express atom Y in its nuclear notation (1 mark)

Answer

$^{14}_{6}Y$

(b) Give any two factors which affect the melting point of a substance (2 marks)

Answer

— Impurities

— Altitude

6. (a) Define density (1 mark)

Answer

— It is the mass of matter per unit volume

(b) Explain how an increase in temperature affects the density of a substance (3 marks)

Answer

— An increase in temperature leads to increased volume of matter while mass remains constant. So increase in temperature decreases the density of substance since it increases the value of denominator while numerator remains constant in the density equation.

(c) Calculate the altitude at which pure water will boil at 94 °C (3 marks)

Answer

— At 0 ft. altitude water has a boiling point of 100 °C

— An increase in altitude by 500 ft., boiling point of water decreases by 0.5 °C

— e. g 500 ft. = 0.5 °C decrease from boiling point at 0ft altitude

— Difference between 100 °C and 94 °C = 6 °C

$0.5\,^{o}C = 500\,ft$

$6\,^{o}C = \text{More}$

$$\text{Altitude} = \frac{500 \times 6}{0.5}$$

$$= 6000\,ft$$

7. (a) Give one difference between scalar and vector quantities (1 mark)

Answer

— Scalar quantities have magnitude only while vector quantities have magnitude

and direction

(b) Figure 4 is a record of a complete motion of a trolley joined to a ticker -tape with dots showing the position of the trolley at regular intervals of time.

Describe the motion of the trolley from start to finish (A to D) (3 marks)

Answer

— From A to B:Constant speed

— From B to C:Increasing speed

— From C to D:Constant speed

(c) Explain how a seat belt in a vehicle reduces injury to the driver (3 marks)

Answer

——When the car crashes, there is no unbalanced force acting on the person, so they continue forward (Newton's First Law). The person moves against the seat belt, exerting a force on it. The seat belt then exerts a force back on the person (Newton's Third Law). This causes a controlled deceleration of the person.

8. (a) State the energy-work theory (1 mark)

Answer

— The work-energy theorem states that the net work done by the forces on an object equals the change in its kinetic energy.

(b) Give any three properties of electromagnetic waves (3 marks)

Answer

— Do not need a medium to propagate

— Have same speed in vacuum

- Have no charge
- Are transverse in nature.
- Obey wave equation

(c) Describe how shrink fitting method could be applied to make tight fits (3 marks)

Answer

— One metal is cooled down to reduce its size. The metal is fitted into another metal with a hole. When the cooled metal retains its original size, the two metals tight fit together

9. (a) Give two effects of balanced forces on objects (2 marks)

Answer

— Object remains at rest

— Object moves at constant speed

(b) Give any two differences between mass and weight (2 marks)

Answer

— Mass does is the same at earth and moon while weight is different at earth and moon

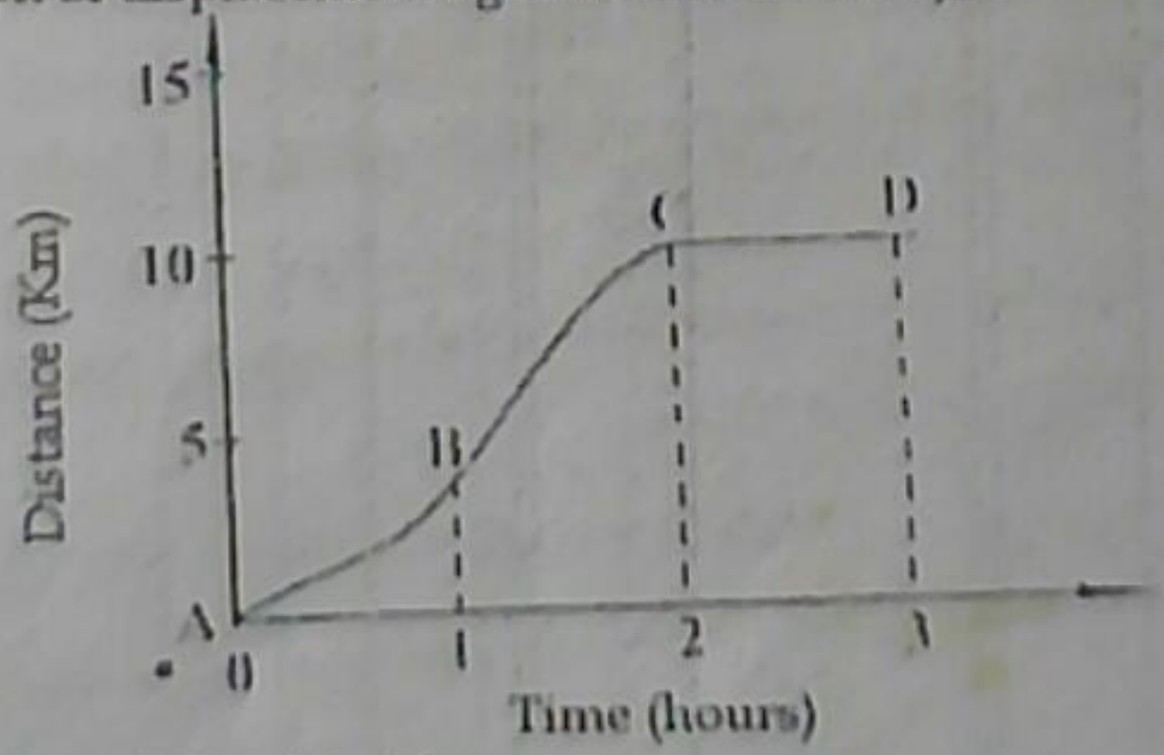
— Mass is measured in kilograms while weight is measured in newtons

(c) Outline the energy changes that take place in a burning stick of matches (3 marks)

Answer

— A matchstick has a lot of chemical energy stored in it. When the match is struck, it burns and the chemical energy in it produces heat energy and light energy.

10. Figure 5 is a graph of displacement against time of an object.



(a) Describe the motion of the object from:

(i) A to B (1 mark)

Answer

— Increasing speed

(ii) B to C (1 mark)

Answer

— Decreasing speed

(iii) C to D (1 mark)

Answer

— Constant speed

(b) Calculate the average speed of the object from A to C (2 marks)

Answer

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{10km}{3H}$$

$$= 3.3\text{Km/H}$$

(c) Explain how Newton's third law of motion is used when one is walking (2 marks)

Answer

— When walking the foot pushes backward on the ground and the ground reacts by pushing the foot forward

11. (a) Describe how a falling object in air reaches terminal velocity (5 marks)

Answer

— Soon after being released the object falls with high speed because of no air resistance. The object falls due to sole influence of gravity

— As the object speeds, air resistance builds up leading to reduction in speed of the falling object

— Eventually the air resistance balances with the weight of object and falls at constant speed called terminal velocity

(b) Using a truth table, describe how an OR gate works (5 marks)

Answer

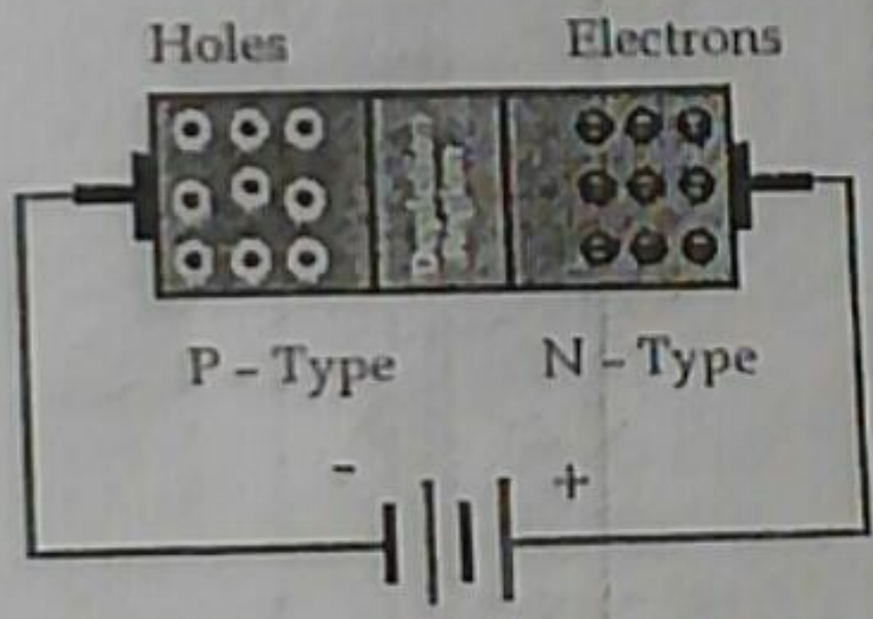
— An OR gate gives an output of 1 when one of the inputs is 1 or both inputs are 1

— If both inputs are 0, the output is 0

Input A	Input B	Output C
1	1	1
0	0	0
1	0	1
0	1	1

12. (a) With the aid of a well labelled diagram, explain why a diode does not conduct electricity when reverse biased (6 marks)

Answer



— In reverse bias the positive terminal of battery is connected to N-type material of diode so they attract. So electrons moves towards N-type material The negative terminal of battery is connected to P- type material of diode. Holes will move towards p - type material. The energy gap increases. Hence diode will not conduct electricity when reverse biased.

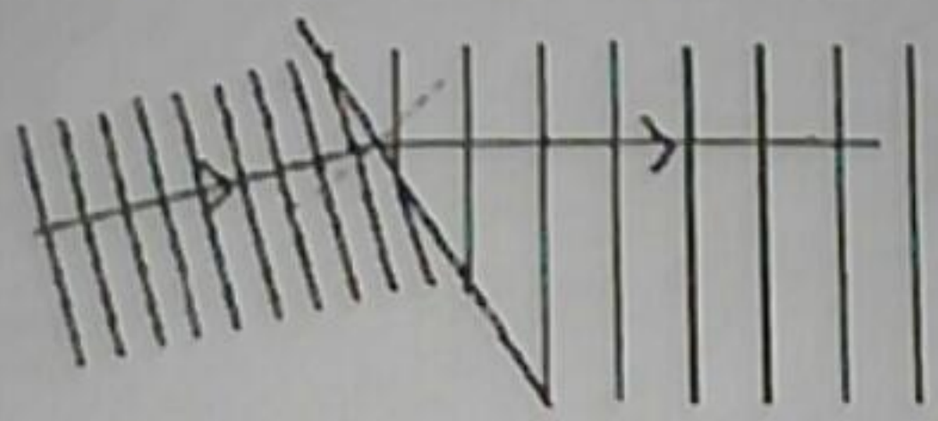
(b) Describe how a thermometer can be graduated into a degrees Celsius (°C) scale (4 marks)

Answer

For the thermometer, first subtract 90°C - 80°C = 10°C. Next, count that ten intervals are between the labeled graduations. Therefore, the scale increment is 10°C/10 graduations = 1°C/graduation.

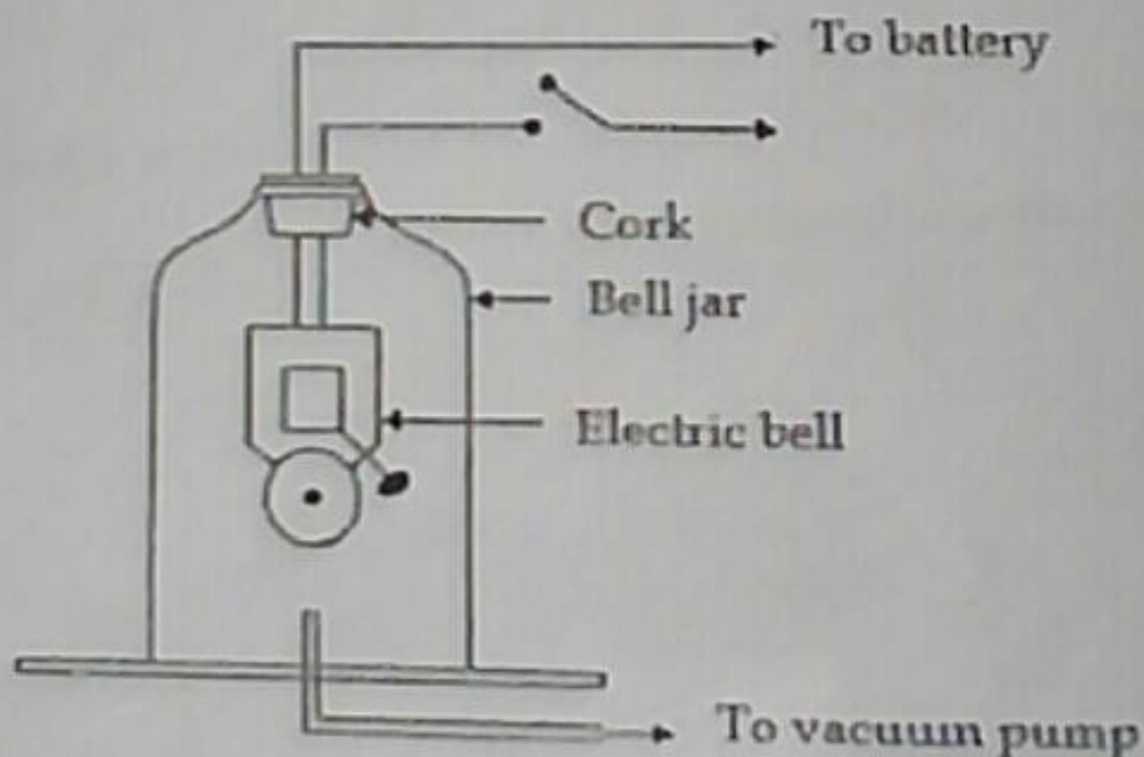
13 (a) With the aid of a well labelled diagram, describe the refraction of water waves as they travel from shallow to deep region (5 marks)

Answer



The wave has the same frequency, but speed increase, wavelength increase and the water wave is refracted away from the normal.

(b) With the aid of a diagram, describe an experiment that could be done to show that sound requires a medium to travel through (5 marks)



— Put an electric bell inside a glass jar
— Connect an electric bell to power source and vacuum pump
— Turn on the switch of the electric bell
— It will be observed that the hammer hits the gong of the electric bell
— The electric bell will produce loud sound
— Start pumping out air from the glass jar using a vacuum pump
— It will be observed that sound starts becoming faint and eventually sound stops being heard despite seeing the hammer hitting the gong
— This sows that sound needs a medium like air to transmit

MALAWI NATIONAL EXAMINATIONS BOARD

2020 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

Friday, 26 June

PAPER II (Cancelled paper)

(40 Marks)

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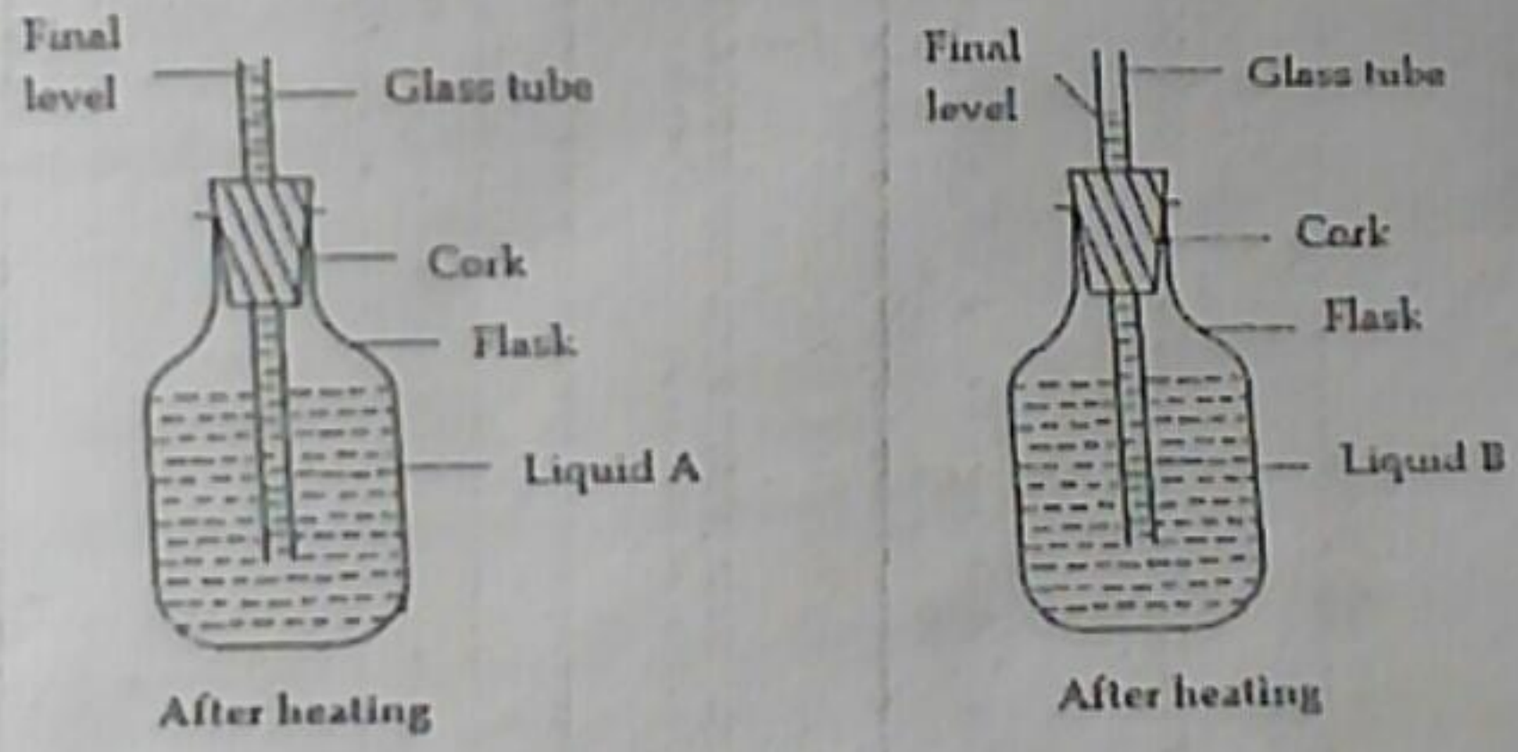
1. With the aid of a well labelled diagram, describe an experiment that could be done to show that different liquids expand by different amounts when heated equally.

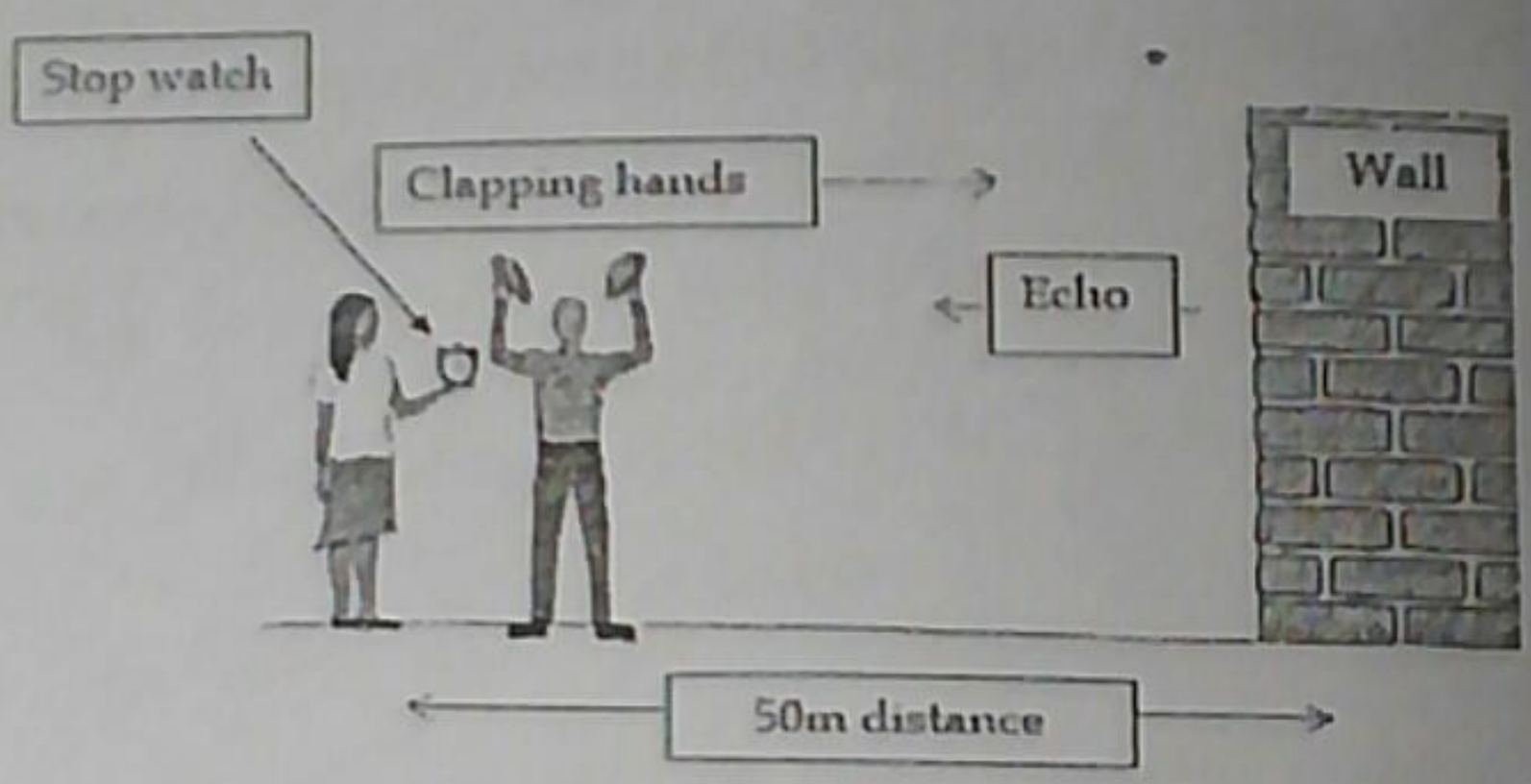
Answer



— Fill two identical flasks with different liquids
— The volume of liquids should be equal
— Inser two glass tubes in corks having holes
— Now fit the corks tightly on the mouth of both flask
— The liquids will rise into the tubes
— Set the tubes properly so that the level of liquid is equal
— Mark the initial level of liquid in both tubes
— Instantly put both flasks in a bath of hot water
— Stir the bath continuously to ensure that temperature is uniform
— Observe the level of liquid in each tube after 10 minutes
— It will be observed that the liquids have different level in the tubes
— This shows that liquids expand differently when heated equally

2. Design as experiment that could be used to find the speed of sound in air using an echo

Answer



— Using a measuring tape, measure a distance of 50m from a tall wall

— Let two students stand at a distance of 50m away from the wall

— One student should clap hands and the other student should instantly start a stop watch

— Once the echo is heard, the stop watch should be stopped

— The time taken for the echo to be heard should be recorded

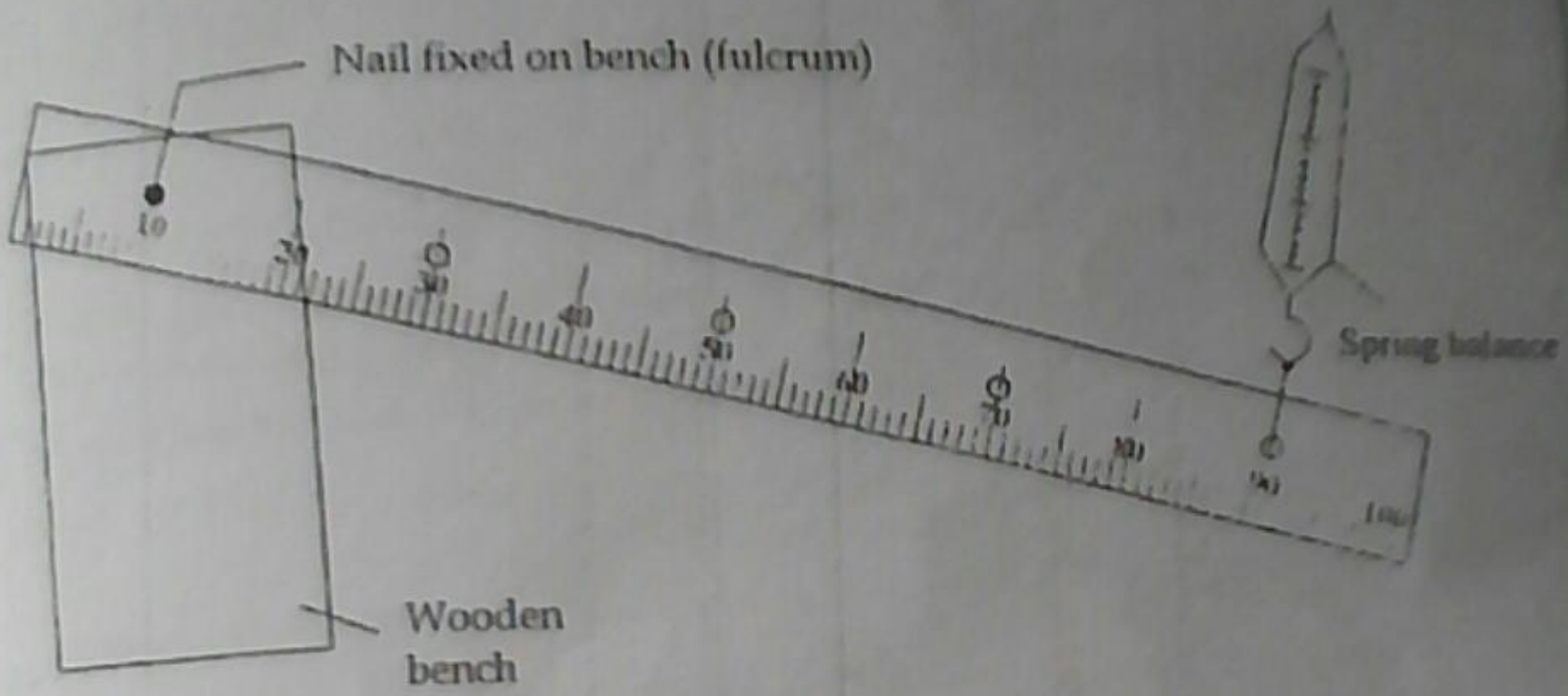
— Speed of sound will be found by dividing the distance between students times 2 then divided by time taken

— The equation for speed of sound using echo method is:

$$\text{Speed of sound} = \frac{\text{Distance} \times 2}{\text{Time taken}}$$

3. You are provided with a spring balance, a hole punched metre rule (with holes at 10 cm, 30 cm, 50 cm, 70 cm and 90 cm), a nail fixed on a bench and a 400g mass.

a. Arrange the apparatus as shown in figure 1



b. Hook the spring at 90cm of the metre rule

c. Hook the mass at the 30 cm mark on the meter rule

d. Raise the spring balance until the metre rule is horizontal to the ground

e. Record the reading of the spring balance in table 2

f. Repeat steps (c) to (e) using the following marks on the metre rule 50 cm, 70 cm and 90 cm. (4 marks)

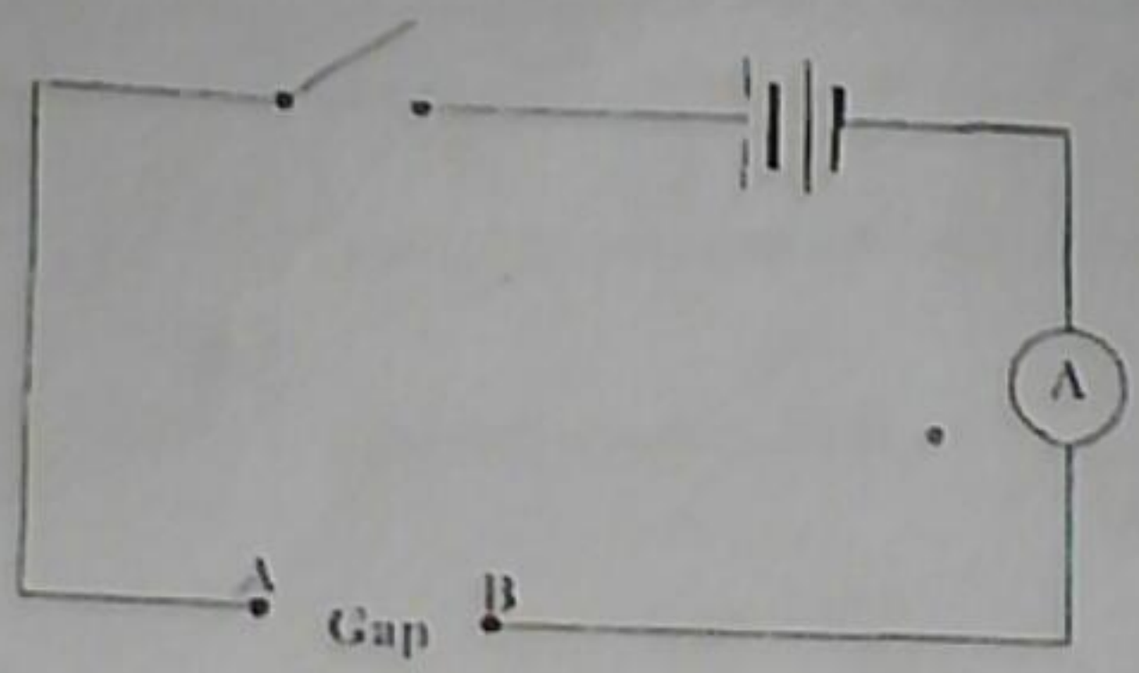
Distance of load from fulcrum (cm)	Reading of spring balance (effort)
30	
50	
70	
90	

g. Plot a graph of effort against distance of load from the fulcrum (5 marks)

h. From the graph, deduce one way of reducing the effort of this lever(1 mark)

4. You are provided with the following materials: Voltmeter, ammeter, 5 connecting wires, switch, 20cm nichrome wire, four 1.5V cells.

a. Arrange the apparatus as shown in figure 2 below



b. Connect the 20 cm nichrome wire the gap AB

c. Starting with one cell, close the switch and record the ammeter and voltmeter readings in the table.

d. Repeat step C with 2, 3 and 4 cells and record the ammeter and voltmeter readings in the table (4 marks)

Number of cells	Current (amperes)	Voltage (Volts)

e. Plot the graph of voltage against current (4 marks)

f. From the graph determine the resistance of a 20cm nichrome wire (2 marks)

MALAWI NATIONAL EXAMINATIONS BOARD

2020 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

Friday, 8 January, 2021

PAPER II (Repeated paper)

(40 Marks)

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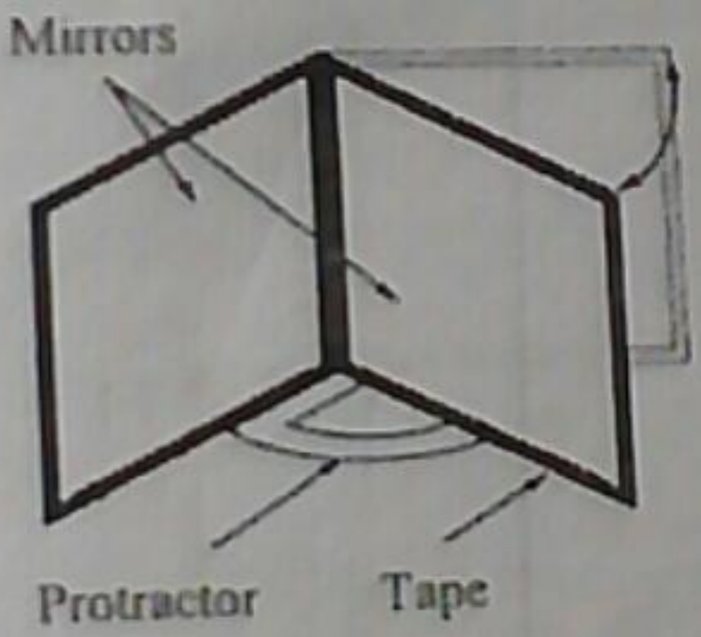
1. Describe an experiment that can be done to find out the effect of increasing the angle between two mirrors on the number of images formed by the mirrors (10 marks)

Answer

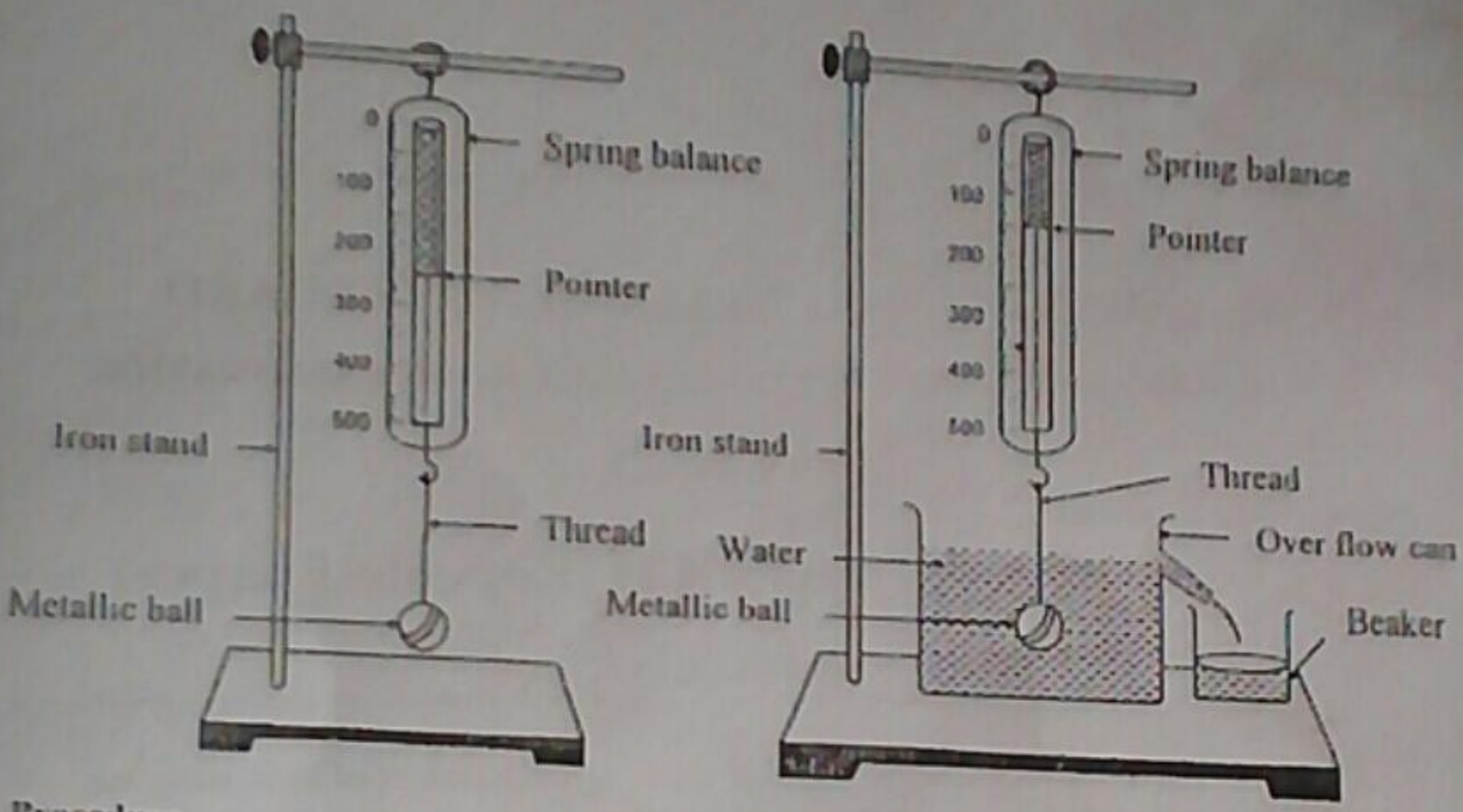


Procedure

— Place two plane mirrors side by side
— Fix the junction where they meet with a cello tape.
— It will be possible to open and close the mirrors like a book.
— Place both the mirrors at a small angle apart in the upright position on the floor
— Place a lighted candle in the space between the two mirrors.
— Many images of the candle will be observed on the mirrors
— Gradually decrease the angle between the mirrors
— Observe number of images formed
— It will be observed the number of images increase
— gradually increase the angle between the mirrors
— Observe number of images formed
— It will be observed that number of images decrease
— This experiment demonstrates that the number of images formed by two mirrors is inversely proportional to the angle between the mirror

2. Describe an experiment to show that a body wholly immersed in a liquid experiences an up thrust which is equal to the weight of the liquid displaced (10 marks)

Answer

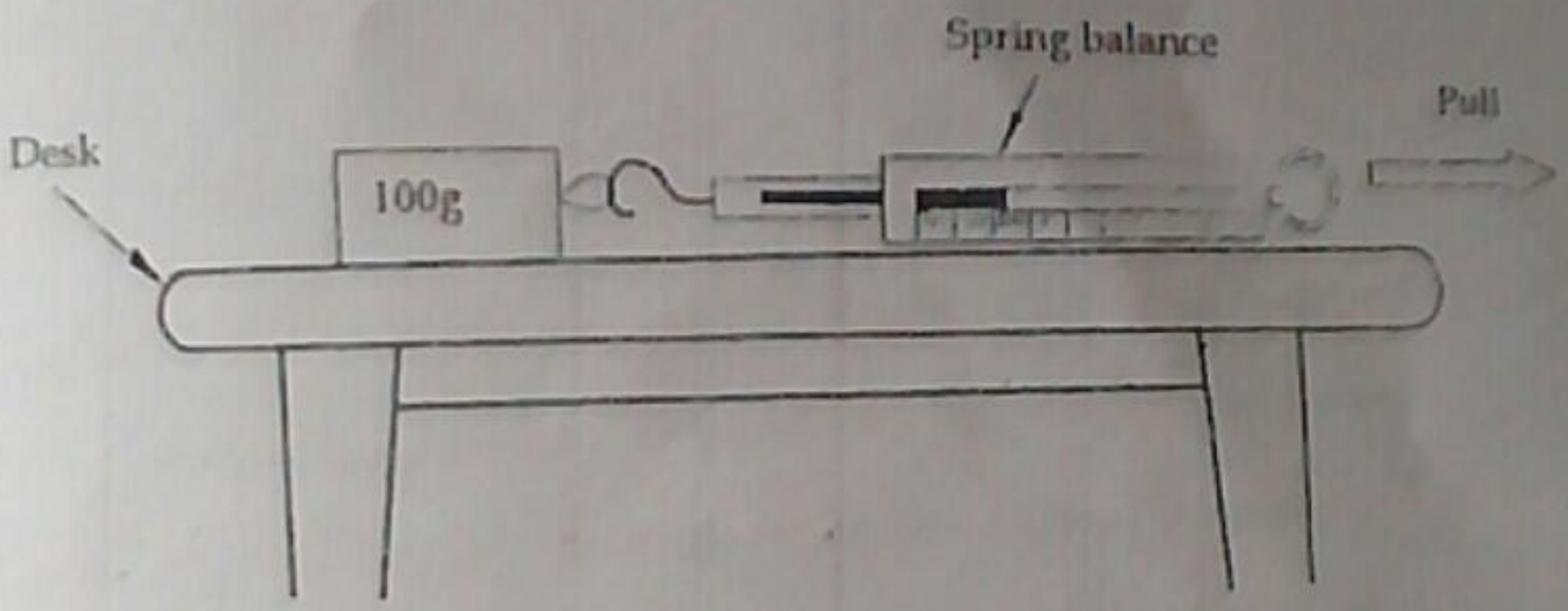


Procedure

— Measure weight of a metallic ball in air using a spring balance. Record this as weight of metallic ball in air
— Put water in an overflow can
— Weigh an empty beaker on a spring balance. Record this as weight of beaker in a suitable table
— Put the beaker under receiving end of the overflow can
— Set the spring balance, overflow can with tap water and beaker as shown in figure above
— Allow the ball to immerse completely in water in overflow' can.
— Note down the new position of pointer of the spring balance. This is the weight of the metal ball in water.
— Weigh the beaker containing displaced water which is collected from the overflow can while immersing the bob in it completely. This is weight of beaker and water
— Find the weight of displaced water by subtracting the weight of beaker from the weight of beaker and water.
— Subtract the weight of metal ball in water from weight of ball in air
— It will be observed that the weight loss of metal ball when completely immersed in water is equal to the weight of displaced water

2. You are provided with a spring balance. 100g, 200g, 300g and 400g masses on the desk.

a Arrange the apparatus as shown in figure 1



b. Pull the spring balance until the mass just starts to move

c. Record the reading on the spring balance in table 1 (4 marks)

Mass (g)	100	200	300	400
Force applied (N)				

d. Repeat steps (b) and (c) using 200g, 300g and 400g

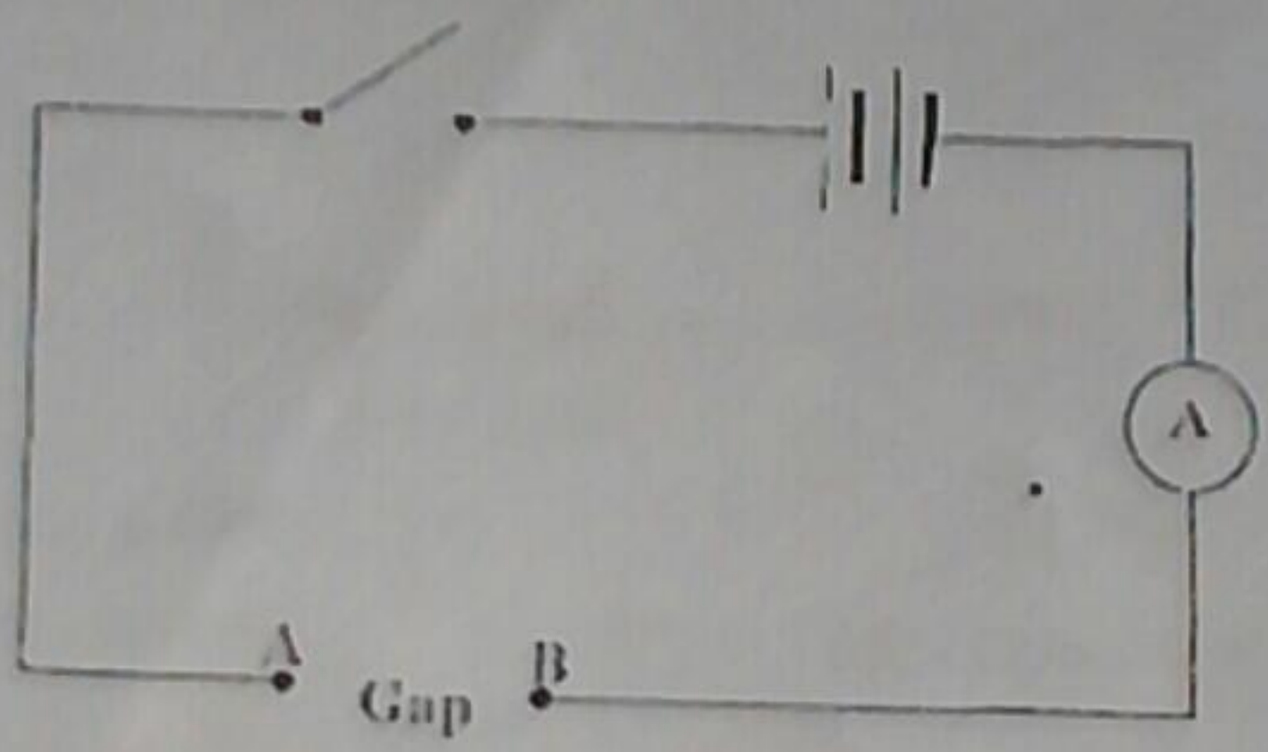
e. Draw a graph of force applied against mass

f. From the graph, deduce the relationship between mass and force applied on the spring (1 mark)

3. You are provided with the following materials:

0.5A ammeter, 5 connecting wires, switch, 100 cm nichrome wire of thickness 0.5mm, two 1.5V cells, a cell holder and a 1m ruler.

a. Arrange the apparatus as shown in figure 2



b. Measure a length of 20 cm of the nichrome wire and connect it on the gap AB

c. Close the switch, note and record the ammeter reading in tables 2

d. Repeat steps (b) and (c) with length of wire of 40 cm, 60 cm and 80 cm and record the ammeter readings in table 2 (4 marks)

Length of wire (cm)	Ammeter reading (A)
20	
40	
60	
80	

e Plot a graph of current against length of the wire

f. Deduce the relationship between current and length of the wire (1 mark)

MALAWI NATIONAL EXAMINATIONS BOARD

2021 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATIONS

PHYSICS

Thursday, 4 November

PAPER I

(100 Marks)

SECTION A (70 Marks)

1. (a) Figure 1 is a diagram of a measuring instrument with an error and as a scale ranging from 0kg to 7kg

(i) Name the instrument (1 mark)

Answer

— Compression balance

(ii) Identify the type of error demonstrated in figure 1 (1 mark)

Answer

— Instrumental error (systematic error)

(iii) Explain how the error in question 1a (ii) could be minimized (2 marks)

Answer

— Adjust the zero of the instruments properly

(b) Convert 2,500μm to m (3 marks)

Answer

$1\ \mu m = 1000000m$

$2{,}500\mu m = ?\ (more)$

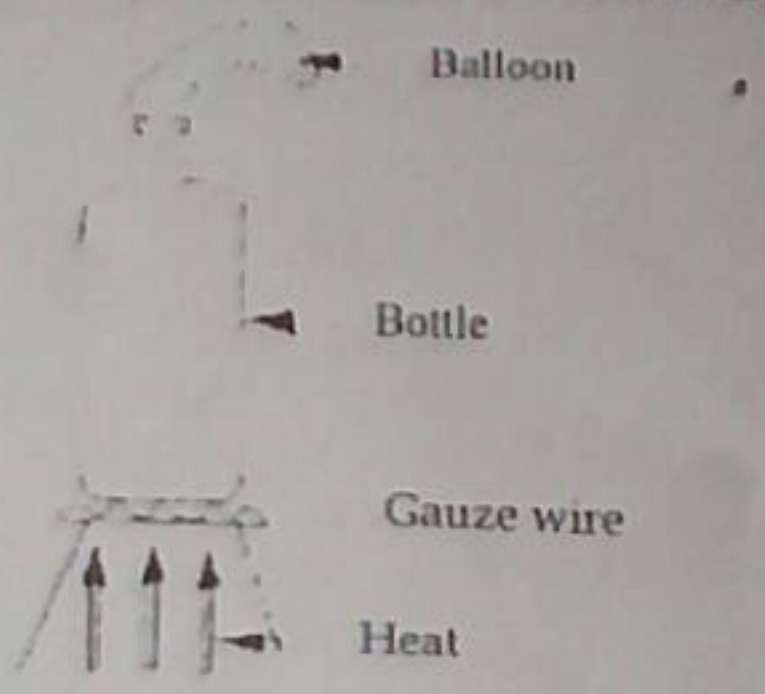
$= 0.0025m$

2. (a) Define absolute temperature (1 mark)

Answer

— It is the coldest possible temperature, at which there is no internal energy, and the particles are stationary

(b) Figure 2 is a diagram showing a balloon fitted to a bottle before heating



(i) What would happen to the volume of the balloon after heating?

Answer

— The volume will be increased

(ii) Explain your answer in 2b (i)

Answer

— When the bottle is heated, the air molecules inside start moving faster. These molecules now collide into the balloon with more energy resulting in increased pressure. The increased pressure causes the balloon to expand.

3. (a) State the difference between angular velocity and linear velocity (3 marks)

Answer

— Linear velocity is the velocity of an object in a straight line while angular velocity is how much an objects spins, rotates, or turns

(b) Calculate the linear velocity of a ball whose radius is 15cm and is rotating at a frequency of 200Hz

Answer

$v = (2\pi f) \times r$

$= 2 \times \frac{22}{7} \times 200\text{Hz} \times 15\ cm$

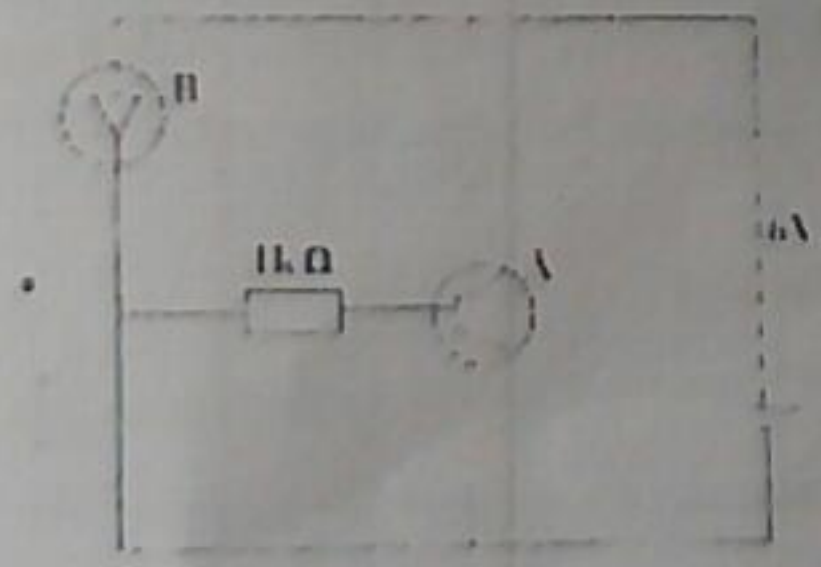
$= 18857\ \text{cm/s}$

4. (a) Explain why two identical bulbs connected in series circuit would have higher electrical resistance than in a parallel circuit

Answer

— When bulbs are connected in parallel, more current flows from the source than would flow for any of them individually, so the total resistance is lower. Each bulb in parallel has the same full voltage of the source applied to it, but divide the total current amongst them.

(b) Figure 3 shows a circuit diagram of a light operated switch



(i) Name the device labelled A (1 mark)

Answer

— Transistor

(ii) Give any two uses of the device labelled B

Answer

— Used as a rectifier

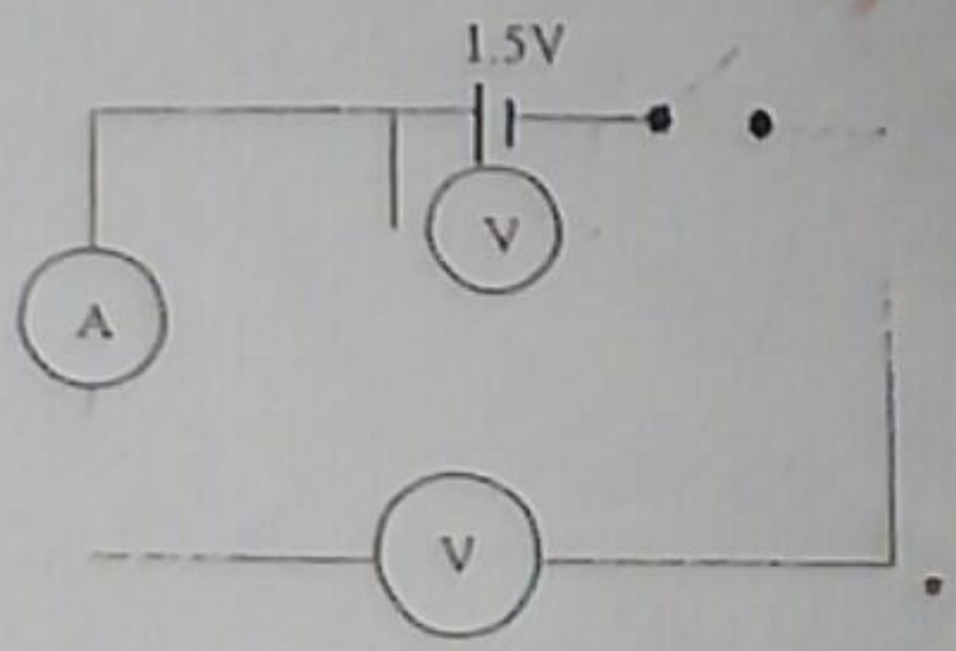
— To allow an electric current to pass in one direction (called the diode's forward direction), while blocking it in the opposite direction (the reverse direction)

5. (a) Define internal resistance of the cell (1 mark)

Answer

— Internal resistance refers to the opposition to the flow of current offered by the cells and batteries themselves resulting in the generation of heat.

(b) Figure 4 is a diagram of a circuit with an ideal ammeter which reads 0.20A when the switch is closed.



Determine the internal resistance

Answer

$$\text{Internal resistance} = \frac{\text{Voltage}}{\text{Current}}$$

$$= \frac{1.5V}{0.20A}$$

$$= 7.5\Omega$$

(c) State any two factors that affect the magnitude and direction of induced electromagnetic force.

Answer

— The number of turns in a coil

— The speed at which the conductor moves through the magnetic field

6. (a) Define the term oscillation (2 marks)

Answer

— Oscillation is the process of moving back and forth regularly about a fixed point

(b) Figure 5 is a diagram showing some waves

(i) Identify the waves K and L (2 marks)

Answer

K: Transverse wave

L: Longitudinal wave

(ii) Explain any **two** differences between wave K and wave L

Answer

— Wave K is made up of crests and troughs while wave L is made up of compressions and rarefactions

— Wave has it motion perpendicular to direction of displaced medium while wave L has its motion in same direction as displaced medium

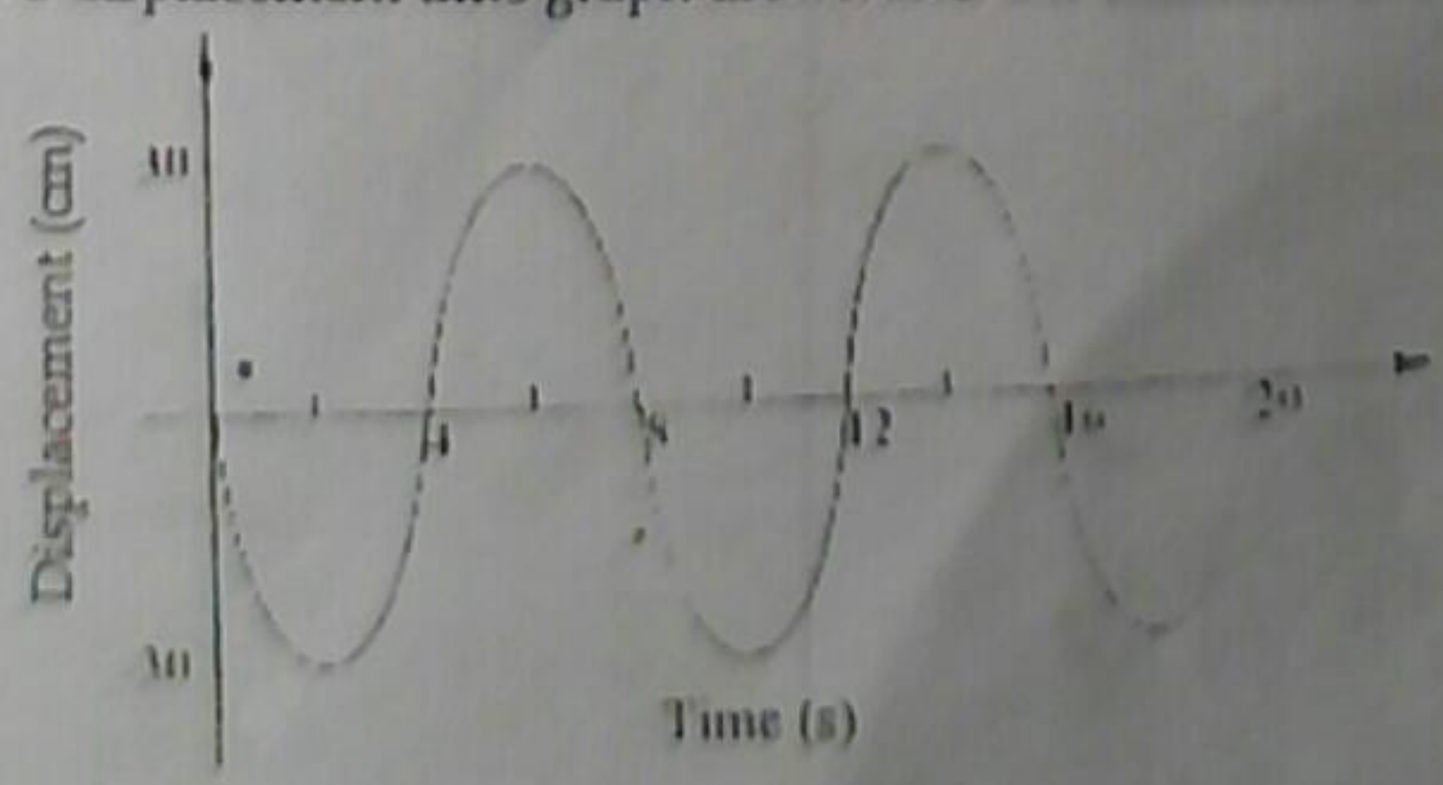
7. (a) Mention any **two** characteristics of waves (2 marks)

Answer

— Waves have frequency

— Waves have amplitude

(b) Figure 6 is a displacement time graph drawn after the oscillation of a pendulum



(i) Identify
1 the amplitude of the oscillation

2 the period of the oscillation

Answers

1 30 cm

2 8 seconds

(ii) Calculate the frequency of the oscillation as shown in the graph

Answer

$$\text{Frequency} = \frac{1}{\text{Period}}$$

$$= \frac{1}{8}$$

$$= 0.125 \text{ Hz}$$

8. (a) List any three uses of radioactivity (3 marks)

Answer

— Used in hospitals to kill cancer cells

— Used in agriculture to sterilize pests

— Used to identify underground leaking pipes

(b) The table below shows the coefficients of sliding friction of surfaces A, B and C with an equal pressing force of 50N.

	Reaction (N)	Coefficient (μ)
Surfaces A and B	50	0.74
Surfaces B and C	50	0.94

(i) Identify the pair of surfaces on which the friction is high (1 mark)

Answer

— Surfaces B and C

(ii) Calculate the sliding friction for surfaces A and B (3 marks)

Answer

Friction = Reaction force × coefficient

= 50N × 0.74

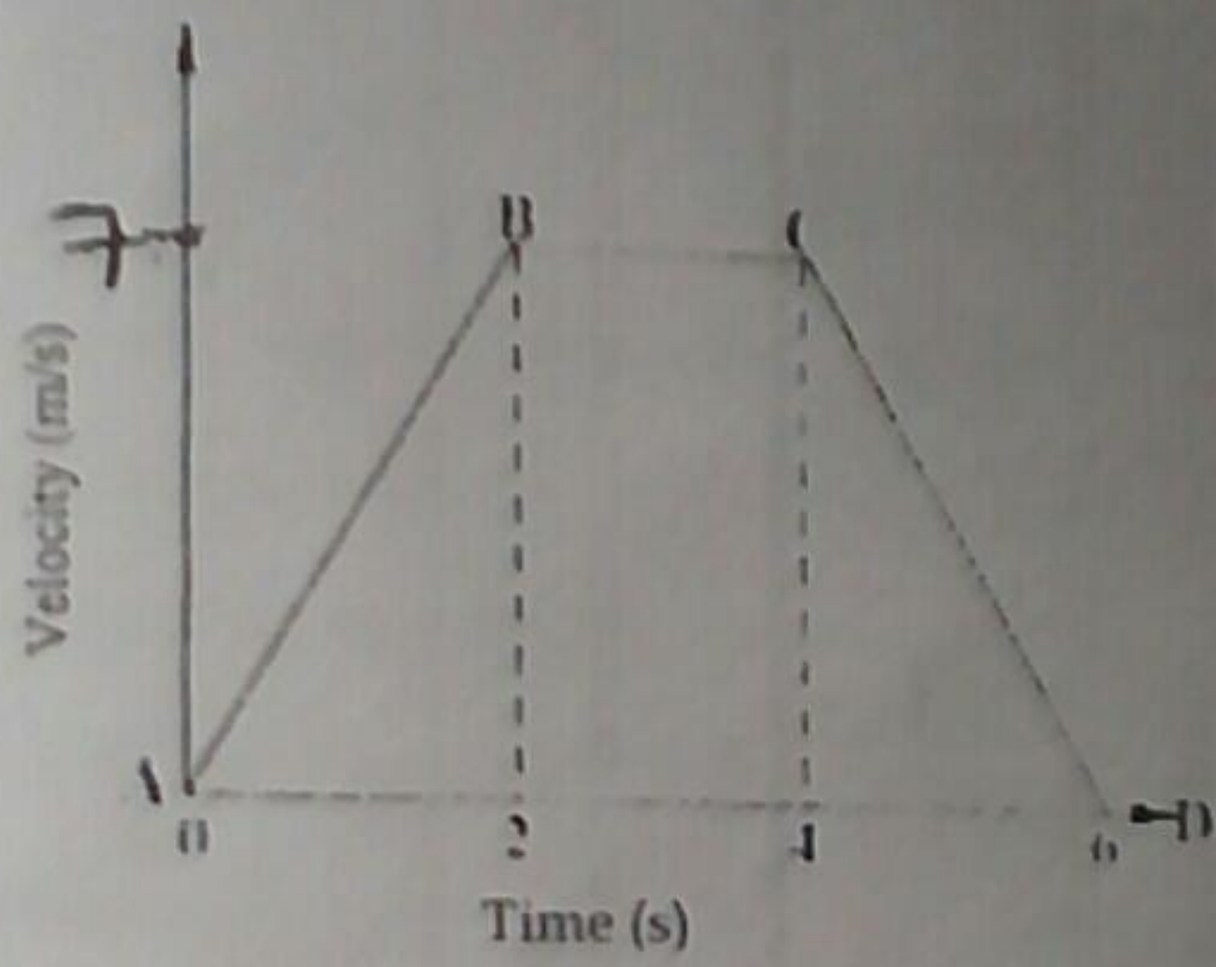
= 37N

9. (a) Define acceleration (1 mark)

Answer

It is the rate of change of velocity

(b) Figure 7 is a velocity –time graph showing the motion of a car in 6 seconds through points A, B, C and D.



(i) Identify any two points during which the car was at rest

Answers

— Point A

— Point D

(ii) On which part of the graph was the car moving with uniform velocity?

Answer

— Between B and C

(iii) Calculate the distance travelled by the car in the first 2 seconds

Answer

Distance = Area under the graph (area of triangle) = $\frac{1}{2}$ × base × height

$= \frac{1}{2} \times 2s \times 7m/s$

$= 7m$

The distance in first 2 seconds is $7m$

10. (a) State the principle of moments for a body at equilibrium (1 marks)

Answer

— For a body at equilibrium, the sum of clockwise moments is equal to sum of anti-clockwise moments

(b) A crane lifts 9,940N when an effort of 116N is applied. If the efficiency of the crane is 75%, find:

(i) Mechanical advantage (2 marks)

Answer

$$\text{Mechanical advantage} = \frac{\text{Load}}{\text{effort}}$$

$$= \frac{9940\text{N}}{116\text{N}}$$

$$= 85.69$$

(ii) Velocity ratio (4 marks)

Answer

$$\text{Velocity ratio} = \frac{\text{Mechanical advantage}}{\text{efficiency}} \times 100\%$$

$$= \frac{85.69}{75\%} \times 100\%$$

$$= 114$$

11. (a) Explain how photographic plates are used to detect radioactive emissions.

Answer

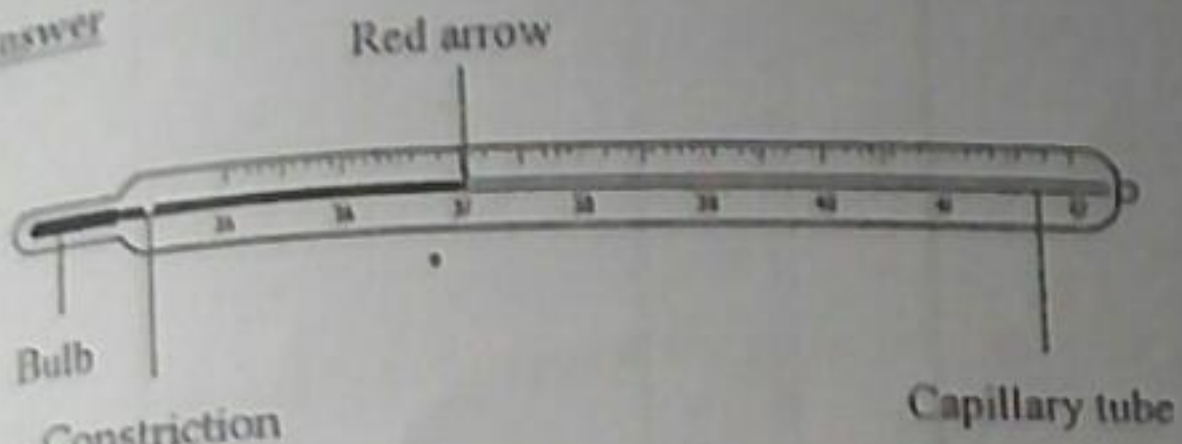
— Photographic plates change colour to dark when they are exposed to radioactive emissions.

— The intensity of darkness indicates the amount of radioactive emissions

— More darkness means a lot of radioactive emissions

(b) With the aid of a diagram, describe how a clinical thermometer works

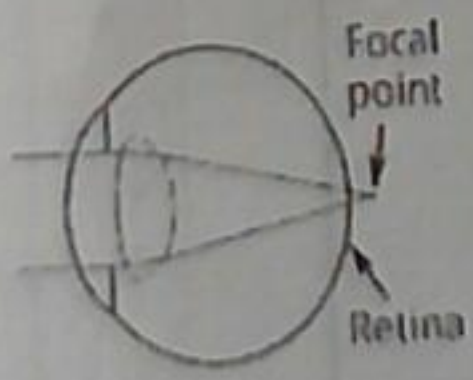
Answer



A clinical thermometer works on the principle that solids and liquids expand on heating. As the temperature rises, mercury expands causing it to move upwards and depict the temperature. The liquid is often mercury, but alcohol thermometers use a colored alcohol. As the temperature of the bulb rises, the liquid expands up the tube through the constriction.

12. (a) With the aid of a labelled diagram, describe the problem of long sight in the human eye (5 marks)

Answer



It is the defect of human eye in which a person can see clearly objects at large distances from it but cannot see nearby objects clearly. It occurs when the converging power of the eye lens is less than normal.

(b) With the aid of a ray diagram, describe the nature of an image formed by a convex lens of focal length 10cm, with the object 10 cm high placed at 6 cm from the convex lens (use a scale of 1cm: 5 units) (5 marks)

Answer

— the image is upright

— the image is virtual

— the image is enlarged

13. (a) Explain how the principle of circular motion is applied in drying wet clothes in a drying machine (5 marks)

Answer

— It contains a drum in which wet clothes are kept. As the drum rotates, the water particles get separated from the cloth. The general description of this action is that the centrifugal force throws the water particles away from the drum

(b) Explain in terms of the band theory why insulators are bad conductors of electricity even if their temperature is increased (5 marks)

Answer

— An insulator has a large gap between the valence band and the conduction band. The gap is so big such that even if electrons gain enough energy from high temperature they will not be able to cross the gap. The valence band is full as no electrons can move up to the conduction band. As a result, the conduction band is empty. Only the electrons in a conduction band can move easily, so because there aren't any electrons in an insulator's conduction band, the material cannot conduct

MALAWI NATIONAL EXAMINATIONS BOARD

2020 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

PHYSICS

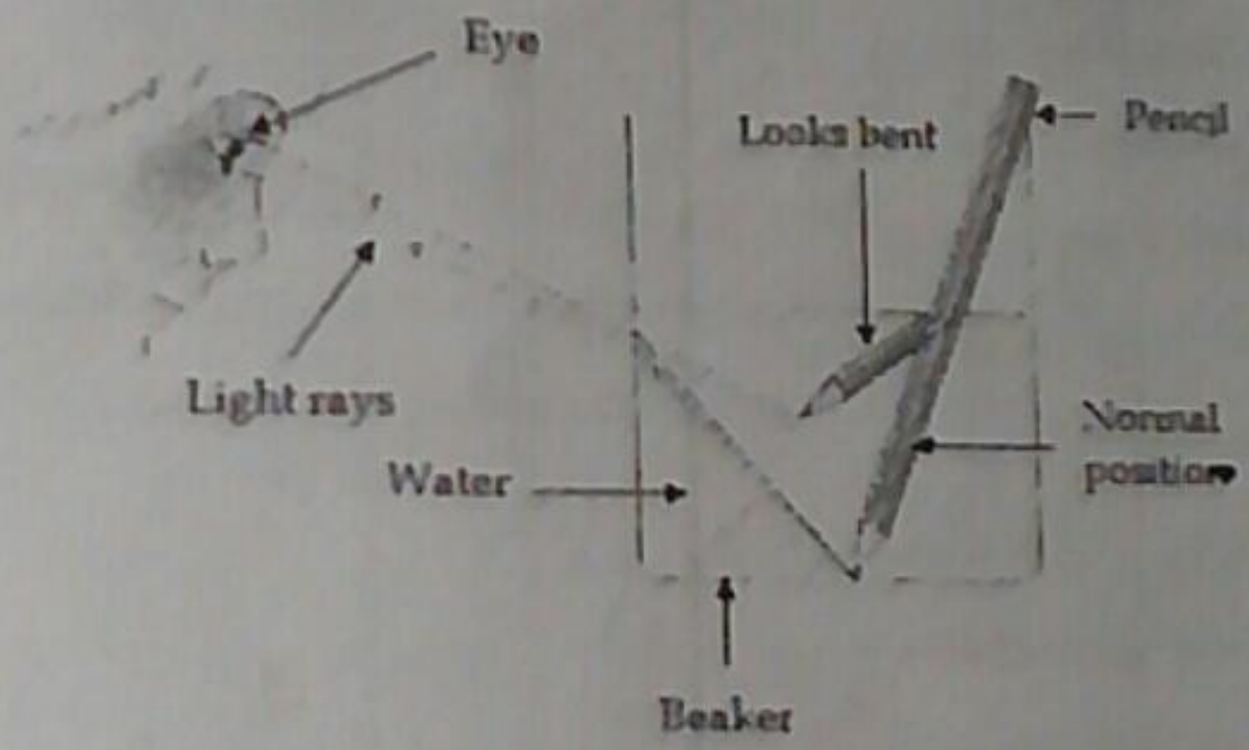
Friday, 8 January, 2021

PAPER II (Repeated paper)

(40arks)

1. With the aid of a well labelled diagram, describe an experiment to show why a pencil partially immersed in water appears to be bent.

Answer



Procedure

— Fill a glass halfway with water

— Put a pencil in the glass and lean it against the side (Image A)

— Loot at the water from the side

— The pencil will look bent (Image B)

— Take the pencil out of the water

— It will be observed that nothing happened to the pencil (Image C)

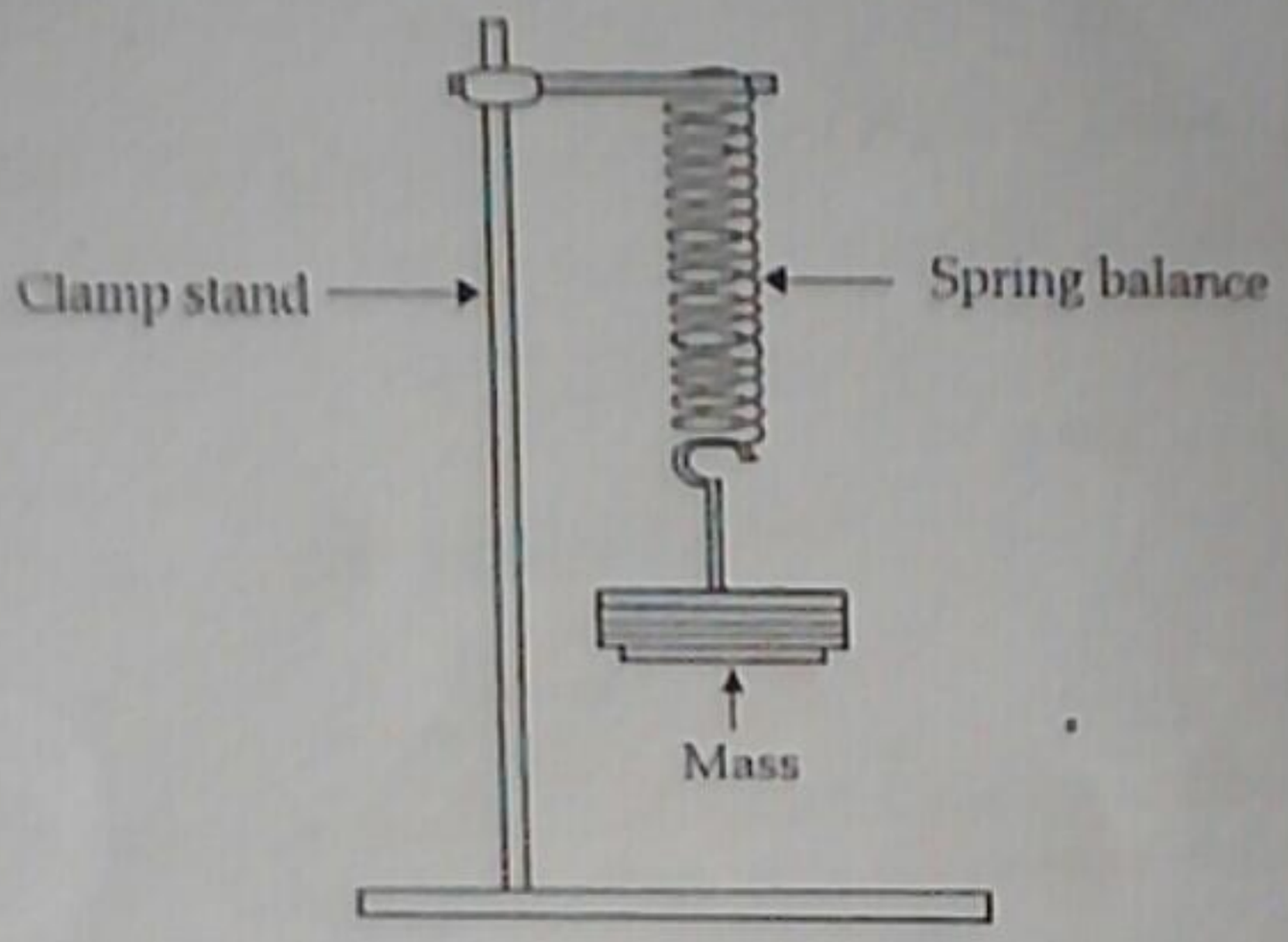
Explanation

— Light rays slow down as they react the edge of the glass and change direction before reaching eyes

— This makes the pencil look bent and the point of the pencil appears to be half way up the glass

2. Describe an experiment that can be conducted to investigate the effect of mass on the frequency of an oscillating mass-spring system

Answer



— Hang a spring on a clamp stand

— Put a 100g mass on a spring

— Pull the mass downwards to a specific amplitude and let it oscillate up and down

— Instantly start a stopwatch

— Count 10 complete oscillations

— Stop the stopwatch

— note the number of oscillations in 1 minute

— Record the time in a table

— Put a 200g mass on the spring

— Pull the mass downward at same amplitude as that of 100g mass

— Let it swing and instantly start a stopwatch

— Note the number of oscillations in 1 minute

— Repeat the experiment with 300 g, 400 g and 500 g

— It will be observed that increasing the mass reduces the frequency of oscillations

3. You are provided with a 0 – 5N spring balance, a measuring cylinder, water, an object labelled X and a string.

a. Tie the mass to the string and fit it to spring balance

b. Measure the weight of the object X in air on the spring balance

c. Record its weight in the table of results (4 marks)

Description	Reading
Weight of object in air	
Weight of object in water	
Initial volume of water (cm^3)	
Final volume of water (cm^3)	

d. Put 25 cm^3 of water in the measuring cylinder

e. Slowly place the mass in the measuring cylinder until it is completely immersed in the water as shown in figure 1

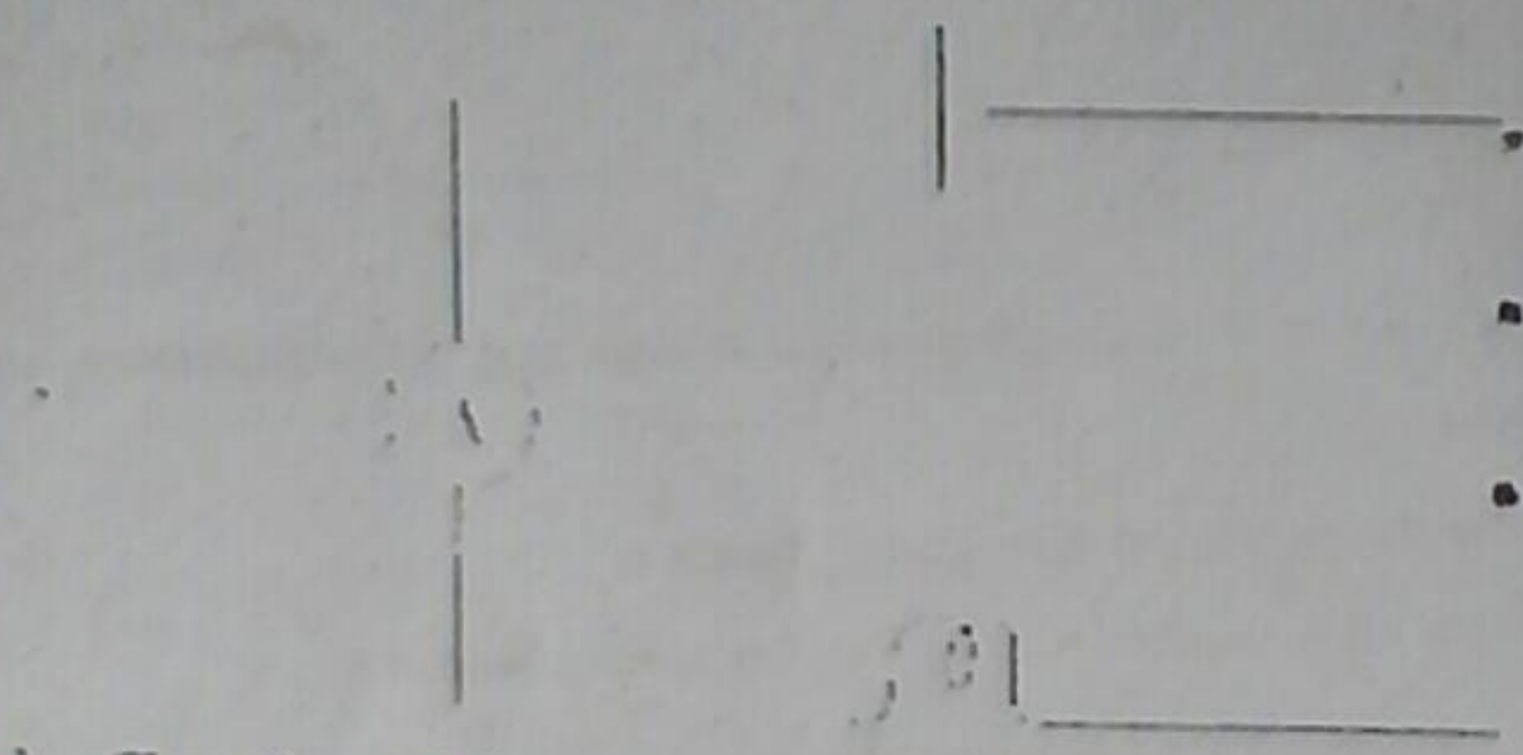
f. Record the final volume of water

g. Record the weight of the object X in water

h. Calculate the up thrust exerted by the water on the mass (3 marks)

4. You are provided with 4 cells, a switch, an ammeter, 4 connecting wires, a bulb and a cell holder.

a. Arrange apparatus as shown in figure 2 using one cell



b. Close the switch

c. Read and record the ammeter reading in the table provided

d. Repeat steps b and c with 2, 3 and 4 cells connected in series

Number of cells	Current (A)	Voltage

e. Assuming that each cell is 1.5V, complete the table by filling in the voltage values (2 marks)

f. Plot a graph of voltage against current (3 marks)

g. Using your graph, find the resistance of the bulb (1 mark)

Grace Kazangeta

- Complete Syllabus -

Physics

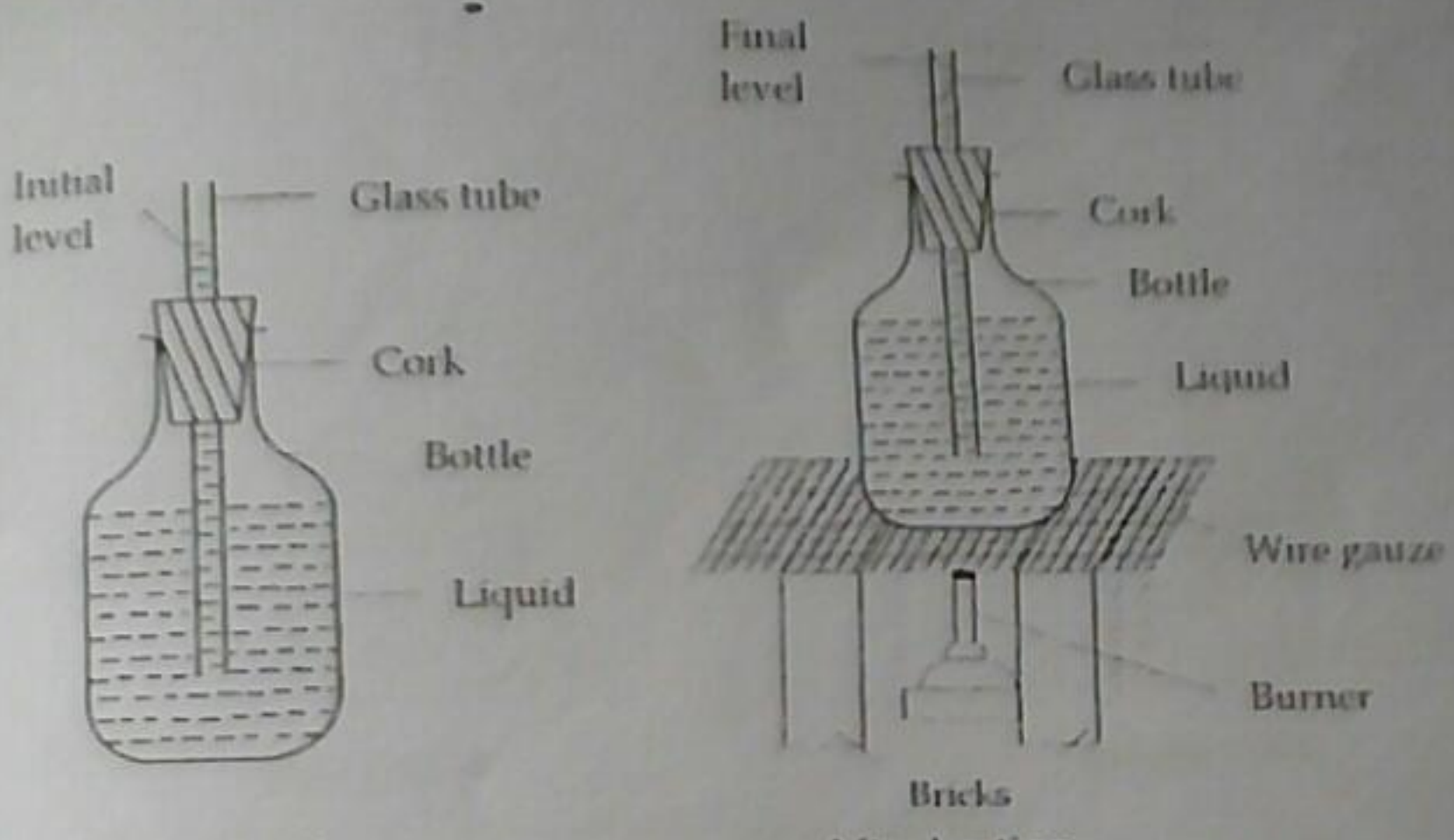
MANEB Practicals

Questions and Answers

Sam Smith Silumbu

BSc. Civil Eng

1 With the aid of a well labelled diagram, describe an experiment that could be conducted to show that liquid expand when heated



Before heating

After heating

Procedure

— Take a flask filled with a liquid up to brim

— Take a rubber cork with a hole in it and insert a glass tube in it

— Now fit a the cork tightly on the mouth of the flask

— Observe what happens

— It will be noticed that the level of the liquid will rise in the tube

— Note down the level in the tube

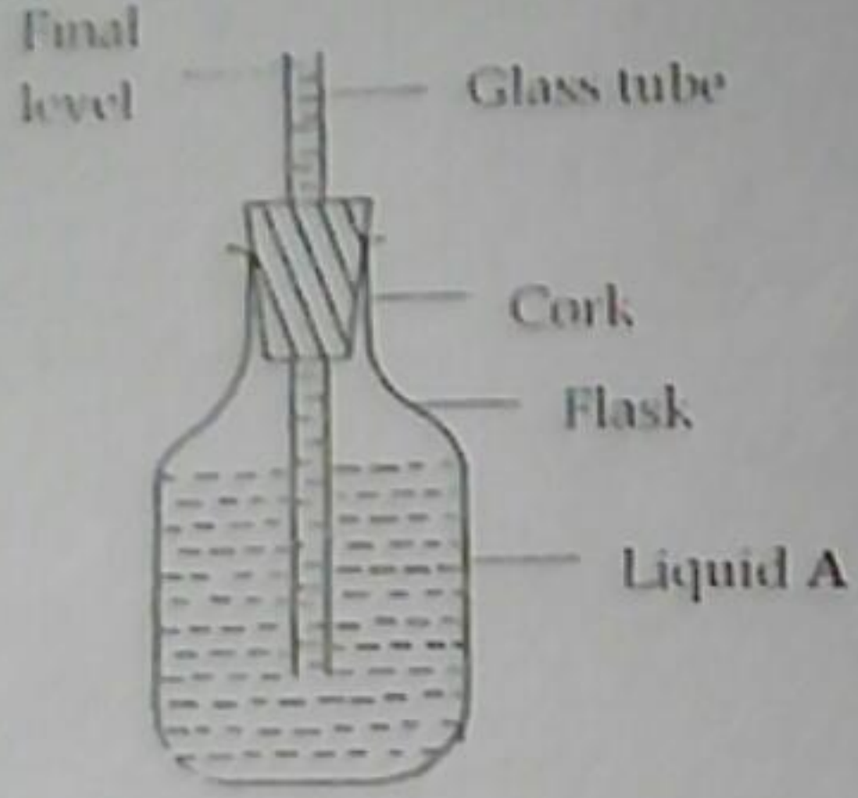
— Start heating the flaks

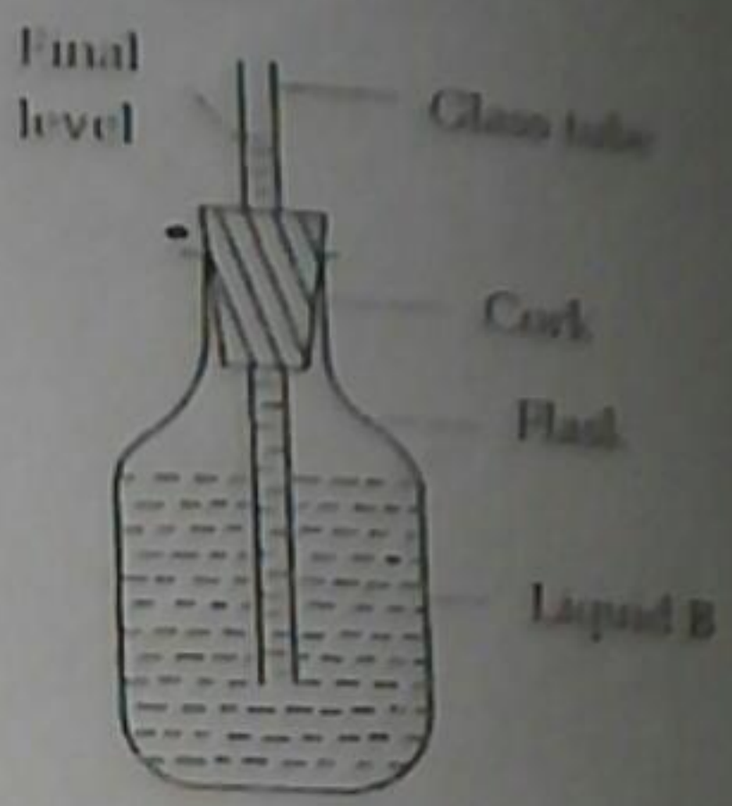
— Observe level of liquid in glass tube

— After sometime it will be observed that the level of liquid in the tube starts to rise

— This proves that liquids expand when heated

2 With the aid of a well labelled diagram, describe an experiment that could be conducted to show that different liquids expand differently when heated equally





Procedure

— Fill two identical flasks with different liquids

— The volume of liquids should be equal

— Inser two glass tubes in corks having holes

— Now fit the corks tightly on the mouth of both flask

— The liquids will rise into the tubes

— Set the tubes properly so that the level of liquid is equal

— Mark the initial level of liquid in both tubes

— Instantly put both flasks in a bath of hot water

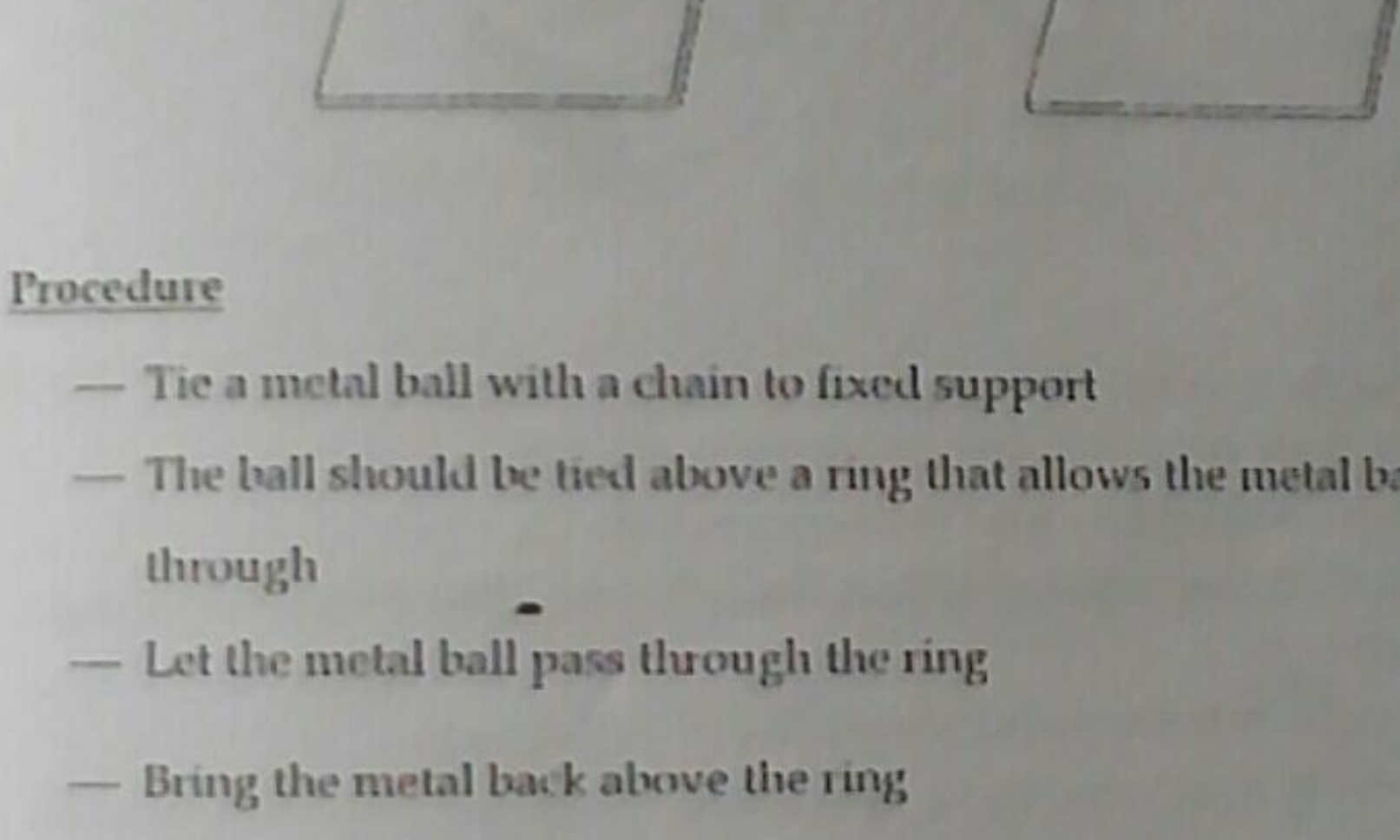
— Stir the bath continuously to ensure that temperature is uniform

— Observe the level of liquid in each tube after 10 minutes

— It will be observed that the liquids have different level in the tubes

— This shows that liquids expand differently when heated equally

3. With the aid of a well labelled diagram, describe an experiment that could be conducted to show that solids expand when heated



Procedure

— Tie a metal ball with a chain to fixed support

— The ball should be tied above a ring that allows the metal ball to pass through

— Let the metal ball pass through the ring

— Bring the metal back above the ring

— Heat the metal ball strongly

— Let the metal ball fall through the ring

— Observe what happens

— It will be observed that the metal ball has increased in size

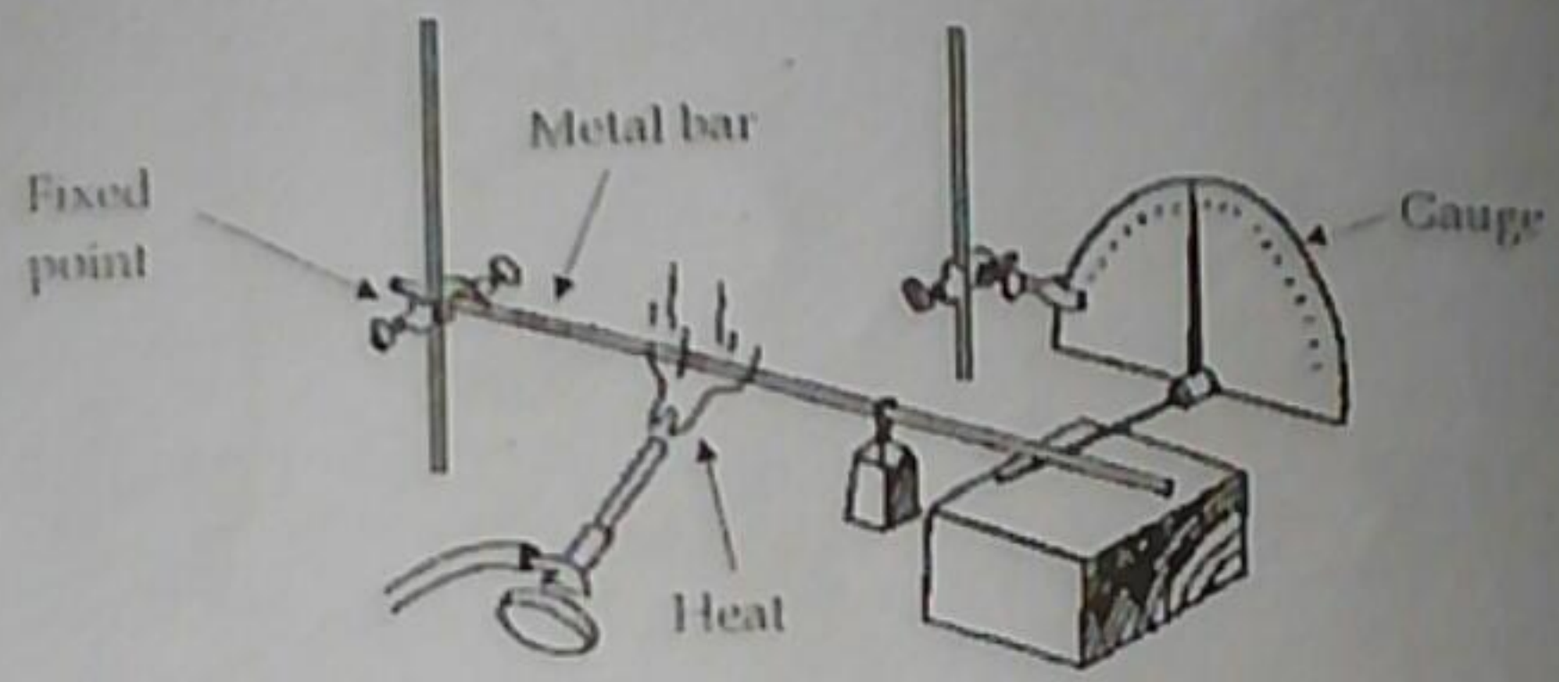
— It will also be observed that it does not pass through the ring

— Repeat the experiment with metal balls made from different metals

— All metals will show same behaviour

— This experiment shows that heating causes solids to expand

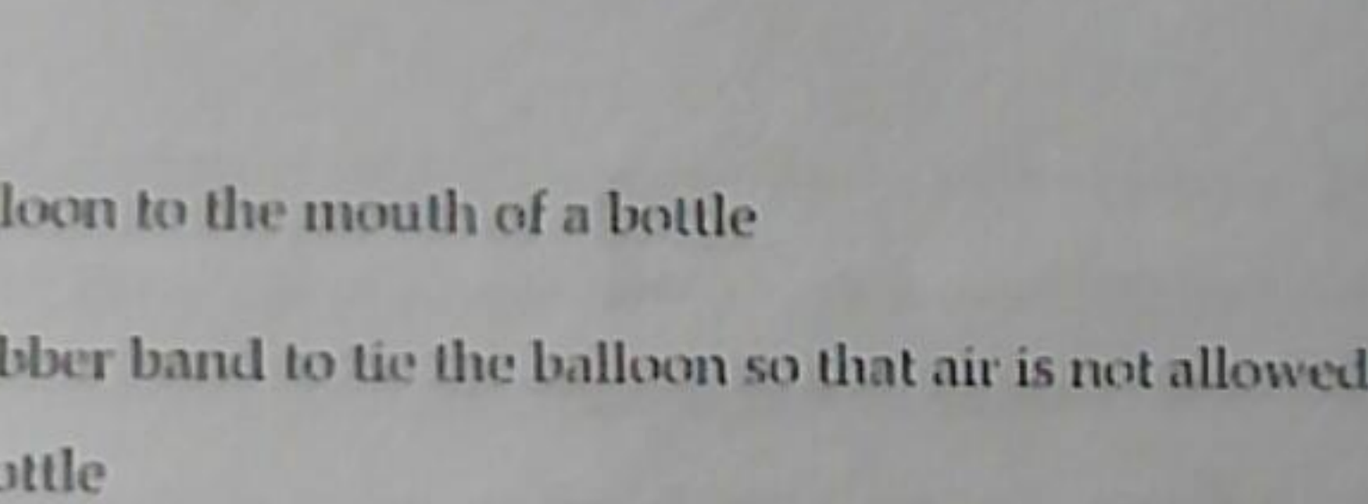
4. With the aid of a well labelled diagram, describe an experiment that could be conducted to show that different solids expand differently when heated equally



Procedure

— This experiment is investigated using bar and gauge method
— Take four metal bars from different materials
— Fix one end of the metal bar to a support
— The other end of the metal bar should be kept in contact with gauge pointer
— Strongly heat the end of the metal bar for 5 minutes
— Read the scale value on the gauge and record the value in a suitable table
— Remove the metal bar and put another type of metal bar
— Strongly heat the end of the metal bar for 5 minutes
— Read the scale value on the gauge and record the value in a suitable table
— Repeat the experiment with the remaining two metal bars
— The metal bars should be heated with same amount of heat
— Record results in a suitable table
— Compare results
— It will be discovered all metals have different values from the gauge
— This shows that different metals expand differently when heated equally

5. With the aid of a well labelled diagram, describe an experiment that could be conducted to show that gases expand when heated



(a) Before heating (b) After heating

Procedure

— Tie a balloon to the mouth of a bottle

— Use a rubber band to tie the balloon so that air is not allowed to go out of the bottle

— Observe the balloon

— The balloon will be deflated

— Put the bottle in a water bath of boiling water

— Let the bottle stand upright

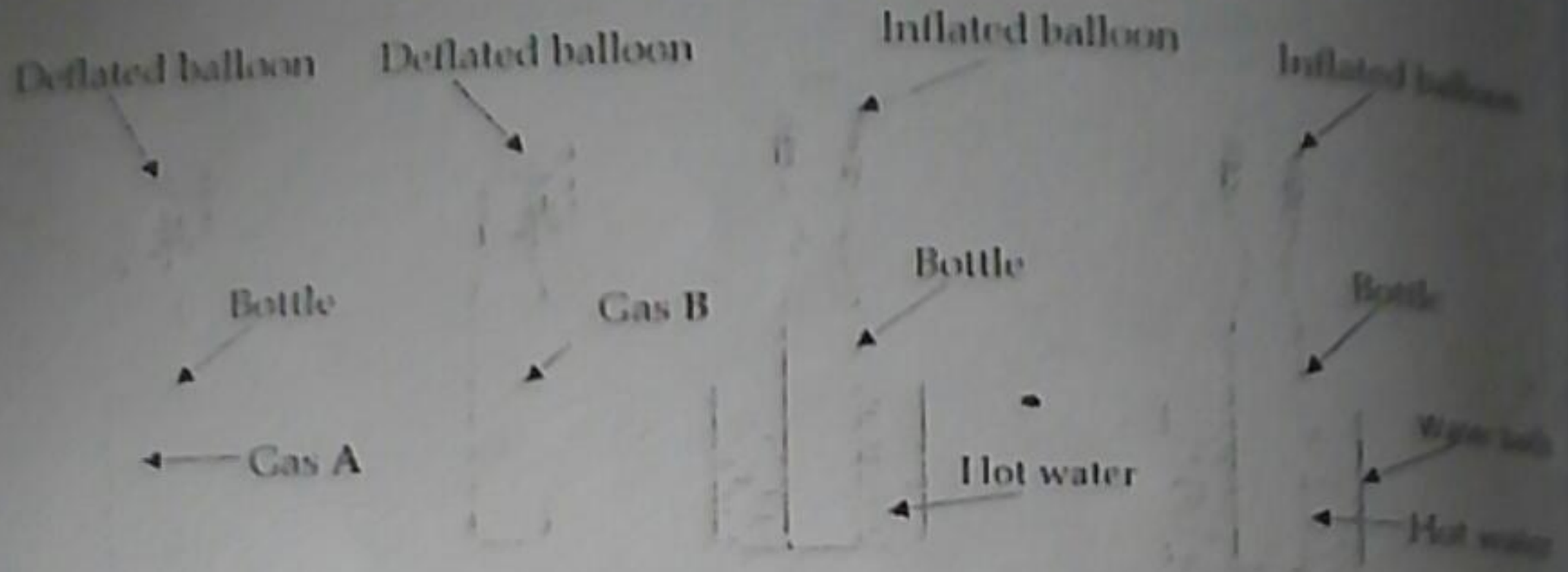
— Let the bottle stand in the water bath for 5 – 10 minutes

— Observe what happens to the balloon

— It will be observed that the balloon inflates after heating;

— The inflating of balloon shows that air inside the bottle and balloon is expanding;

6. With the aid of a well labelled diagram, describe an experiment that could be conducted to show that all gases expand equally when heated equally



Procedure

— Take two bottles and put equal volume of different gases

— Tie a balloon to the mouth of each bottle

— The balloons should be tied with a rubber band so that air does not escape from the bottle

— Observe the balloons

— The balloons will be deflated

— Put the bottles in a water bath of boiling water

— Let the bottles stand upright

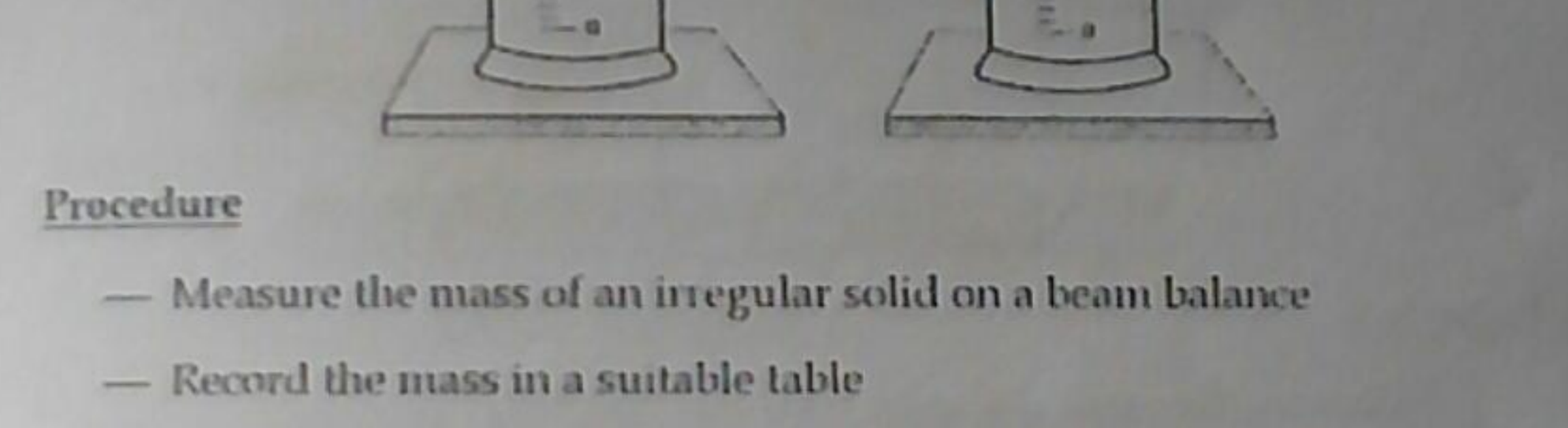
— Let the bottles stand in the water bath for 5 – 10 minutes

— Observe what happens to the balloon

— It will be observed that the balloons inflate by with same volume after heating

— This shows that gases expand equally when heated equally

7. With the aid of a well labelled diagram, describe an experiment that could be conducted to find the density of an irregular solid object



Procedure

— Measure the mass of an irregular solid on a beam balance

— Record the mass in a suitable table

— Pour water in a volumetric cylinder

— Record the volume of water in the cylinder

— Record the volume in a suitable table

— Record this as volume 1

— Tie an irregular solid to a string

— Drop the solid into the volumetric cylinder with water

— Record the volume of water in the cylinder

— Record this as volume 2

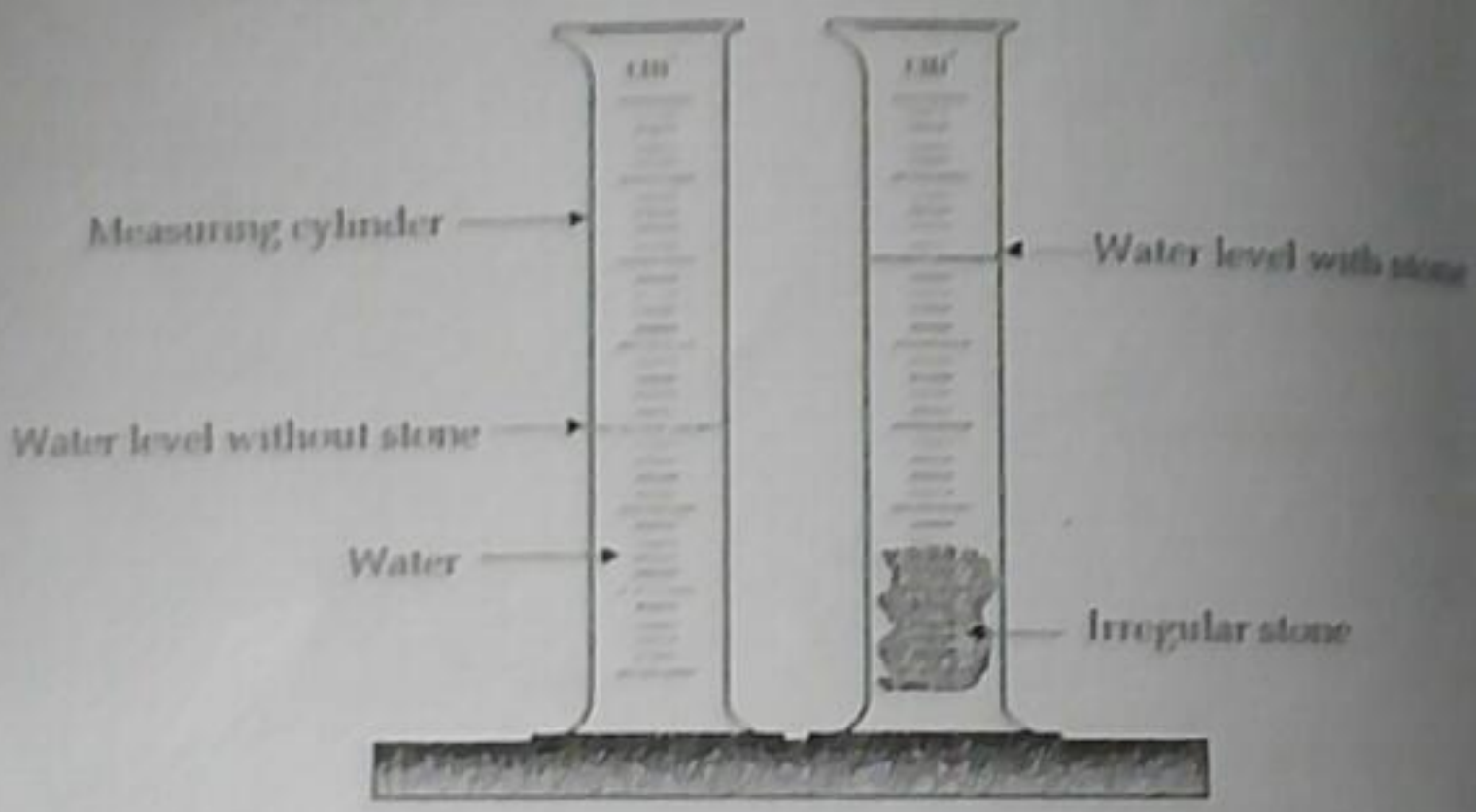
— Subtract volume 1 from volume 2

— The difference is volume of irregular solid

— Calculate the ~~volume~~ Density of irregular solid by dividing its mass by its volume

- $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

8. A student wishes to determine the density of a small irregular stone. With the aid of a well labelled diagram, describe an experiment to determine the density of the stone.

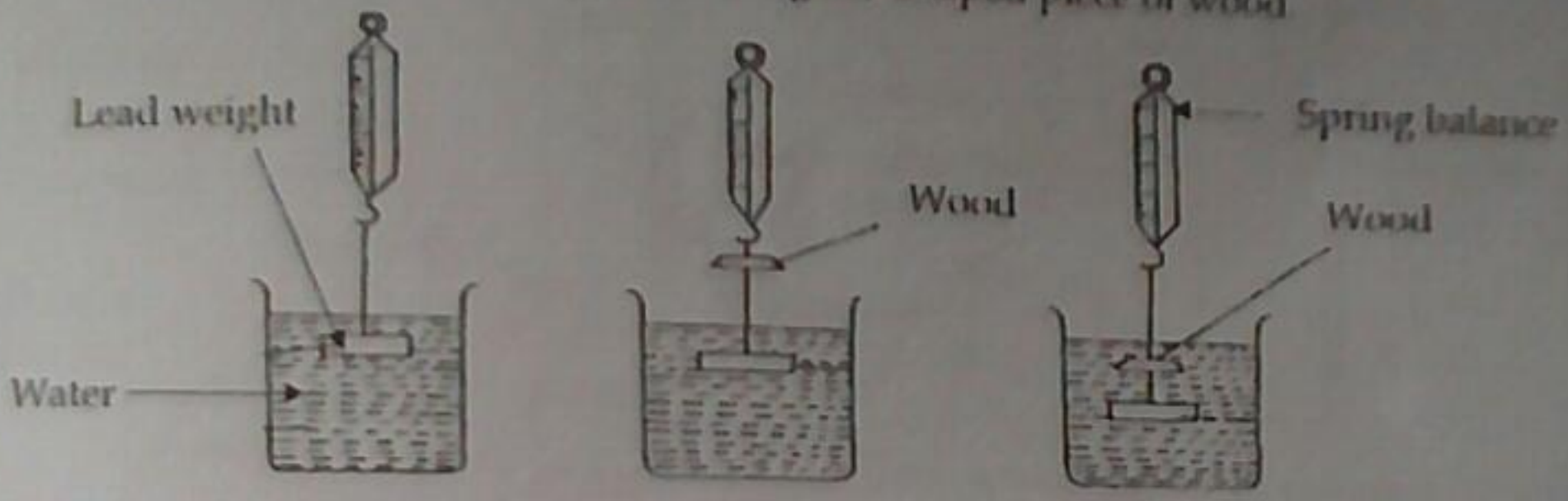


Procedure

- Measure the mass of a small irregular stone using a beam balance
- Record the mass in a suitable table
- Pour water in a measuring cylinder
- Record the volume of water in the cylinder
- Record the volume as volume 1
- Gently drop the stone in the measuring cylinder
- Record the volume of water and stone
- Record this as volume 2
- Subtract volume 1 from volume 2
- The difference is the volume of an irregular stone
- Calculate density of the small irregular stone by dividing its mass with its volume

• $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

9. A student wishes to determine the density of a small irregular shaped piece of wood that floats in water. He notices that a small lead weight tied to the wood makes it sink in water. With the aid of a well labelled diagram, describe how the student can carry out an experiment to determine the density of the irregular shaped piece of wood



Procedure

— Measure the mass of wood using a spring balance

— Record the value in a suitable table

— Put water in a cylinder

— Drop a lead weight into the cylinder

— Record the volume of water and lead weight

— Record this as volume 1

— Tie the wood to lead weight using a thin string

— Drop the lead weight and wood into the cylinder

— Record the volume of water, wood and lead weight

— Record this as volume 2

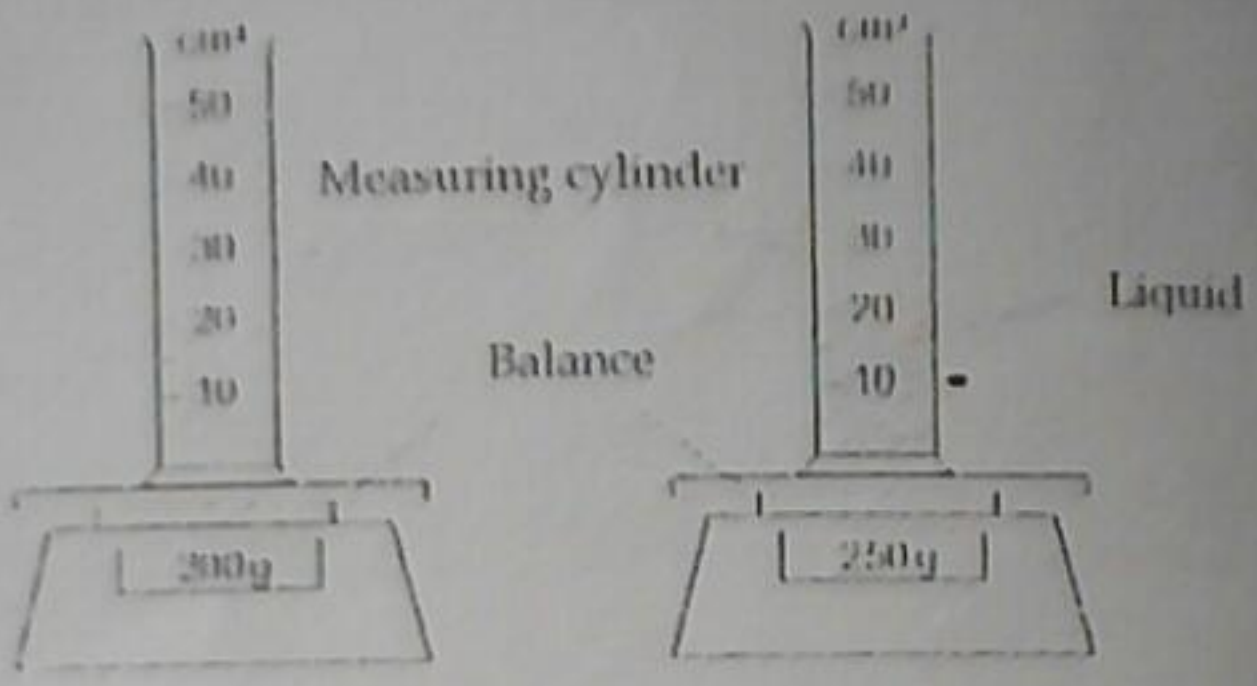
— Subtract volume 1 from volume 2

— The difference is volume of wood

— Divide the mass of wood by volume of wood to find density of the wood

- $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

10. With the aid of a well labelled diagram, describe an experiment that could be carried out to determine the density of a liquid



Procedure

— Put a measuring cylinder on a beam balance

— Record the mass in a suitable table

— Record this as mass 1

— Pour a liquid into the cylinder

— Record the mass of cylinder with liquid

— Record this as mass 2

— Subtract mass 1 from mass 2

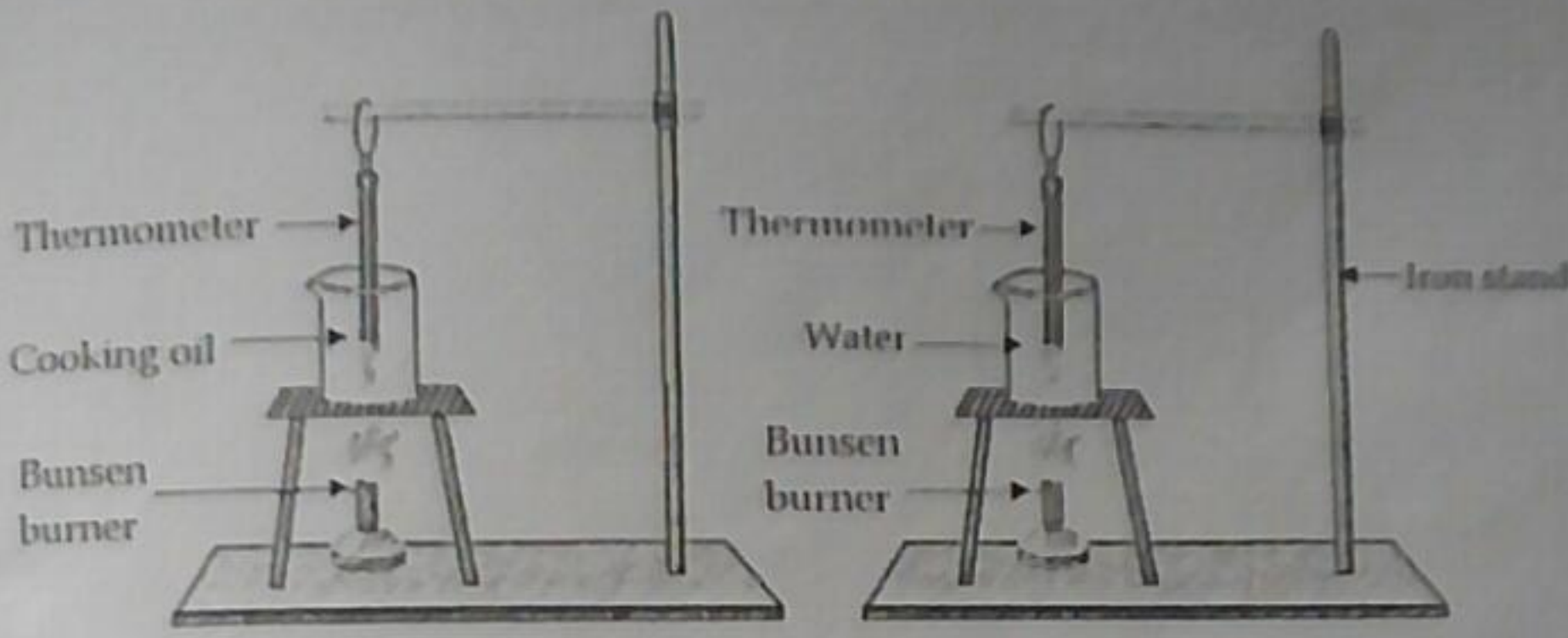
— This is mass of a liquid

— Notice the volume of liquid in the cylinder

— Find the density of a liquid by dividing mass of the liquid by its volume

- $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$

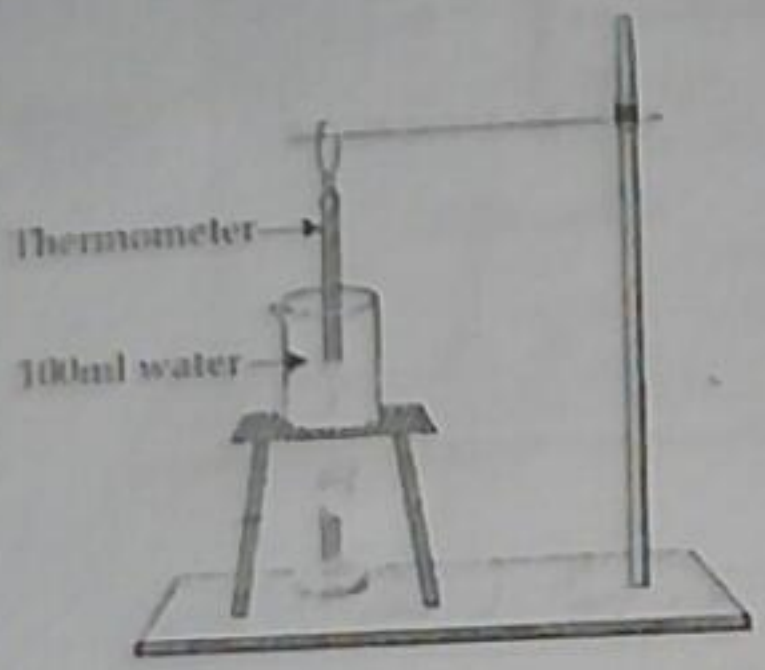
11. With the aid of a well labelled diagram, describe an experiment that could be conducted to show that different substances have different specific heat capacity

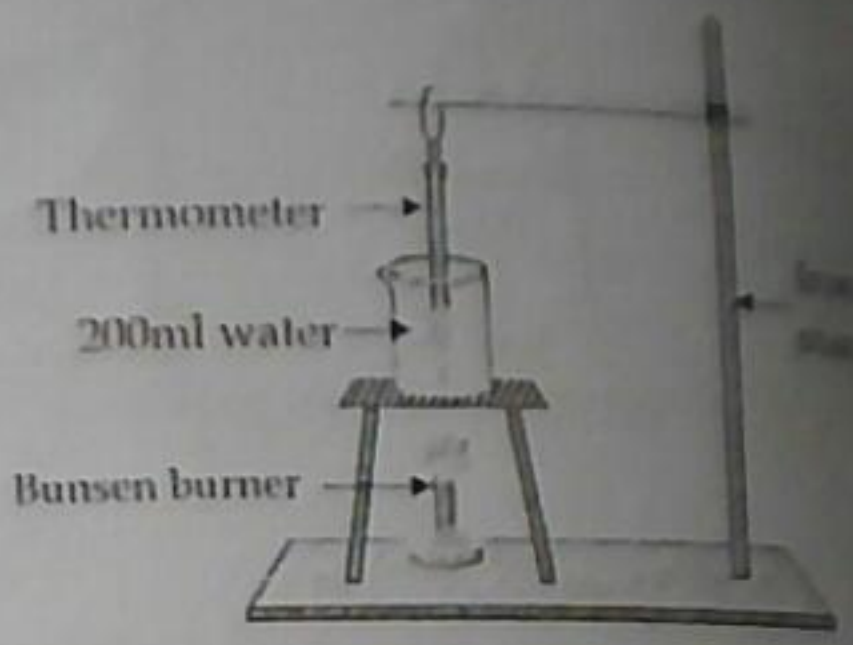


Procedure

— Put equal volume of cooking oil and water in different beakers
— Measure initial temperature of each liquid using a thermometer
— Record the values in a suitable table
— Put beakers on a tripod stand
— Put a source of heat under each tripod stand
— Record the temperature of each liquid at equal time intervals
— Record results in a suitable table
— Subtract initial temperature of each liquid from final temperature
— The difference is temperature change for each liquid
— Compare the temperature in the two liquids
— It will be observed that the liquids have different temperature change
— This experiment confirms that different substances have different specific heat capacity when heated equally

12. Describe an experiment that could be conducted to show that quantity (Mass, volume) of a substance affect its heat capacity

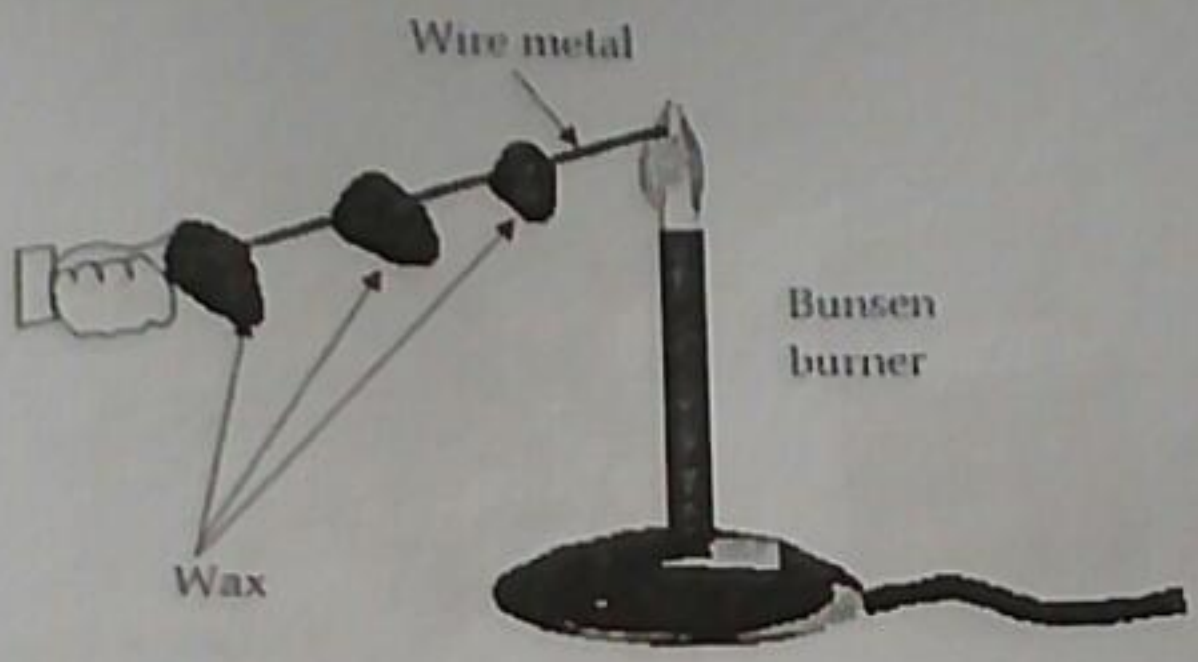




Procedure

— Put 100 ml of pure water in beaker labelled A
— Put 200 ml of pure water in beaker labelled B
— Put each beaker on a tripod stand
— Measure initial temperature of water using a thermometer
— Put a source of heat under each beaker
— Record the temperature of water at equal intervals in both beakers
— Record results in a suitable table
— Subtract initial temperature from final temperature in each beaker
— Compare temperature changes between the two experiments
— It will be observed that a beaker with 100 ml of water has a large temperature change as compared to a beaker with 200 ml of water
— Repeat the experiment five times
— It will be observed that the results are not different
— This experiment confirms that quantity of a substance affects its heat capacity

13. With the aid of a well labelled diagram, describe an experiment to show that metals are good conductors of heat



Procedure

— Put three small pieces of candle wax on a piece of thick metal wire about 15 cm long

— Fix the metal wire at a support

— Heat one end of the metal wire away from wax pieces

— Observe what happens

— It will be observed that wax melts beginning with the wax piece nearest to the flame working down to the farthest piece

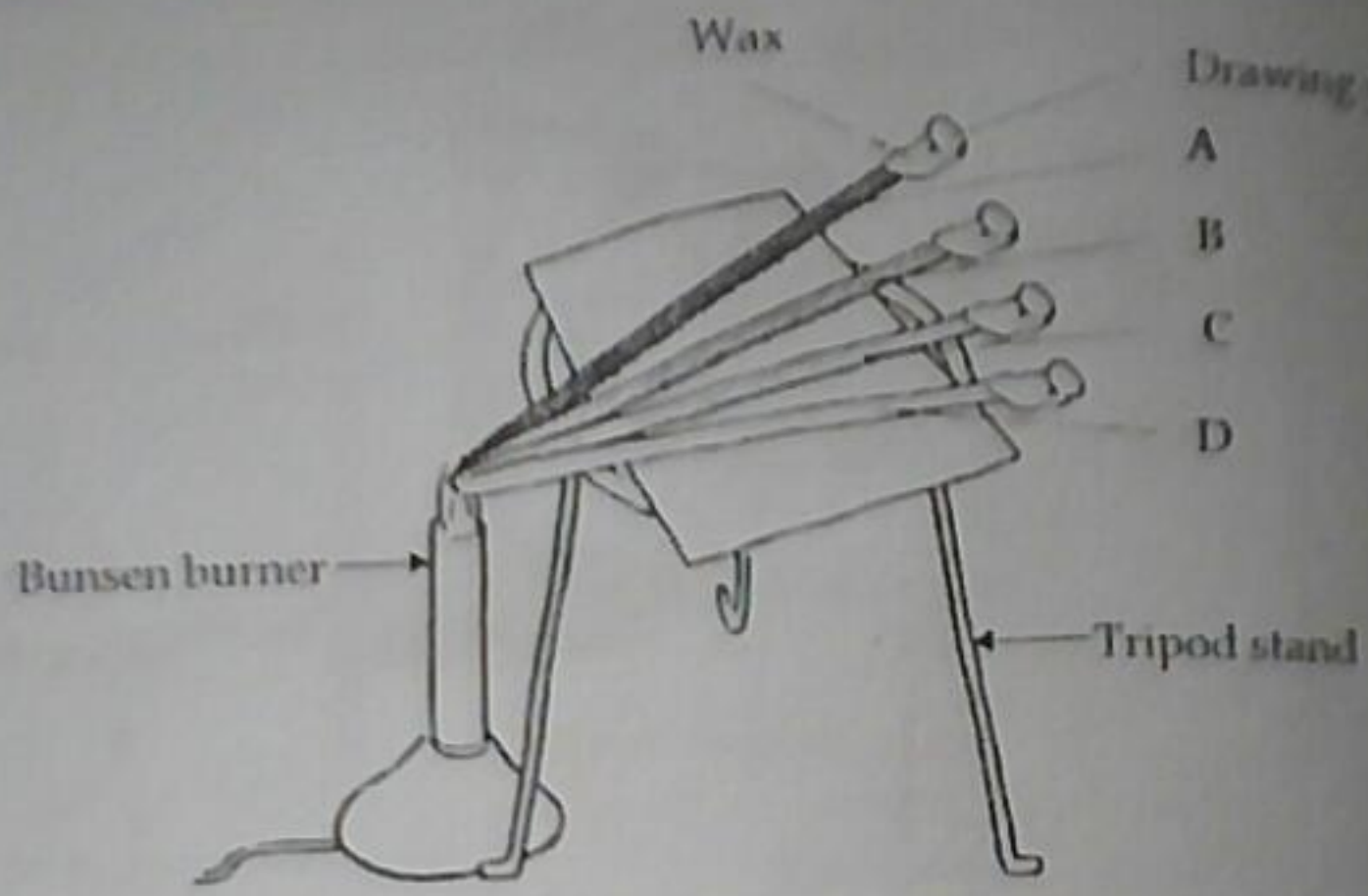
— Repeat the experiment with different types of metals

— It will be observed that the result is the same

— This observation shows that heat is travelling through the length

— This experiment confirms that metals are good conductors of heat

14. With the aid of a well labelled diagram, describe an experiment to show that metals have different rate of heat conduction



Procedure

— Fix four different metals on a support

— Mark metals using letters A, B, C and D

— Attach a piece of wax at the end of each metal rod

— Plant a drawing pin in the wax of each metal rod

— Use same amount of wax on each metal rod

— Heat metals with same amount of heat away from the wax side

— Measure and record the length of time it takes for the wax to melt and drawing pin to fall down

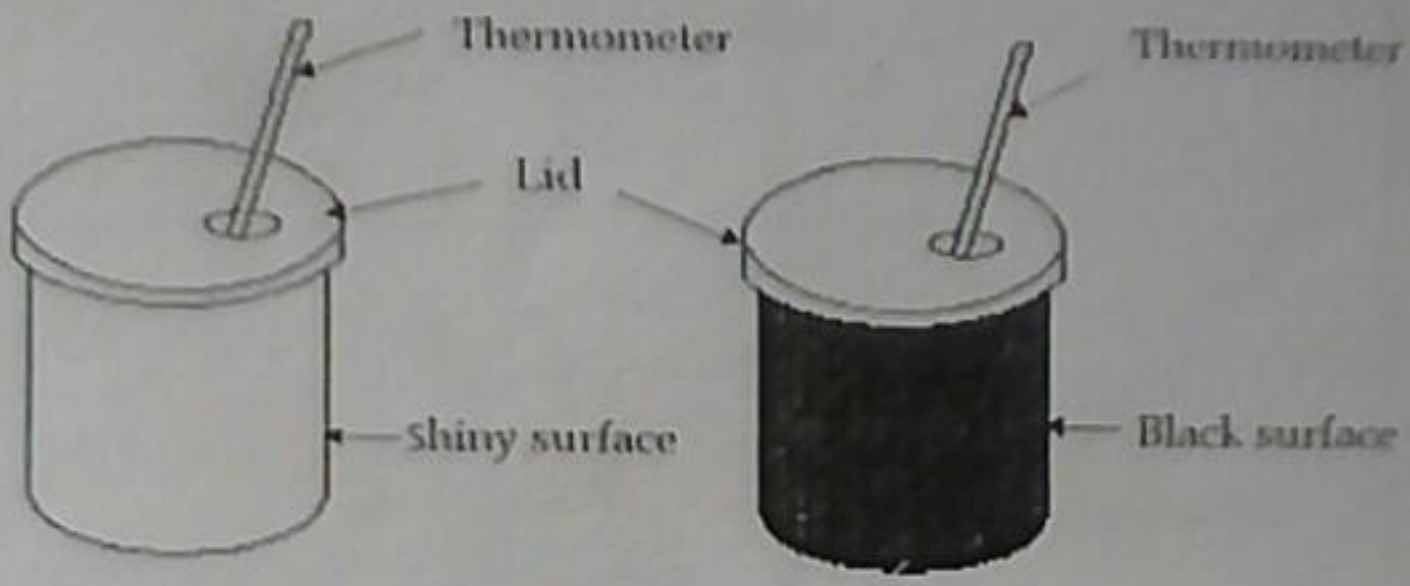
— Repeat the experiment three times

— Record results in a suitable table

— It will be observed that wax melts at different times in the three metals

— Metals with very good conduction of heat will have the wax melt fast while metals with poor conduction will take more time for wax to melt

15 With the aid of a well labelled diagram, describe an experiment to demonstrate that shinny surface and dark surfaces have different heat absorption rate



Procedure

— Put water in a tin with a black surface

— Put equal volume of water in a shiny surface

— The tins should be made of the same metal types

— Place a cover on top of each tin

— Place thermometers through the holes of the covers

— Record the initial temperature of water

— Place the two tins under scotching sunshine

— Record the temperature of water in each tin at time interval of 5 minutes for 1 our

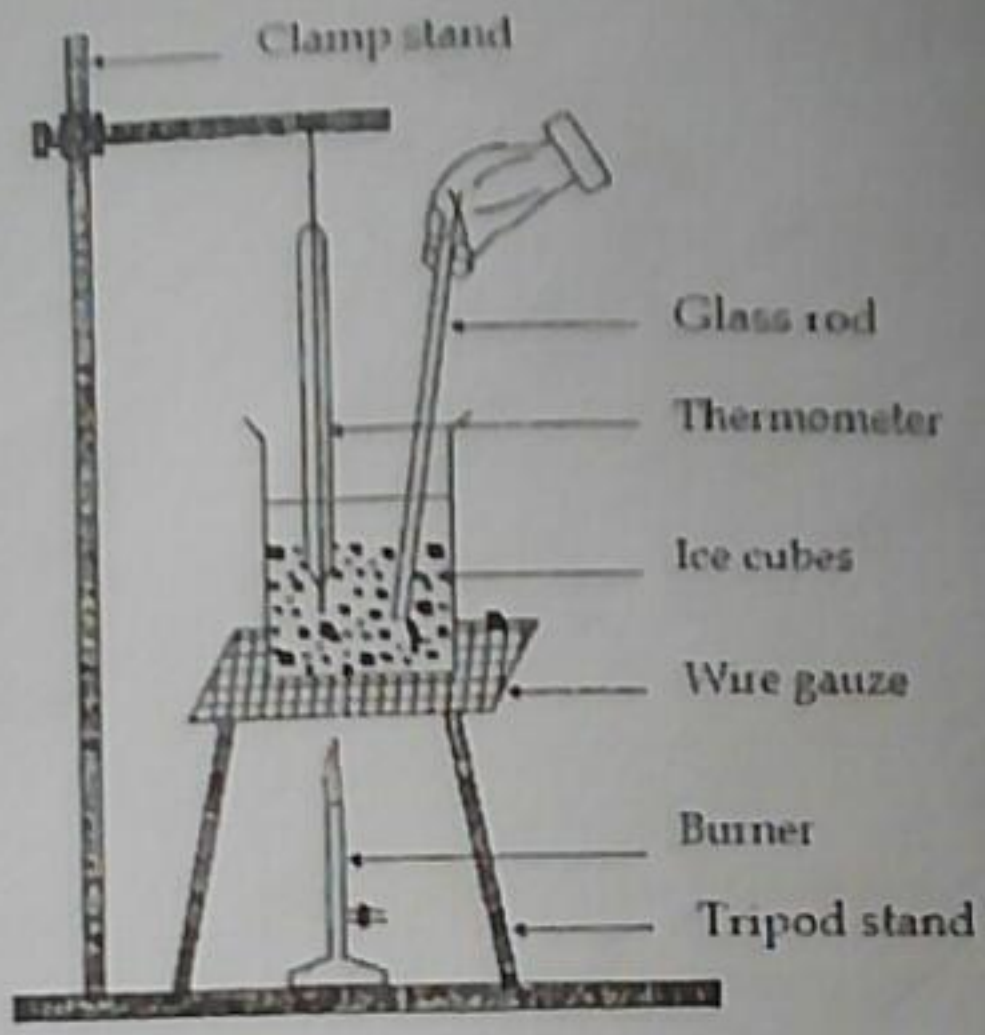
— Record values in a suitable table

— After 1 hour, evaluate results

— It will be observed that a tin with a black surface as recorded a very high temperature rise compare to a tin with a shiny surface

— Thus shows that black surfaces have a good heat absorption rate than shiny surfaces

16 Describe an experiment that could be carried out to investigate the melting point of ice. Include a well labeled diagram



Procedure

— Take some ice cubes. Dry them using the filter paper and put them quickly in a beaker.

— Place the beaker on a wire gauze kept over a tripod stand.

— Suspend a thermometer, into the ice cubes, with the help of a clamp stand.

— Heat the ice cubes and stir continuously for uniform heating.

— Note the temperature (t_1) when ice starts melting.

— Heat continuously till ice melts completely. Note this temperature (t_2)

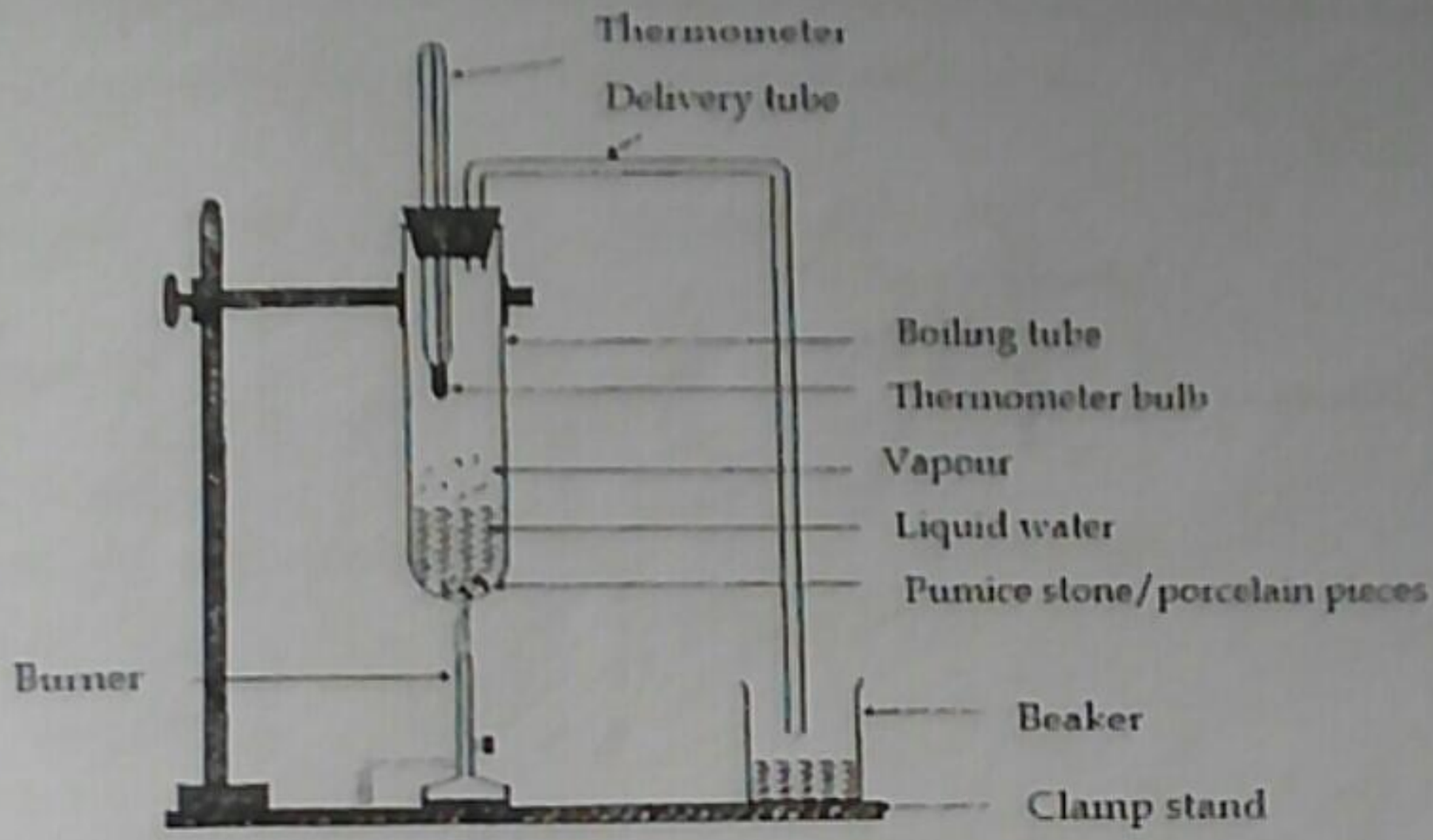
— Record your observations in the table.

— Find the mean value of starting melting temperature and temperature when ice completely melts

- Mean temperature $= \frac{t_1 + t_2}{2}$

— The mean temperature is melting point of ice

17. Describe an experiment that could be carried out to investigate the boiling point of water. Include a well labeled diagram



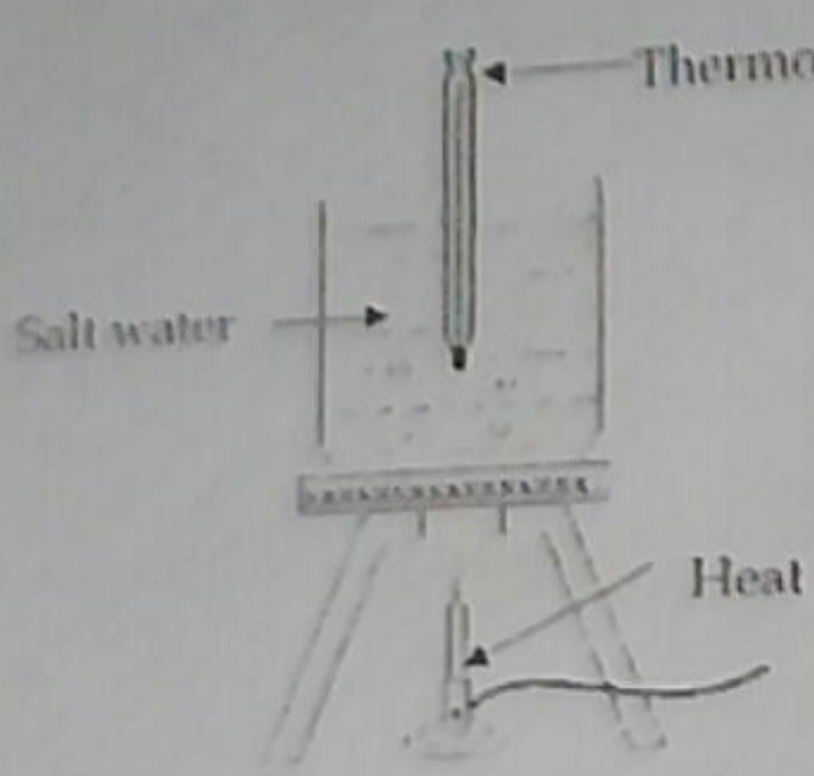
Procedure

— Take about 50 ml distilled water in a boiling tube, and add few pieces of pumice stone/porcelain to it.
— Fix a cork with two bores in the mouth of the boiling tube and fix a thermometer in one bore and delivery tube in the other.
— Clamp the tube to the stand.
— Place a beaker below the open end of the delivery tube to collect condensed water.
— Heat the boiling tube by preferably rotating the flame for uniform heating.
— Note the temperature (t_1) when water starts boiling.
— Heat continuously till the temperature becomes constant, and water keeps on boiling. Note this temperature (t_2)
— Record your observations in the table.
— Calculate mean of temperature at the start of boiling and final constant temperature

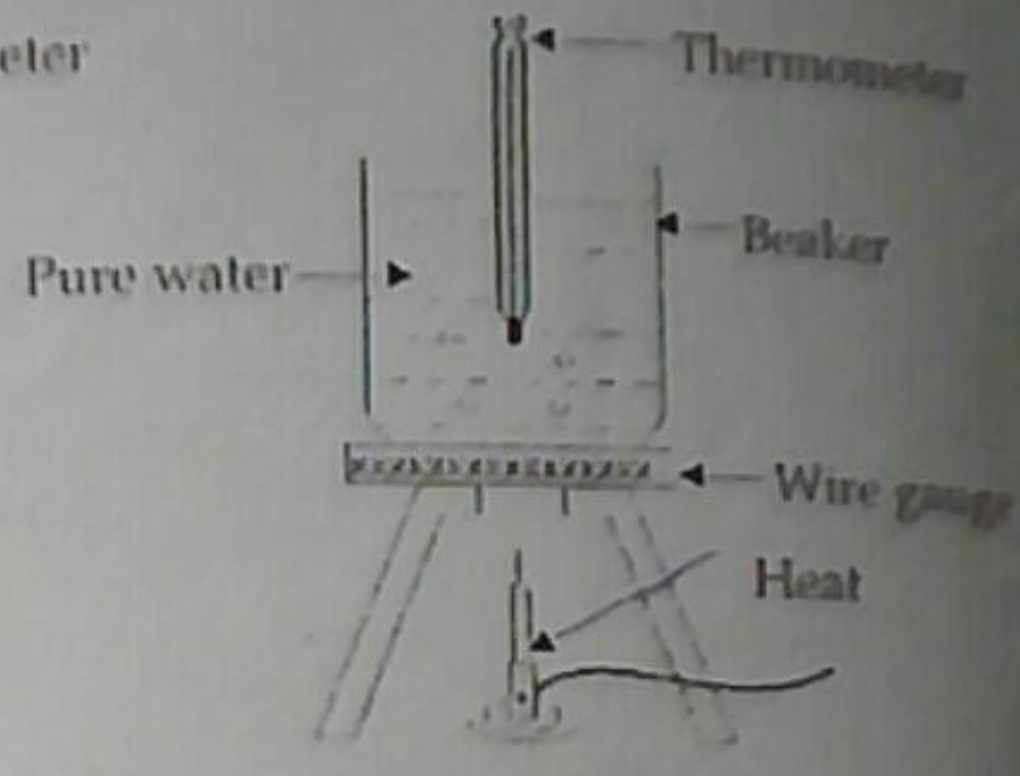
- Mean temperature $= \frac{t_1 + t_2}{2}$

— The mean temperature is boiling point of water

18. With the aid of a well labelled diagram, describe an experiment to show how impurities (salt) affect the boiling point of water



X

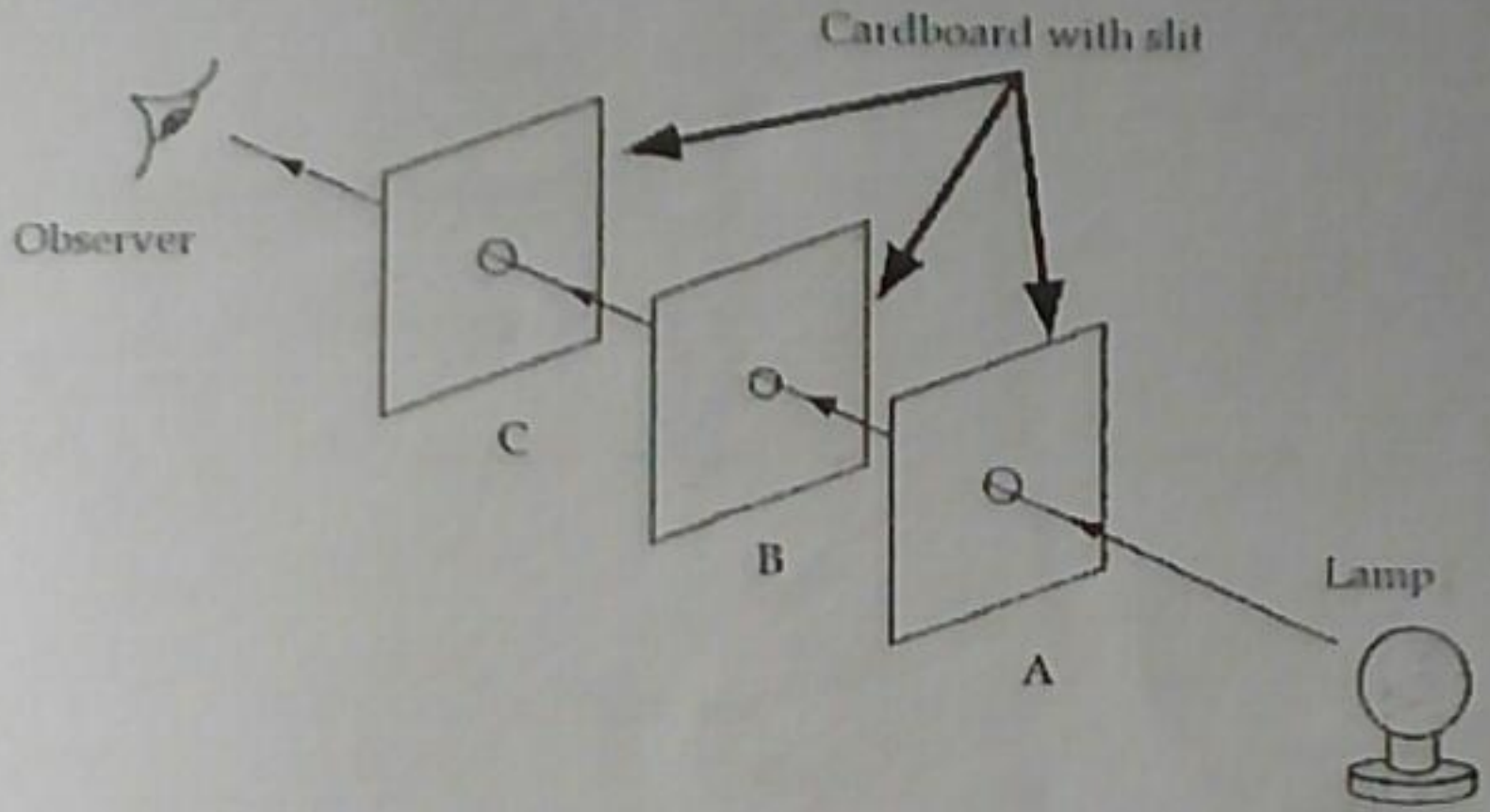


Y

Procedure

— Add equal volume of pure water to two beakers
— Mark beakers as X and Y
— Put one tea spoon of salt to beaker X and don't add anything to beaker Y
— Put beakers on a tripod stand
— Insert a thermometer in each beaker
— Put a source of heat under each tripod
— Record the highest temperature at which water boils in the two beakers
— Repeat the experiment five times
— Record results in a suitable table
— Compare boiling temperatures in salt water and pure water
— It will be discovered that salt water as a higher boiling temperature
— This experiment shows that salt increases the boiling point of water

19. With the aid of a well labelled diagram, describe an experiment that could be carried out to show that light travels in a straight line



Procedure

— Take three cardboards label them **A**, **B** and **C**

— Make a pinhole at their centres with same height from the bottom

— Arrange the cardboards in such a way that the three pinholes are in a straight line

— Put a lamp at **A**

— Look through **C**

— It will be observed that light from the lamp is seen through C

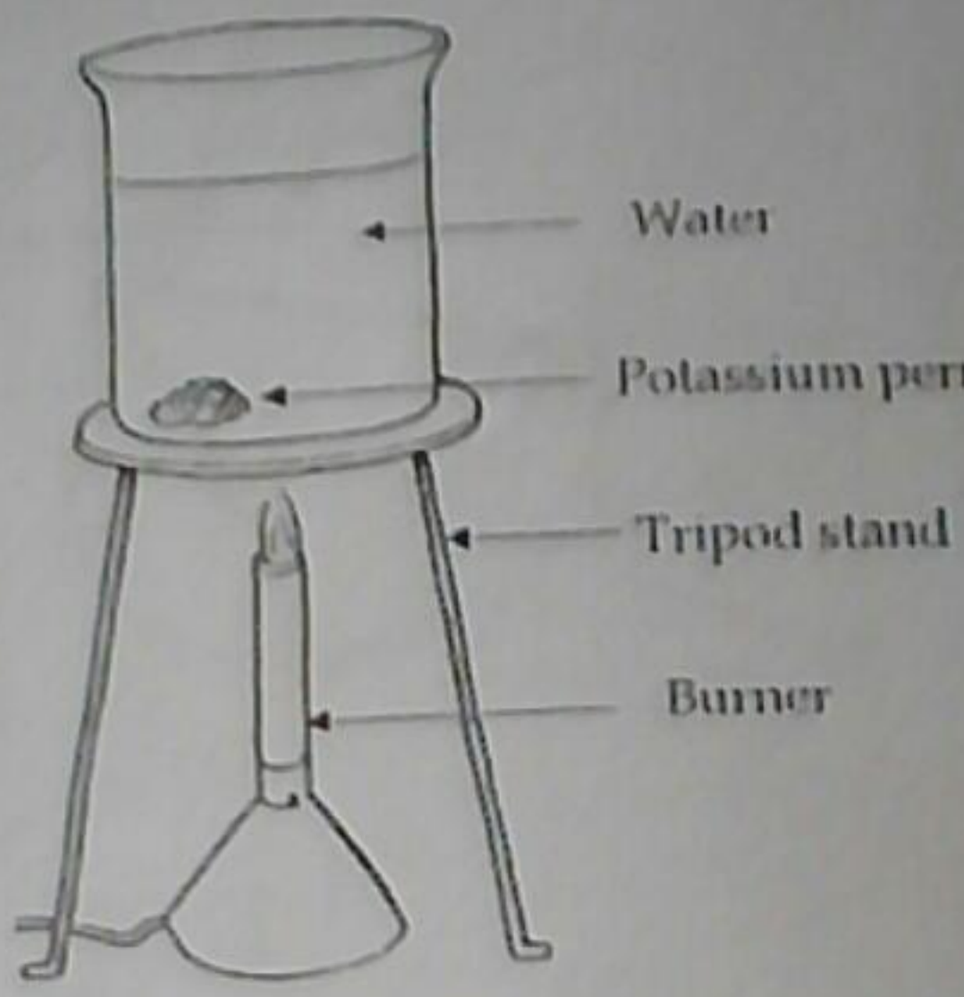
— Displace cardboard B such that its pinhole is not in straight line

— Look through C

— It will be observed that light from the lamp is not seen

— This shows that light travels in straight line

20 Describe an experiment that could be conducted to investigate heat transfer by convection



Procedure

— Half fill the beaker with cold tap water.

— Carefully put a small amount of potassium permanganate on one side of the beaker. Do not stir.

— Heat the water directly under the side of the beaker with potassium permanganate with a Bunsen/spirit burner

— Observe what happens.

— It will be observed that a coloured liquid moves upwards from potassium permanganate to the top of the container

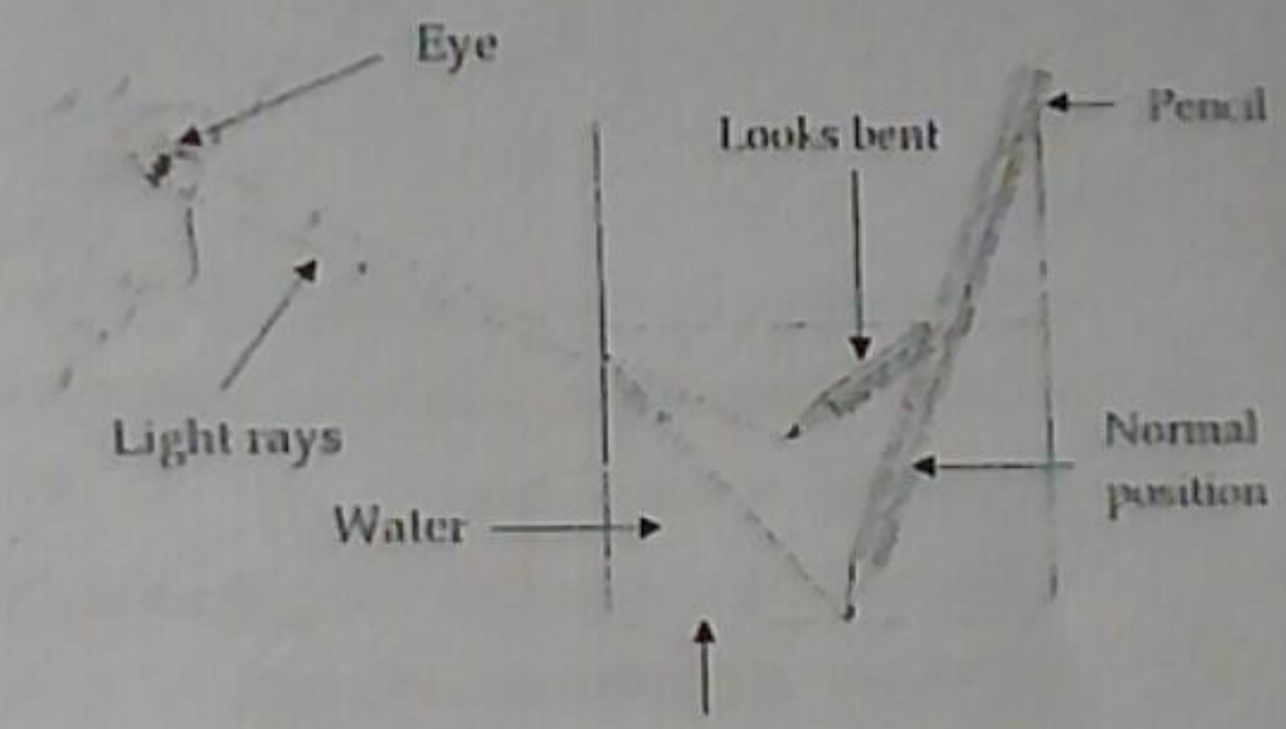
— After sometime it was also observed that the colour liquid started moving downwards to the bottom of the beaker

— This movement is due to heat transfer by convection

— The hot liquid at the bottom becomes lighter and goes on top while cold liquid on top is heavier and sinks down

21. Describe an experiment that could be done to investigate why a pencil appears bent when partially submerged in water

A B C



Procedure

— Fill a glass halfway with water

— Put a pencil in the glass and lean it against the side (Image A)

— Loot at the water from the side

— The pencil will look bent (Image B)

— Take the pencil out of the water

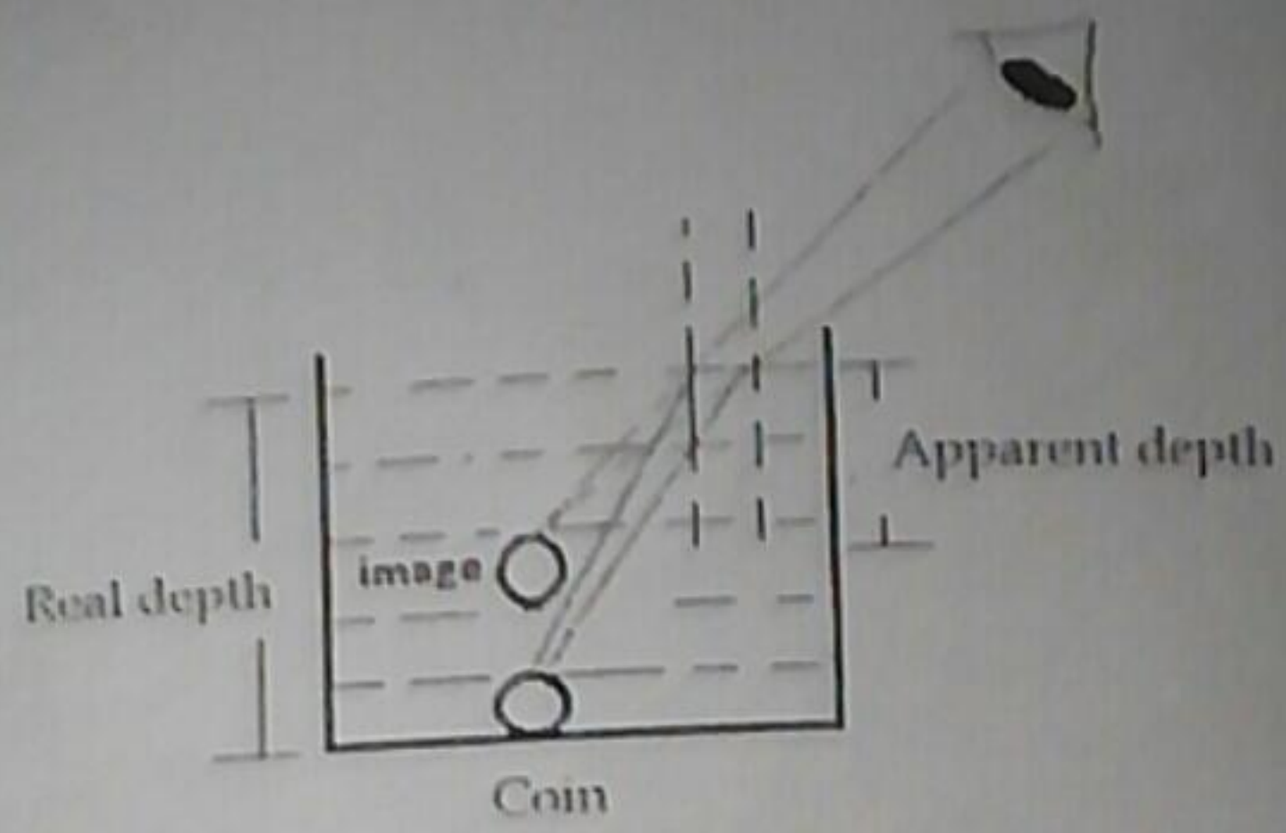
— It will be observed that nothing happened to the pencil (Image C)

Explanation

— Light rays slow down as they react the edge of the glass and change direction before reaching eyes

— This makes the pencil look bent and the point of the pencil appears to be half way up the glass

22 Describe an experiment that could be carried out to explain why a coin put in a container of water appears raised up from its original position at the bottom



Procedure

— Put a coin at the bottom of a tin can

— Move eyes until the coin is just out of sight

— Keep eyes in this position

— Let another person pour water gradually into the tin can

— The eyes will be able to see the coin

Explanation

— When moving away from the can, the coin starts disappearing from sight because, the light rays from the coin will not reach eyes.

— When water is poured, light rays from the coin travels in a straight line until it reaches the surface of water, then it bends.

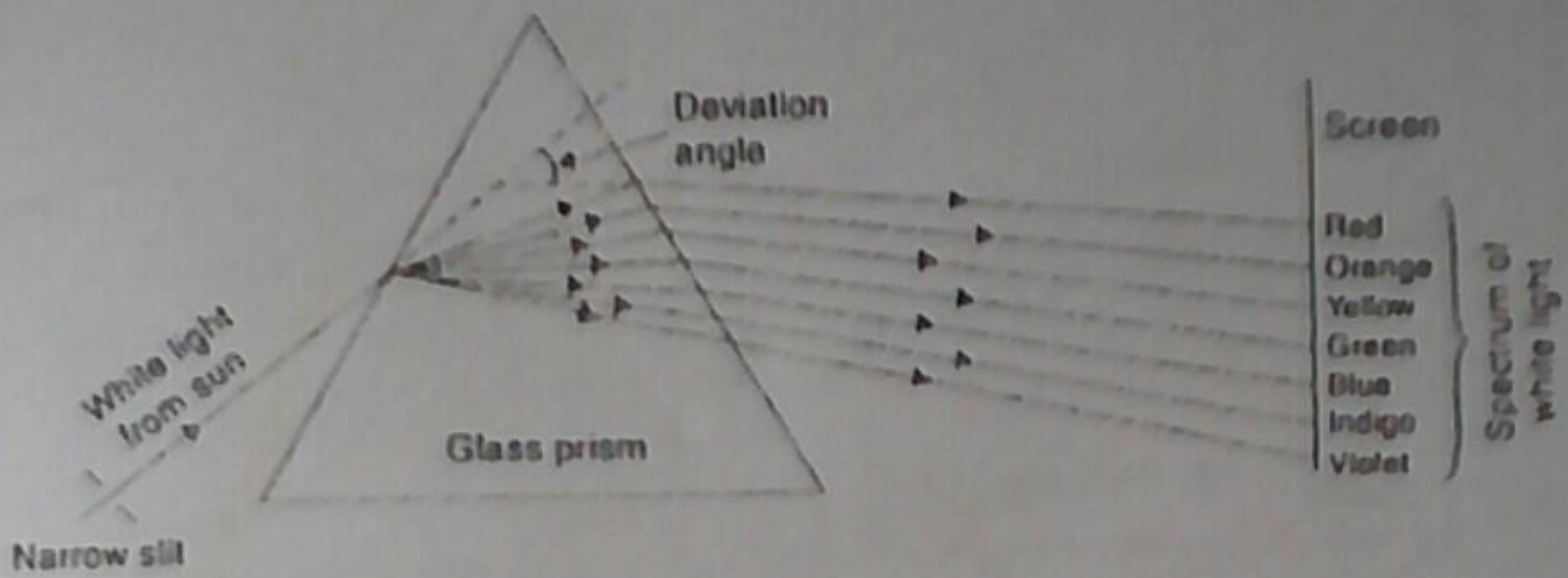
— When produced backwards these light rays appear to come from a different position. Since this position is at a higher level than the original position of the coin, the coin appears raised and becomes visible.

— The raised height of the coin is called apparent depth.

— This phenomenon is known as refraction.

— It is described as, when light rays travel from a denser medium to rarer medium it bends its path away from the normal line.

23. Describe an experiment that could be carried out to split white light into seven colour using a glass prism



Procedure

— Make a small slit on a cardboard

— Position the cardboard such that a beam of white light from the sun can pass through the slit

— Put a white screen behind the cardboard

— Put a glass prism between the screen and cardboard

— Let the beam of white light pass through the prism

— It will be observed that seven colours of light appear on the screen

Explanation

— When white light enters prism it undergoes refraction and speed of light is slowed down leading to splitting of colours

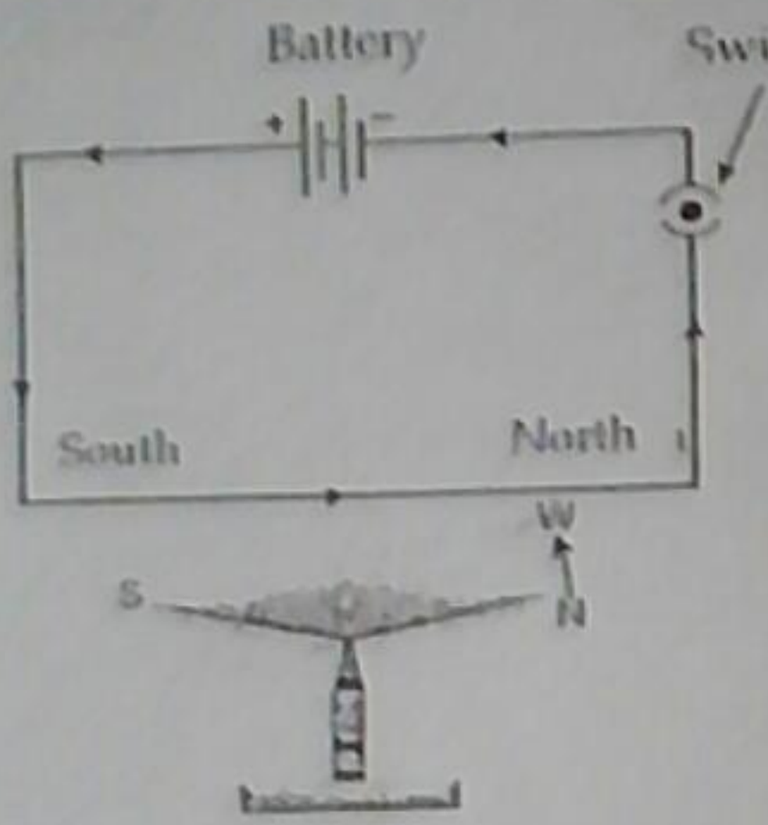
— The red colour is having the maximum speed so it is deviated least

— Red colour forms at the top of the spectrum

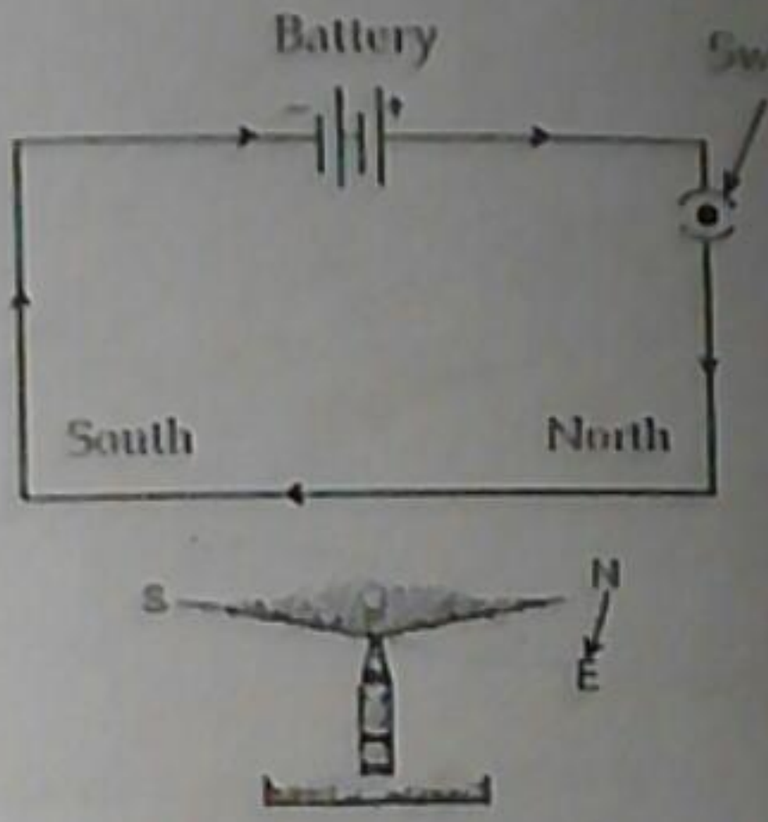
— Violet colour has minimum speed so it is deviated more and will be formed at bottom of spectrum

— A band of colours VIBGYOR are formed on the screen

24 Describe an experiment that could be carried out to demonstrate the magnetic effect of electric current



Magnetic compass needle



Magnetic compass needle

Procedure

— First of all make a simple electric circuit by joining a long straight wire with a battery and a plug

— Take a magnetic compass needle and place the straight wire parallel and over the compass needle

— Then switch on the circuit so that current flows through the wire from south to north directions

— It will be observed that the north pole of compass needle gets deflected towards the west

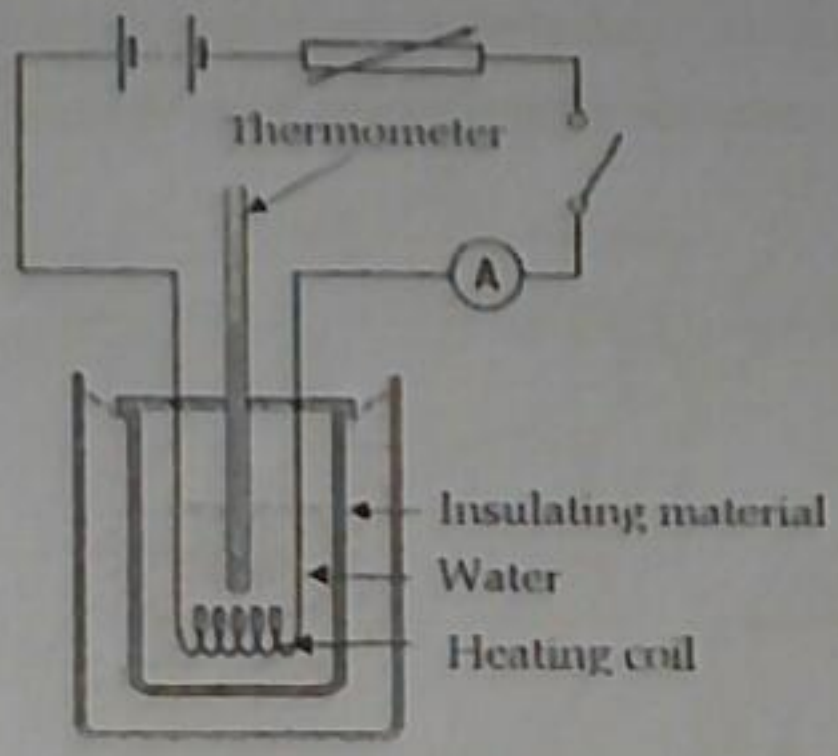
— Reverse the direction of current in the wire

— Observe results

— It will be observed that the north pole of the compass needle gets deflected towards the east

— This experiment demonstrate the magnetic effect of electric current

25 With the aid of a well labelled diagram, describe an experiment that could be carried out to show the heating effect of electric current



Procedure

— Put water in a beaker

— Measure initial temperature of water using a thermometer

— Record the temperature in a suitable table

— Connect one side of a nichrome element to a positive terminal of a battery

— Connect the other side of nichrome element to a negative terminal of a battery

— Dip the nichrome element in the beaker with water

— Turn on the switch

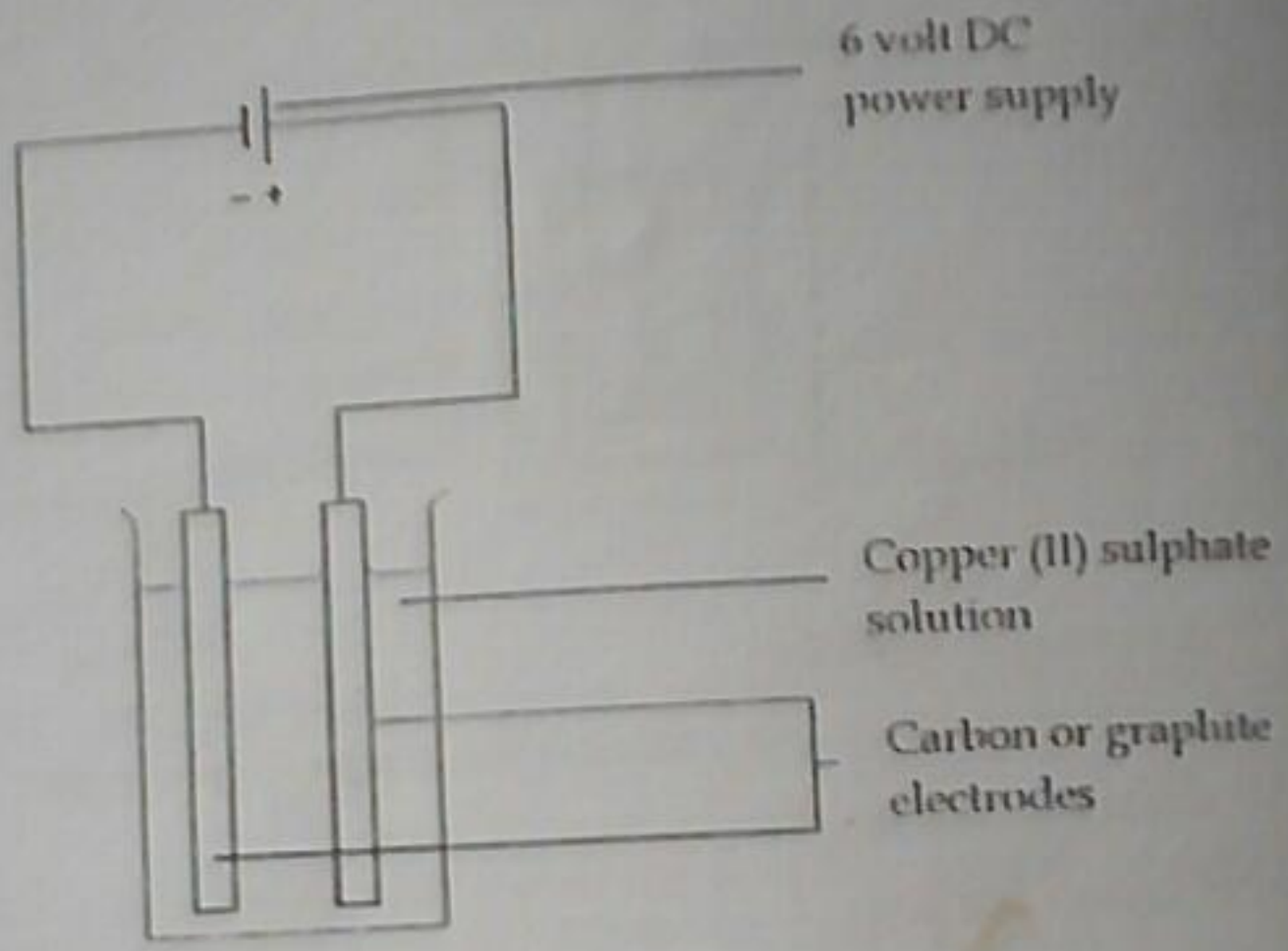
— Measure the temperature of water at intervals of 2 minutes for 10 minutes

— Record results in a suitable table

— It will be observed that once the switch is turned on, the temperature of water starts to rise sharply

— The sharp rise in temperature demonstrates that electric current as a heating effect

26 With the aid of a well labelled diagram, describe an experiment that could be carried out to show the chemical effect of electric current



Procedure

— Connect one electrode to a positive terminal of a battery

— Connect the other electrode to a negative terminal of a battery

— Pour copper (II) sulphate solution in a beaker

— Dip the electrodes in a solution of copper sulphate

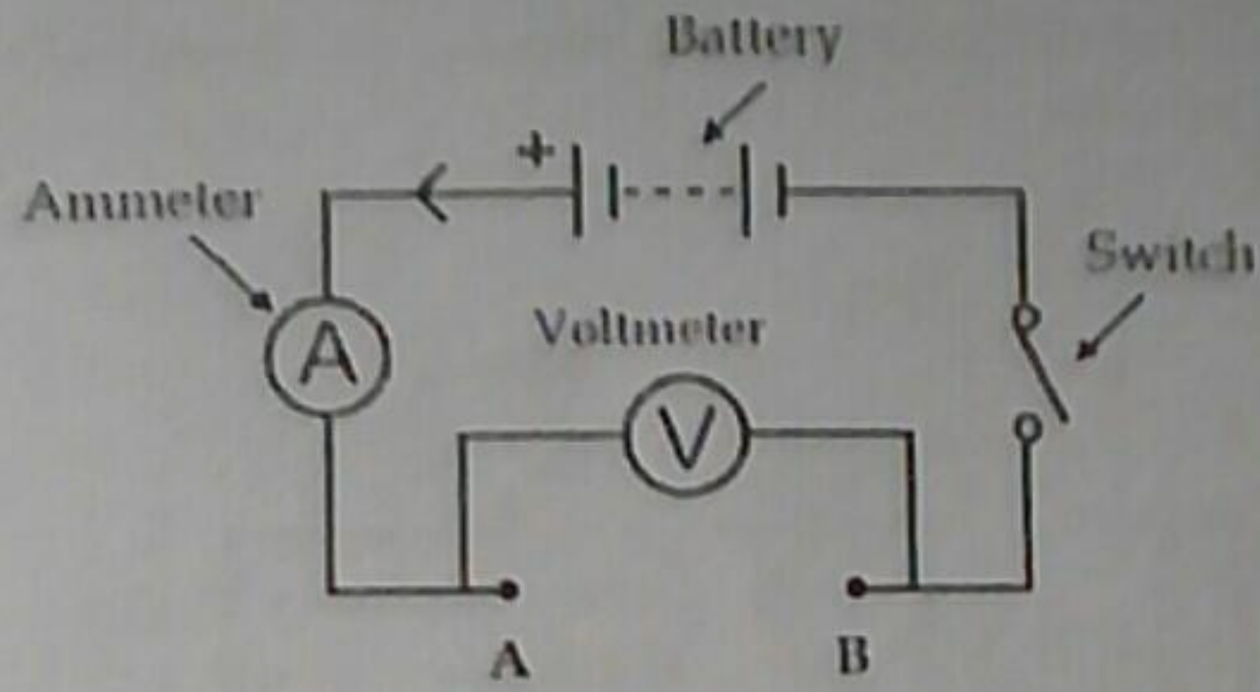
— Turn on the switch

— Observe results

— It will be observed that the blue colour of copper sulphate starts to fade away and bubbles of gas are seen at the positive electrode

— The change in colour of copper sulphate and bubbles indicate a chemical change

27 With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the effect of length of wire on electrical resistance



Procedure

— Make a circuit with an ammeter, voltmeter, switch, battery and gap AB

— Put a 5 cm piece of wire on gap AB

— Close the switch

— Record the voltage and current readings

— Calculate the resistance of the 5cm wire using the equation:

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

— Record the value of resistance in a suitable table

— Repeat all the above steps using wires of the following lengths: 10 cm, 15 cm and 20 cm

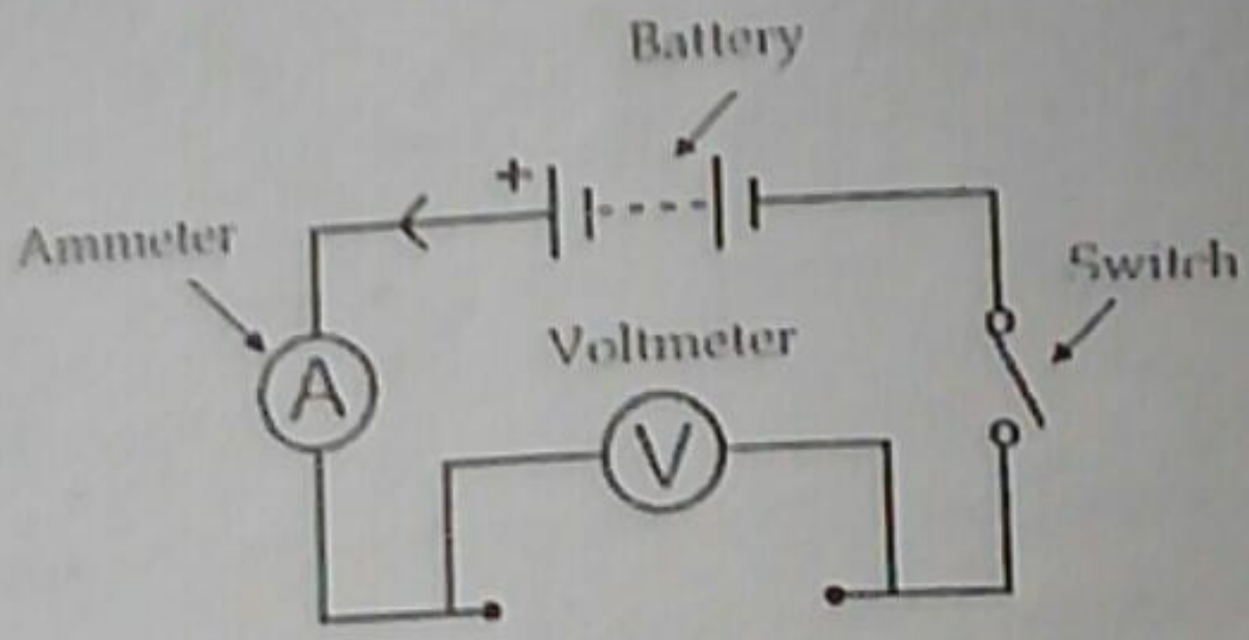
— Make sure that the wires are from same material and have same thickness

— Compare the resistance values

— It will be observed that the resistance increases with the length of wire e.g 5 cm has smallest value and 20 cm as biggest value

— Therefore electrical resistance is directly proportional to the length of wire

28. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the effect of thickness of wire on electrical resistance



Procedure

— Make a circuit with an ammeter, voltmeter, switch, battery and gap AB

— Put a 0.2mm thick piece of wire on gap AB

— Close the switch

— Record the voltage and current readings

— Calculate the resistance of the wire using the equation:

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

— Record the value of resistance in a suitable table

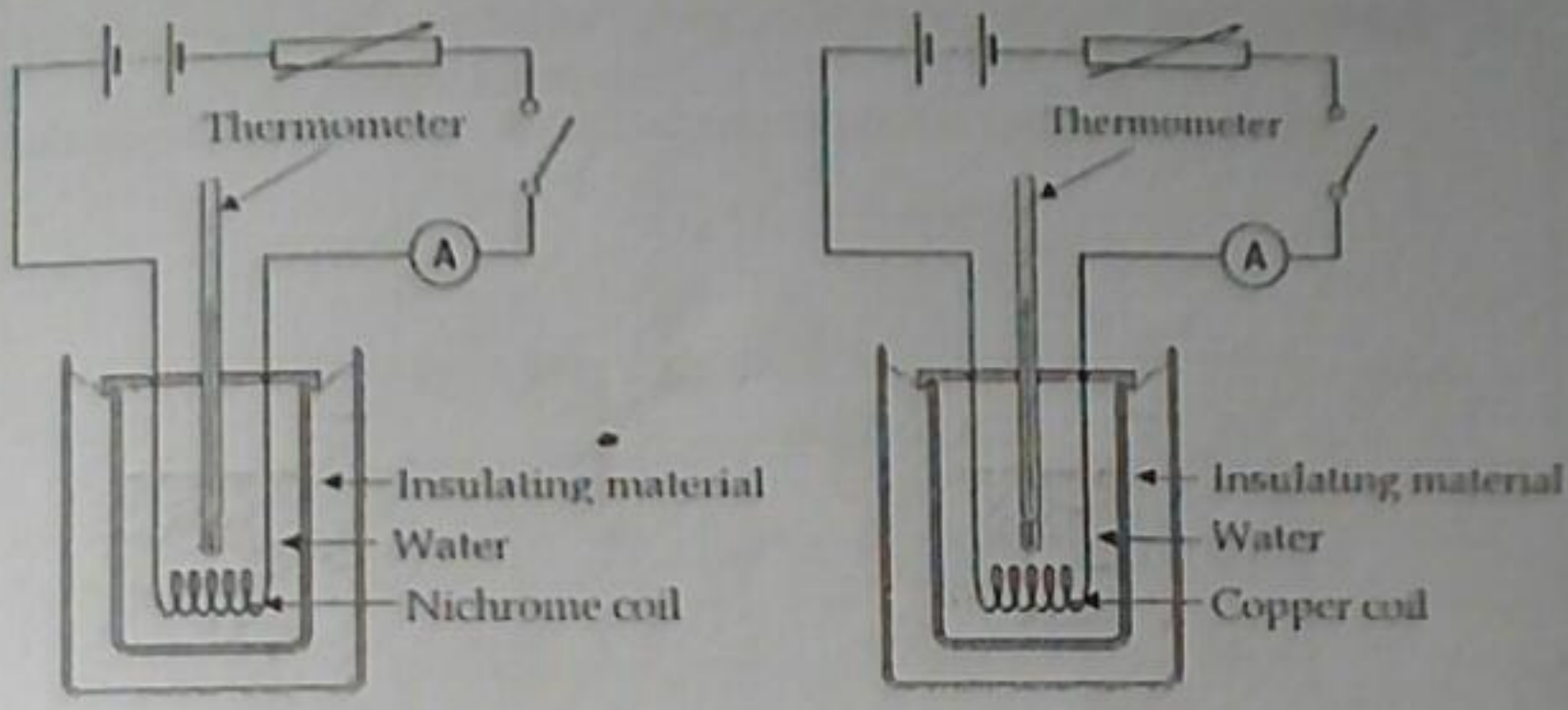
— Repeat all the above steps using wires of the following thickness: 0.3mm, 0.4mm and 0.5mm

— Make sure that the wires are from same material and have same length

— Compare the resistance values

— It will be observed that resistance decreases with thickness of wire

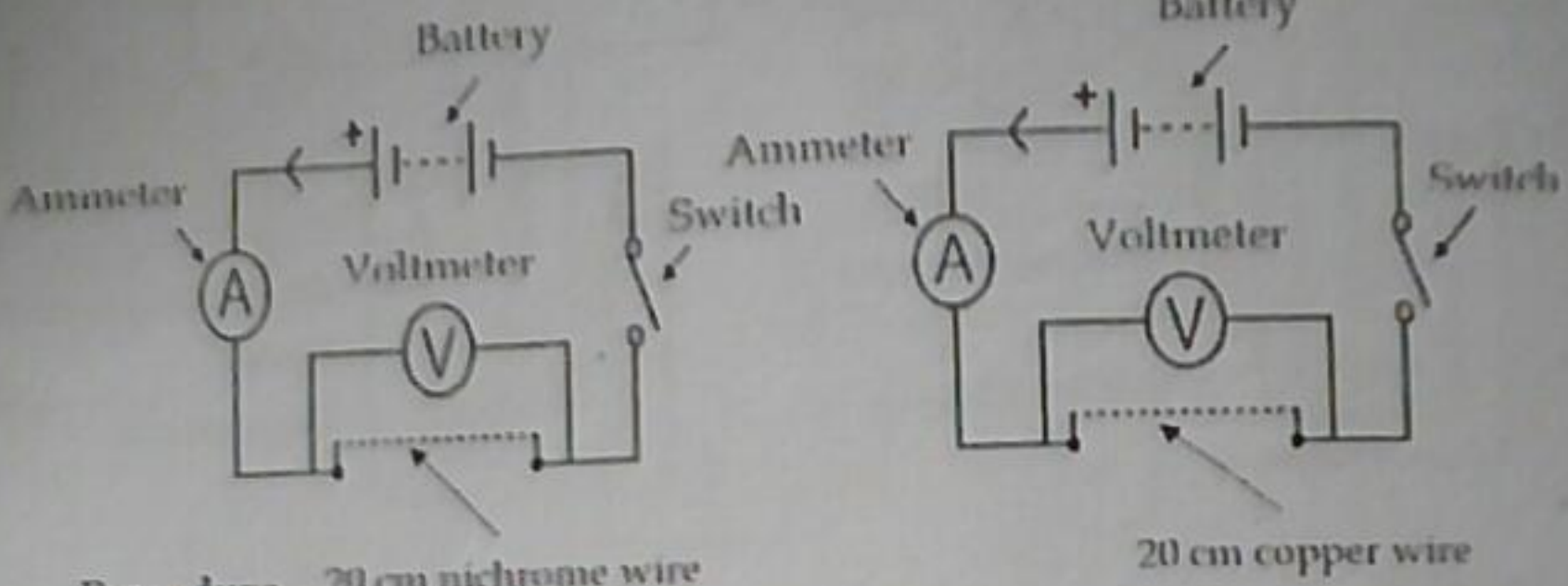
29. With the aid of a well labelled diagram, describe an experiment that could be carried out to show that nichrome wire has more heating effect than copper wire



Procedure

— Pour water from the same source in two beakers
— The water should have the same volume
— Using a thermometer, measure the initial temperature of water and record in a suitable table
— Connect one side of nichrome element to a positive terminal of a battery and connect the other end of the element to a negative terminal of the battery
— Connect one side of copper element to a positive terminal of a battery and connect the other end of the element to a negative terminal of the battery
— Dip the element of nichrome in one beaker and dip the element of copper in the other beaker
— Simultaneously turn on switches in the two beakers
— Measure the temperature of water in each beaker at same intervals and record in a suitable table
— Compare results in the two beakers after 10 minutes
— It will be observed that the beaker with nichrome element as a very big rise in temperature compared with a beaker having an element of copper
— This shows that nichrome has more heating effect than copper

30 With the aid of a well labelled diagram, describe an experiment that could be carried out to show electrical resistance depends on conductor material



Procedure

— Make a circuit with an ammeter, voltmeter, switch, battery and gap AB

— On gap AB put nichrome wire of length 20 cm

— Record the voltage and resistance readings

— Calculate the resistance using the equation:

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

— Record the value in a suitable table

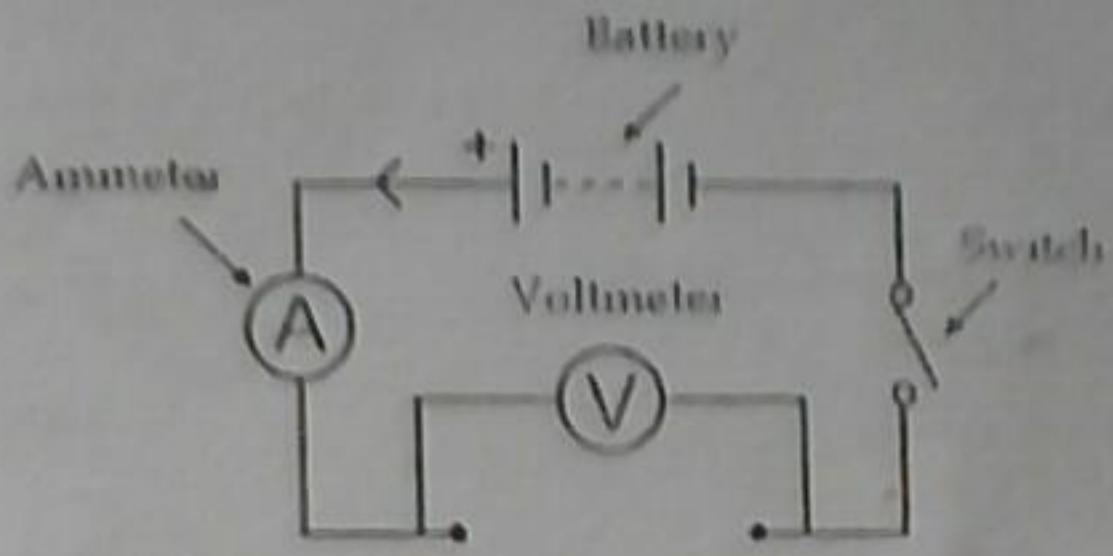
— Repeat all the above steps using a 20 cm copper wire

— Compare the resistance of nichrome wire and copper wire

— It will be observed that nichrome wire has higher resistance than copper wire

— This shows that different materials have different resistance

31. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the effect of temperature on electrical resistance.



Procedure

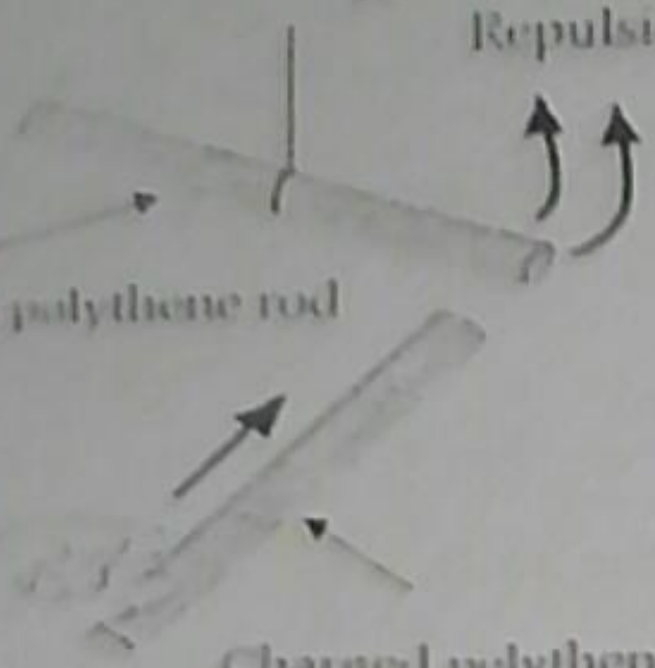
— Make a circuit with an ammeter, voltmeter, switch, battery and gap AB
— Put a 20 cm long piece of wire on gap AB
— Immerse the wire in hot water for 5 minutes
— Close the switch
— Record the voltage and current readings
— Calculate the resistance of the wire using the equation

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

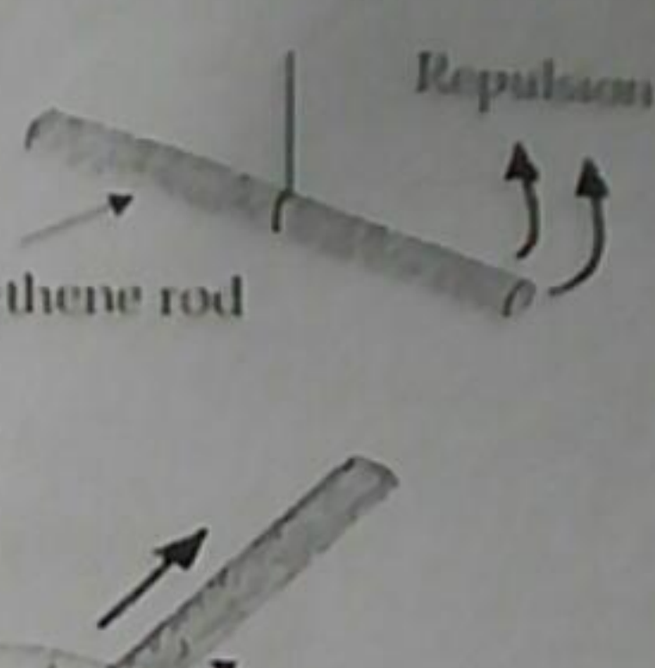
— Record the value of resistance in a suitable table
— Remove hot water and substitute with cold water
— Immerse the 20 cm wire in cold water for 5 minutes
— Close the switch
— Record the voltage and current readings
— Calculate the resistance of the wire
— Compare the resistance values of wire in hot water and same wire in cold water
— It will be observed that the wire has higher resistance when in hot water and has lower resistance when in cold water

32 With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the effect of distance on electrostatic forces

A



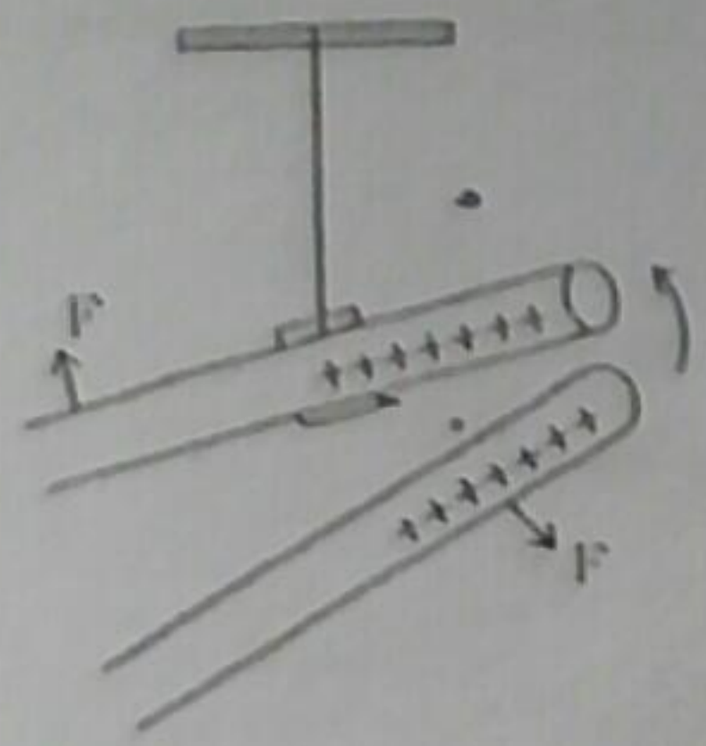
B



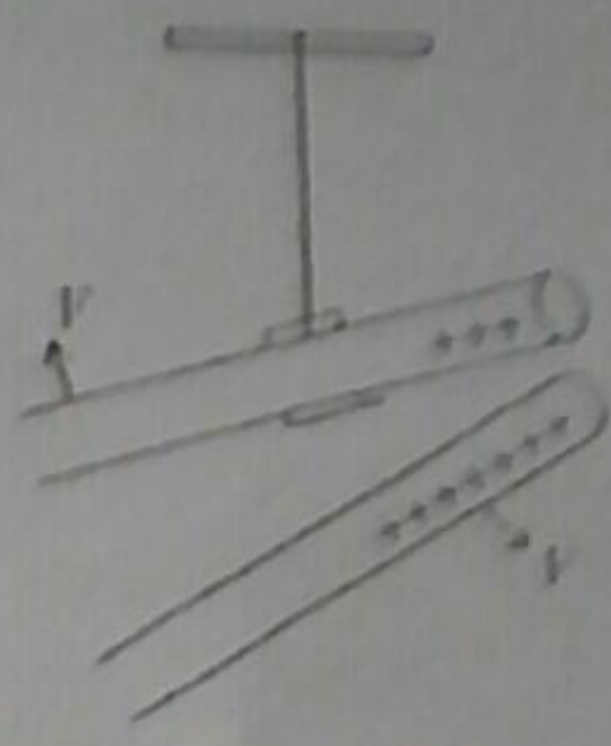
Procedure

— Charge a polythene rod by rubbing it with a duster
— Support the polythene rod with a string so that it is hanging
— Charge another polythene rod by rubbing it with a duster
— Bring the second charged polythene rod very close to the hanging charged polythene rod as shown in diagram A
— Observe the force of repulsion between the two polythene rods
— Increase the distance between the two charged polythene rods as shown in diagram B
— Observe the force of repulsion between the two charged polythene rods
— It will be observed that the force of repulsion is very strong when the two charged polythene rods are very close to each other
— It will also be observed that the force of repulsion is very weak when the two charged polythene rods are far apart
— This experiment shows that the force of repulsion between two charged bodies is inversely proportional to distance between the charged bodies

33. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the effect of magnitude of charge on electrostatic forces



A

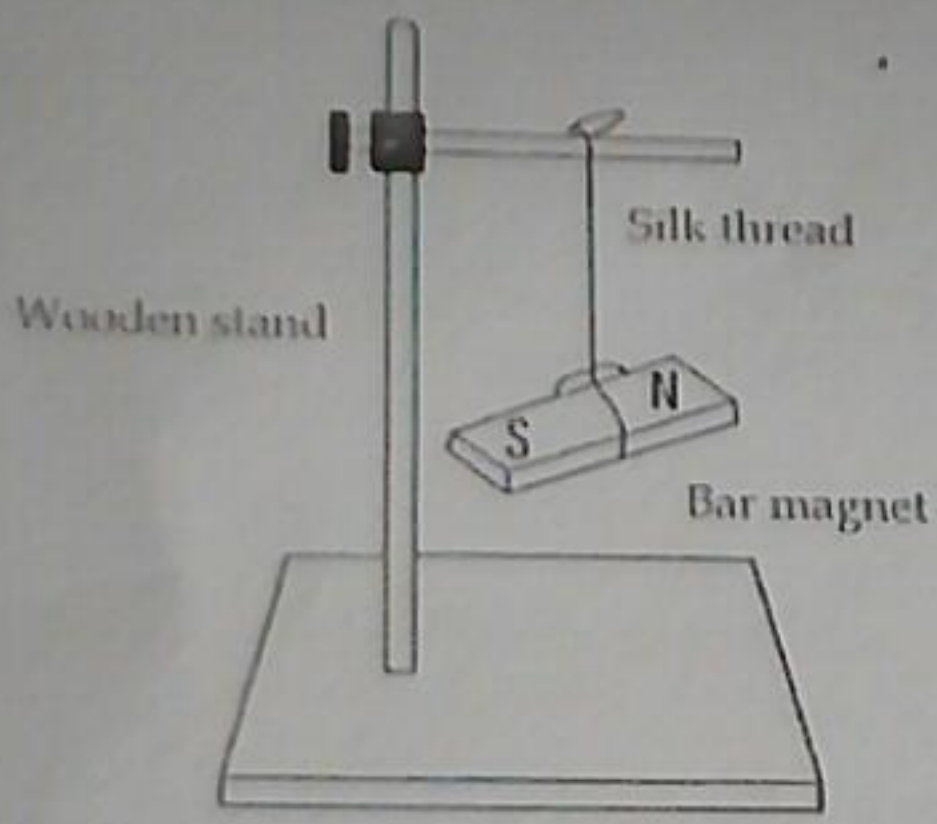


B

Procedure

— Charge a polythene rod by strongly rubbing it against a dry cloth
— Label it as A
— Hang it with a nylon string
— Charge a second polythene rod by weakly rubbing it against a dry cloth
— Label it as B
— Hang it with a nylon string
— Charge a third polythene rod
— Bring the third charged polythene rod close to strongly charged polythene rod
— Observe the force of repulsion between the two charged polythene rods
— The third charged polythene rod close to weakly charged polythene rod
— Observe the force of repulsion between the two charged polythene rods
— It will be observed that the forces of attraction are very strong when the polythene rod was strongly charged
— It will also be observed that the forces of attraction are very weak when the polythene rod was weakly charged
— This shows that magnitude of charge affect electrostatic forces

34 With the aid of a well labelled diagram, describe an experiment that could be carried out to identify poles of unmarked magnet using suspension method



Procedure

— With a silk thread suspend a bar magnet as shown in the figure.
— Mask the poles of the magnet with a masking tape

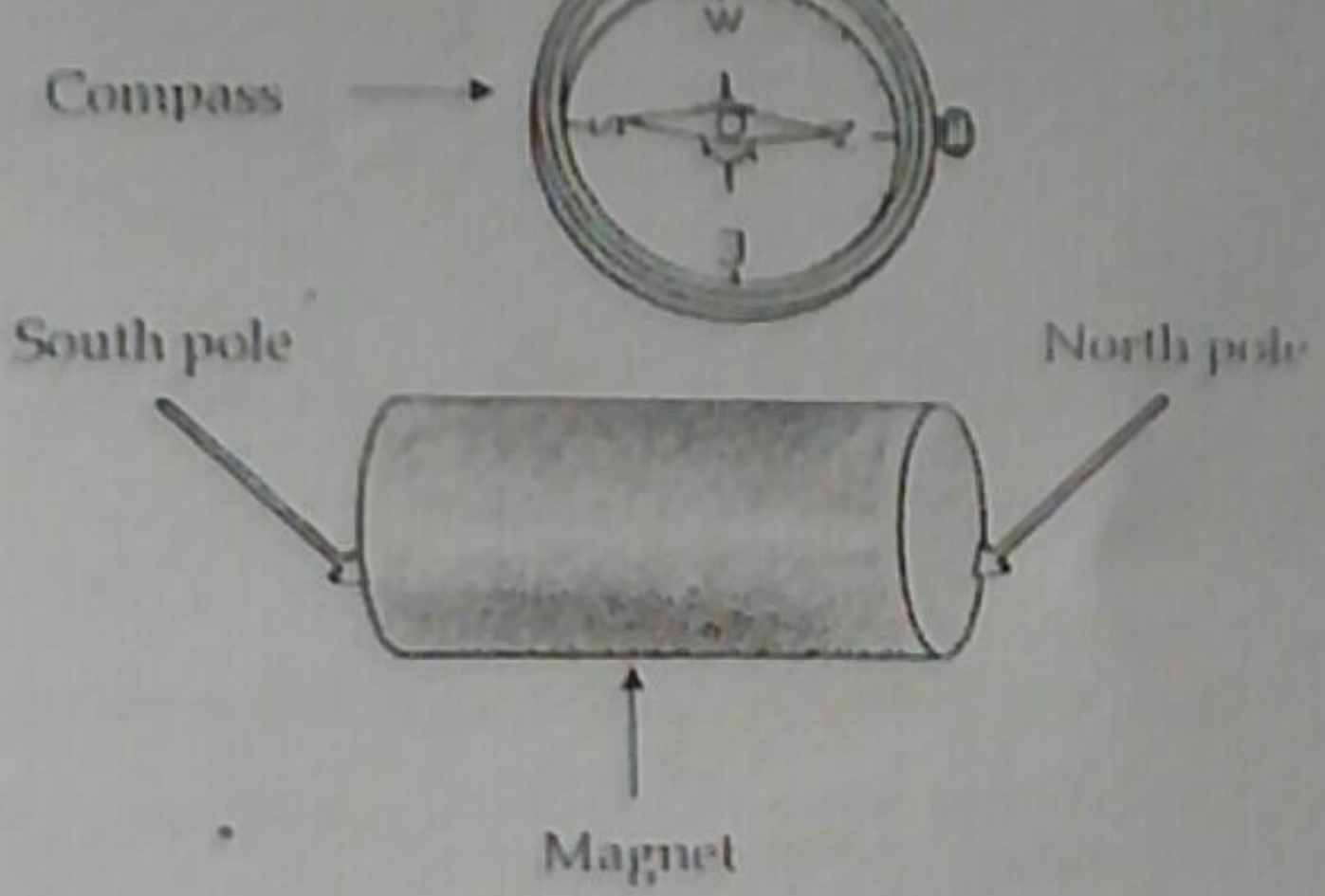
— Let the magnet swing for some time

— Let it come to rest

— Watch as one end orients itself toward the north. This is the magnet's north pole

— If that is the end with the masking tape, write "*N*" on the tape. If the other end has the tape, write "*S*."

35. With the aid of a well labelled diagram, describe an experiment that could be carried out to identify poles of unmarked magnet using a compass



Procedure

— Place your compass on a flat surface, such as a table

—Make sure that the surface is free of any magnetized or metal materials that could cause a false reading

— The North end of the compass needle will point to geographical North

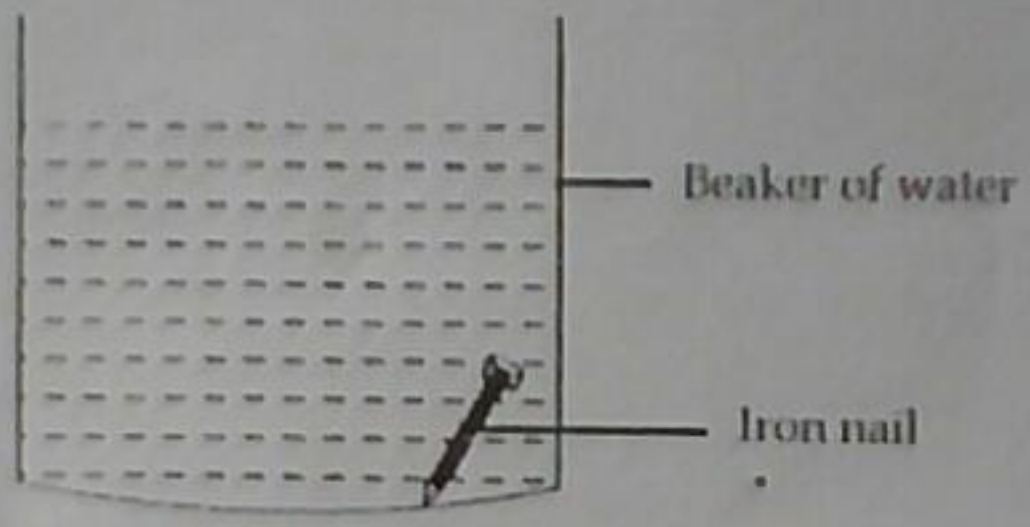
— Move the magnet towards the compass

— Look at the compass needle

— Observe results

— The north pole of the magnet will follow the line of the north pole of the compass

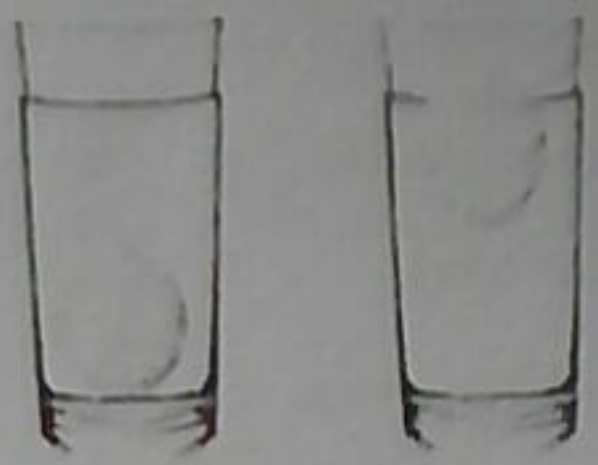
(a) With the aid of a well labelled diagram, describe an experiment that could be carried out to show that iron nails and match box have a lower average density than water while nails only have higher density than water



Procedure

— Put water in a beaker
— Put three iron nails in the beaker
— Observe what happens
— It will be observed that iron nails sink in water
— Put iron nails in a match box
— Put the match box in water
— Observe what happens
— The match box containing water does not sink in water
— Irons nails have a higher density than water. this made iron nails to sink in water
— The average density of irons nails and match box is less than density of water. This made match box with iron nails to float in water

39 With the aid of a well labelled diagram, describe an experiment that could be conducted to explain why a fresh egg sinks in fresh water and floats in salt water



Pure water Salt water

Procedure

— Fill two beakers with equal volume of pure water

— Add salt to one beaker and stir the mixture until it completely dissolves in water

— Don't add salt to the other beaker

— Place one fresh egg in each of the two beakers

— Observe what happens to each egg in the beakers

— It will be observed that the fresh egg floats in salt water

— It will also be observed that fresh egg sinks in fresh water

— Remove eggs from beakers and wash them with pure water

— The egg that was in salt water should be put in pure water

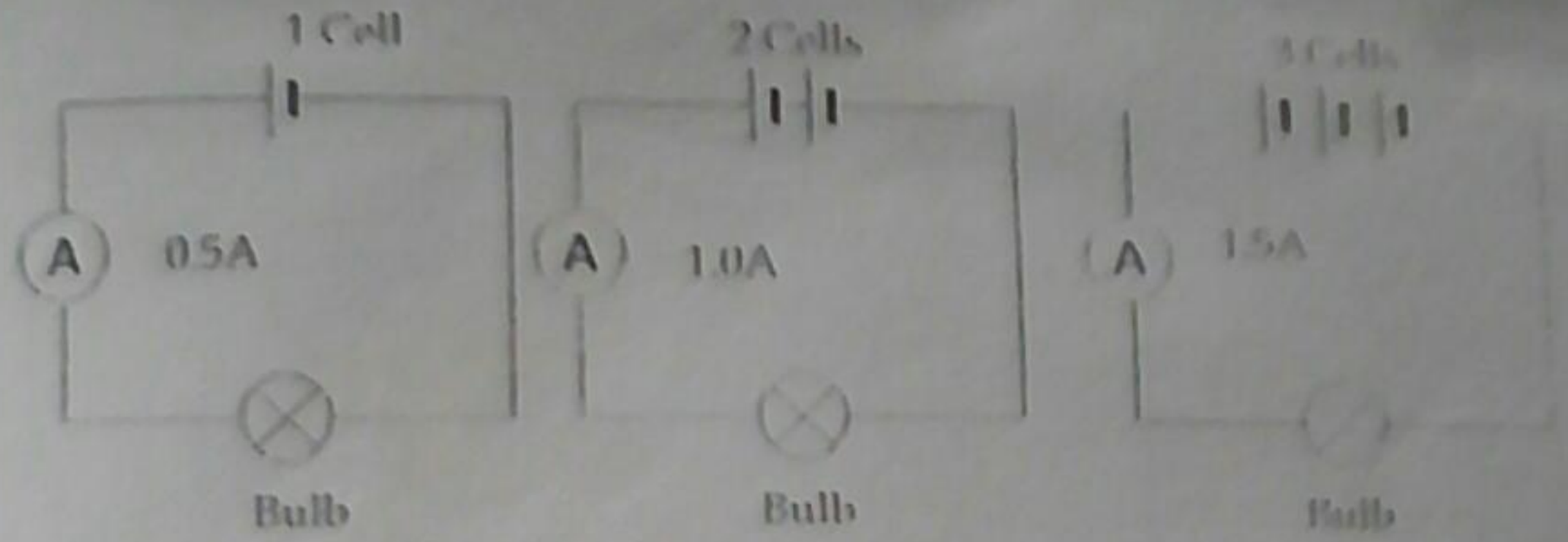
— The egg that was in pure water should be put in salt water

— It will be observed in salt water, the egg floats and egg in fresh water sinks

— The average density of salt and water is higher than density of an egg hence it floats

— The density of pure water is less than density of an egg hence it sinks

42. With the aid of a well labelled diagram, describe an experiment could be done to investigate the impact of adding cells in a series circuit on brightness of bulb and ammeter reading



Procedure

— Make a circuit with a single bulb and an ammeter

— Put one cell in the circuit

— Observe the brightness of the bulb and record ammeter reading in a suitable table

— Put two cells in the circuit

— Record ammeter reading and observe brightness of the bulb

— Repeat the experiment using 3, 4 and 5 cells

— Observe brightness of bulb and record ammeter readings

— Compare results

— It will be observed that when the number of cells increase, the ammeter records increased current

— It will also be observed that when the number of cells increase, the brightness of bulb increases

— This experiment confirms that increasing the number of cells in series leads to increased current and increased bulb brightness

40 Describe an experiment ~~an experiment~~ that could be done to explain the effect of suddenly pouring cold water on a hot stone

Procedure

— Put a stone on fire until it becomes hot red

— Remove the stone from fire and instantly pour cold water on it

— Observe what happens to the stone

— It will be observed that the stone cracks

— Cold water makes stone to cool and stone particles move closer to each other very fast which leads to stone cracking

41 Describe an experiment ~~an experiment~~ that could be done to explain the effect of suddenly dropping an egg in hot water

Procedure

— Put very hot water in a beaker

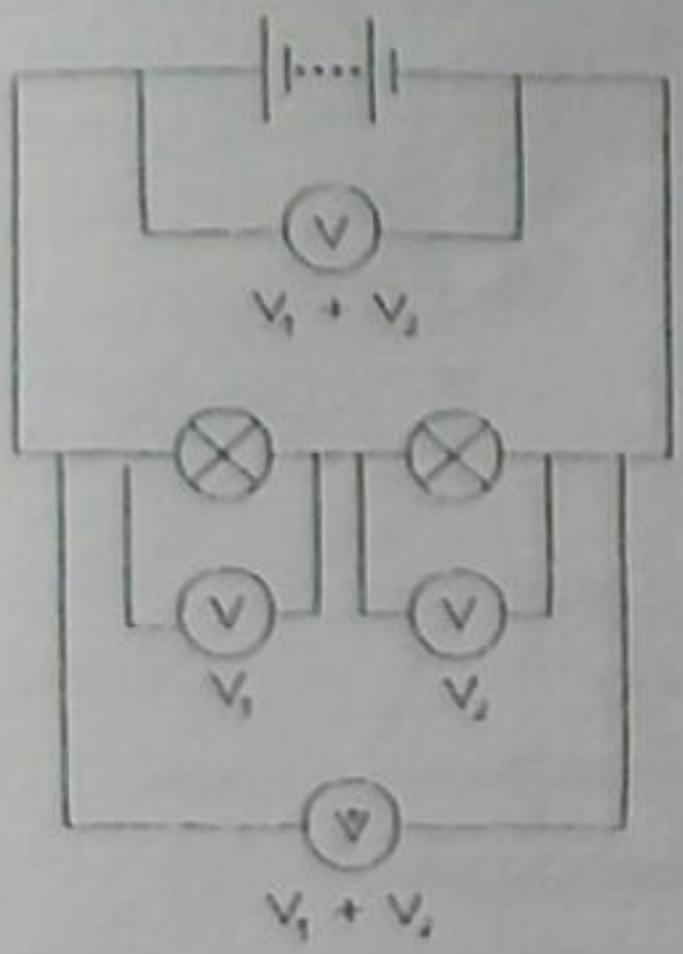
— Instantly drop an egg in the hot water

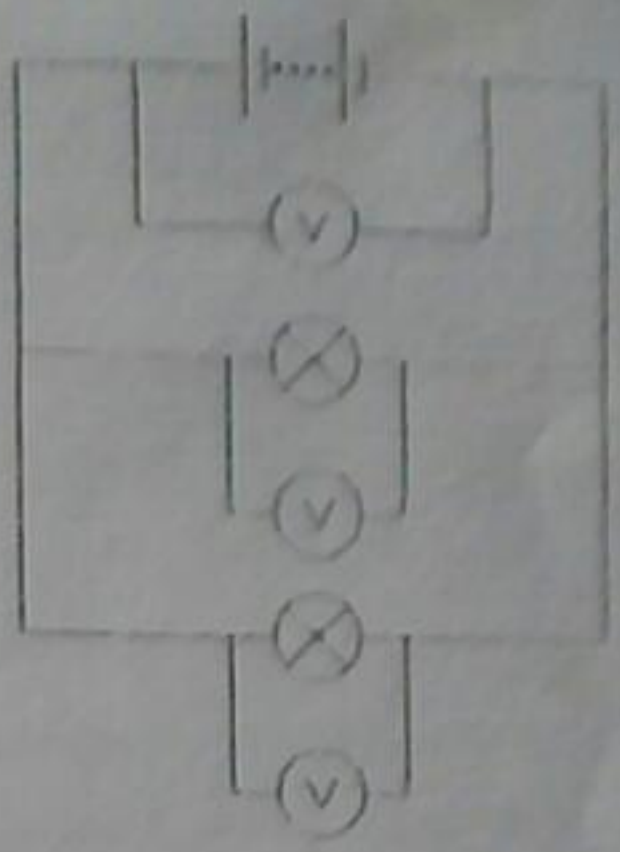
— Observe what happens to the egg

— It will be observed that the egg cracks

— Heat from hot water causes the particles of an egg to move away from each other very fast which leads to sudden cracking of the egg

43 With the aid of a well labelled diagram, describe an experiment could be done to investigate voltage relationship in series and parallel circuits





Procedure

— Make two circuits labelled A and B

— In circuit A, two bulbs should be connected in series

— In circuit B, two bulbs should be connected in parallel

— Each circuit should have a battery

— Measure the voltage of each bulb in parallel circuit and record in a suitable table

— Measure the voltage across each bulb in series circuit

— Record results in a suitable table

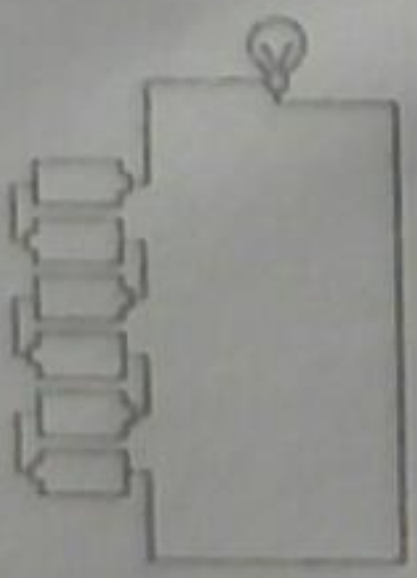
— Compare results in series circuit and parallel circuit

— It will be observed that each bulb in parallel circuit has same voltage as that of battery

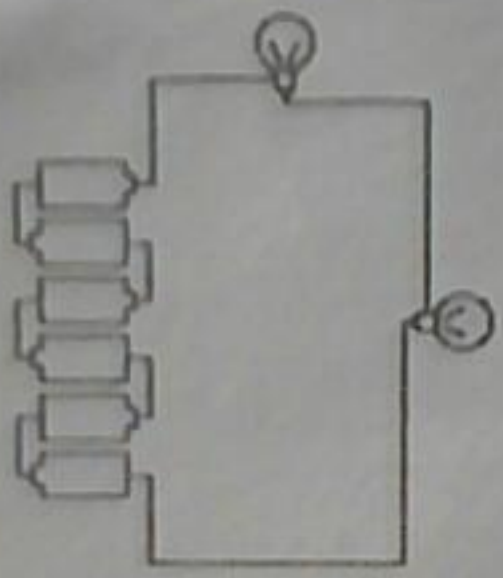
— It will also be observed that each bulb in series circuit has half the voltage of battery

17 With the aid of a well labelled diagram, describe an experiment could be done to investigate the effect on brightness of bulbs when more bulbs are added in series circuit

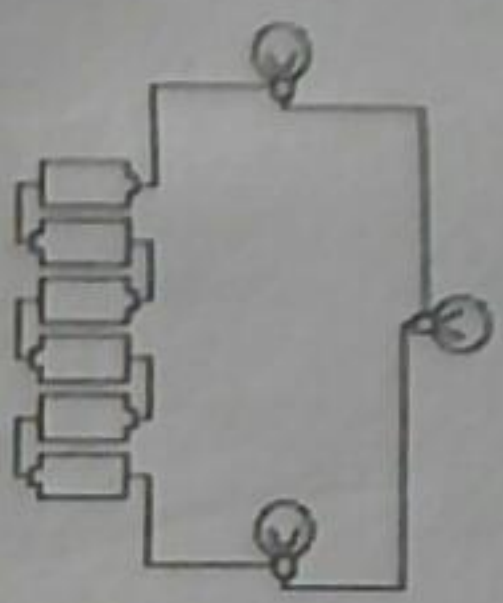
1 bulb



2 bulbs



3 bulbs



Procedure

— Make a circuit with a battery

— Put 1 bulb in the circuit

— Observe brightness of bulb

— Add 2 bulbs in the circuit in series connection

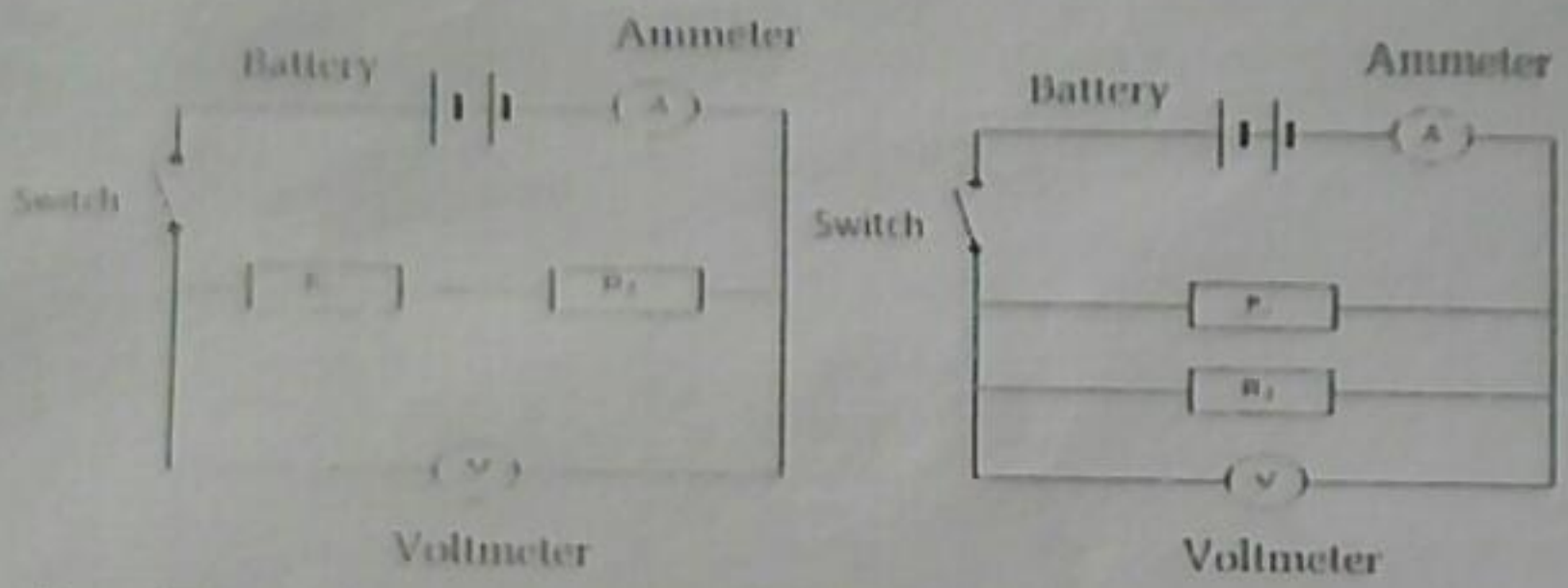
— Observe brightness of the bulbs

— Add 3, 4 and 5 bulbs in the circuit in series connection

— It will be observed that the brightness of the bulbs decrease when the number of bulbs increase in series connection

— This experiment confirms that increasing number of bulbs in series connection decreases their brightness

11. With the aid of a well labelled diagram, describe an experiment could be done to investigate resistance relationship in series and parallel circuits



Procedure

— Set a circuit with two resistors connected in series
— Put a voltmeter across the two resistors
— Put an ammeter in series connection with the two resistors
— Record the voltage and current in a suitable table
— Calculate the total resistance of the two resistors using the equation

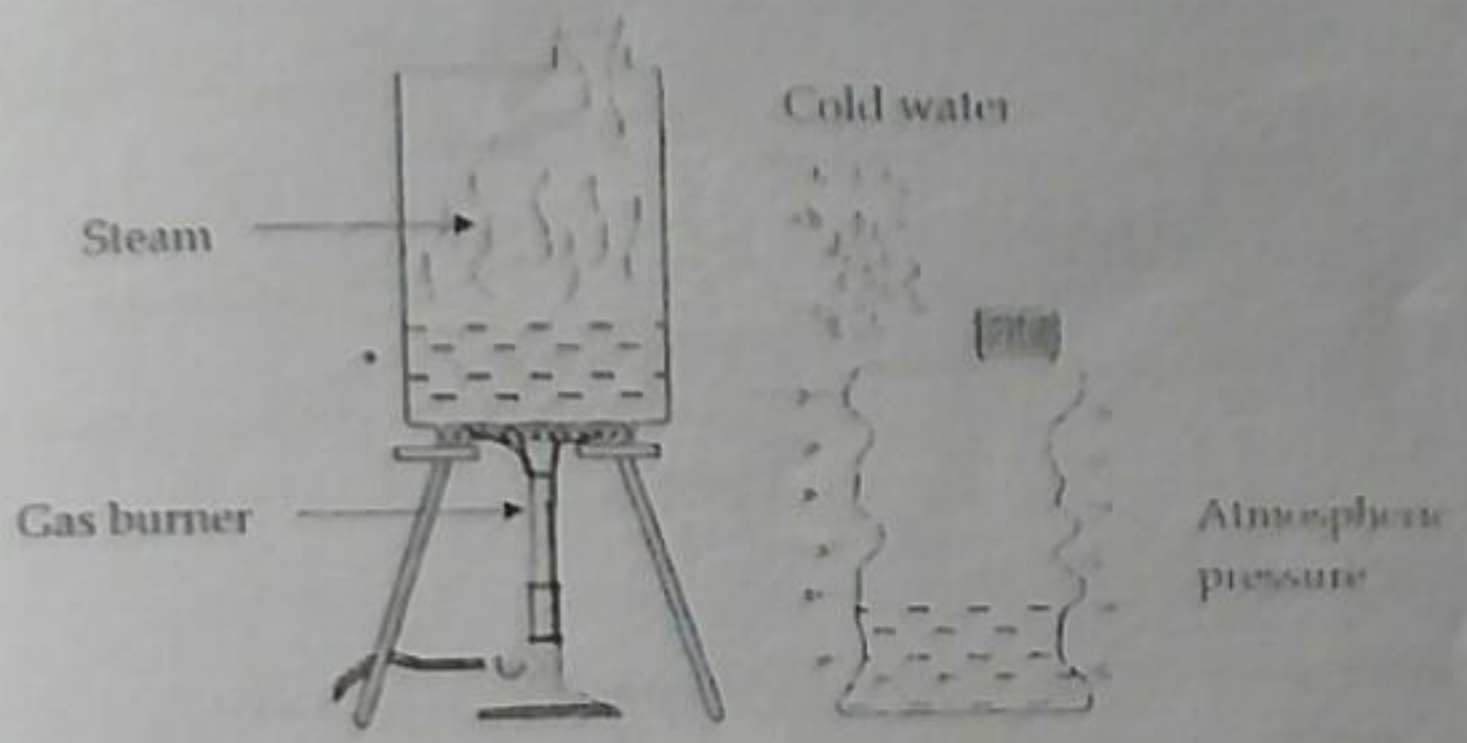
$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

— Connect the same two resistors in parallel circuit
— Measure the voltage across the two resistors using a voltmeter
— Measure the current using an ammeter
— Record the voltage and current in a suitable table
— Calculate the total resistance of the two resistors using the equation

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

— Compare the total resistance in series circuit and parallel circuit
— It will be observed that the total resistance of two resistors in series circuit is equal to simple addition of resistance of two resistors
— It will also be observed that total resistance in parallel circuit is less than simple addition of resistance of two resistors

45. With the aid of a well labelled diagram, describe an experiment that could be carried out to demonstrate the existence of atmospheric pressure using collapsing can experiment



Procedure

— Fill an empty can with water up to half its volume

— Heat the can until water boils and there is steam inside the can

— Close the mouth of the can with a cap

— Pour cold water outside the can

— Observe what happens to the can

— It will be observed that the can collapses

— The can collapsed of greater atmospheric pressure outside the can

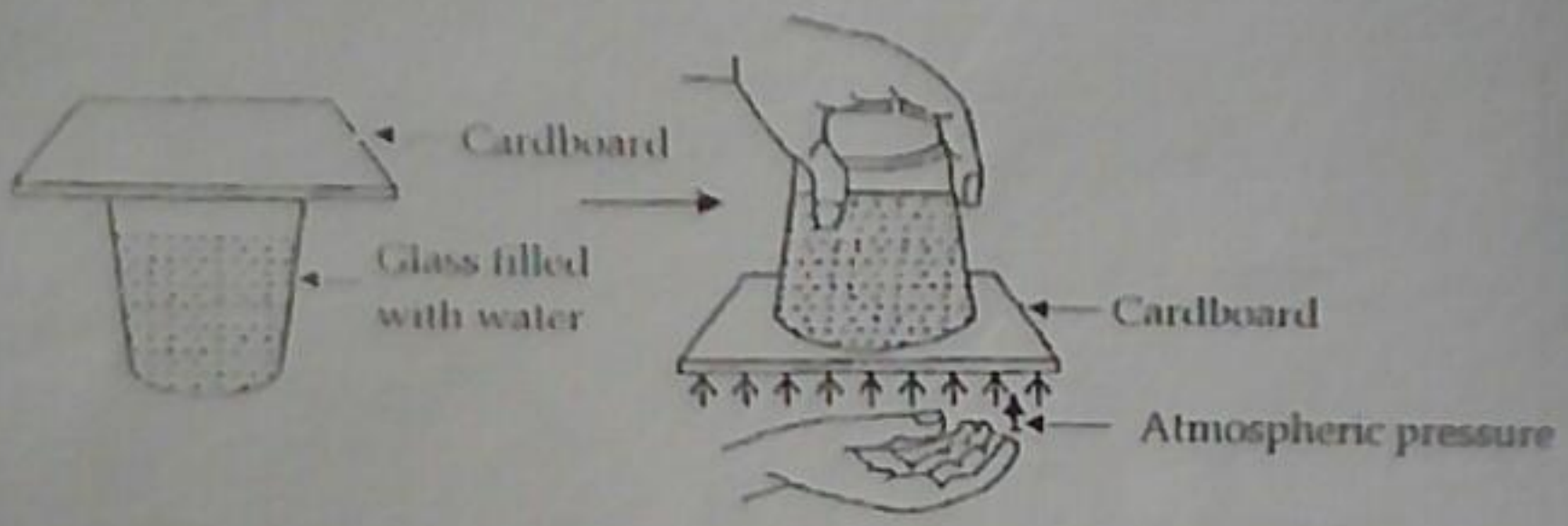
— Pouring cold water outside the can made the air molecules inside the can to cool and led to decreased pressure inside the can

— The pressure inside the can became smaller compared to atmospheric pressure outside the can

— The greater atmospheric pressured forced the can to collapse

— This experiment confirms the existence of atmospheric pressure

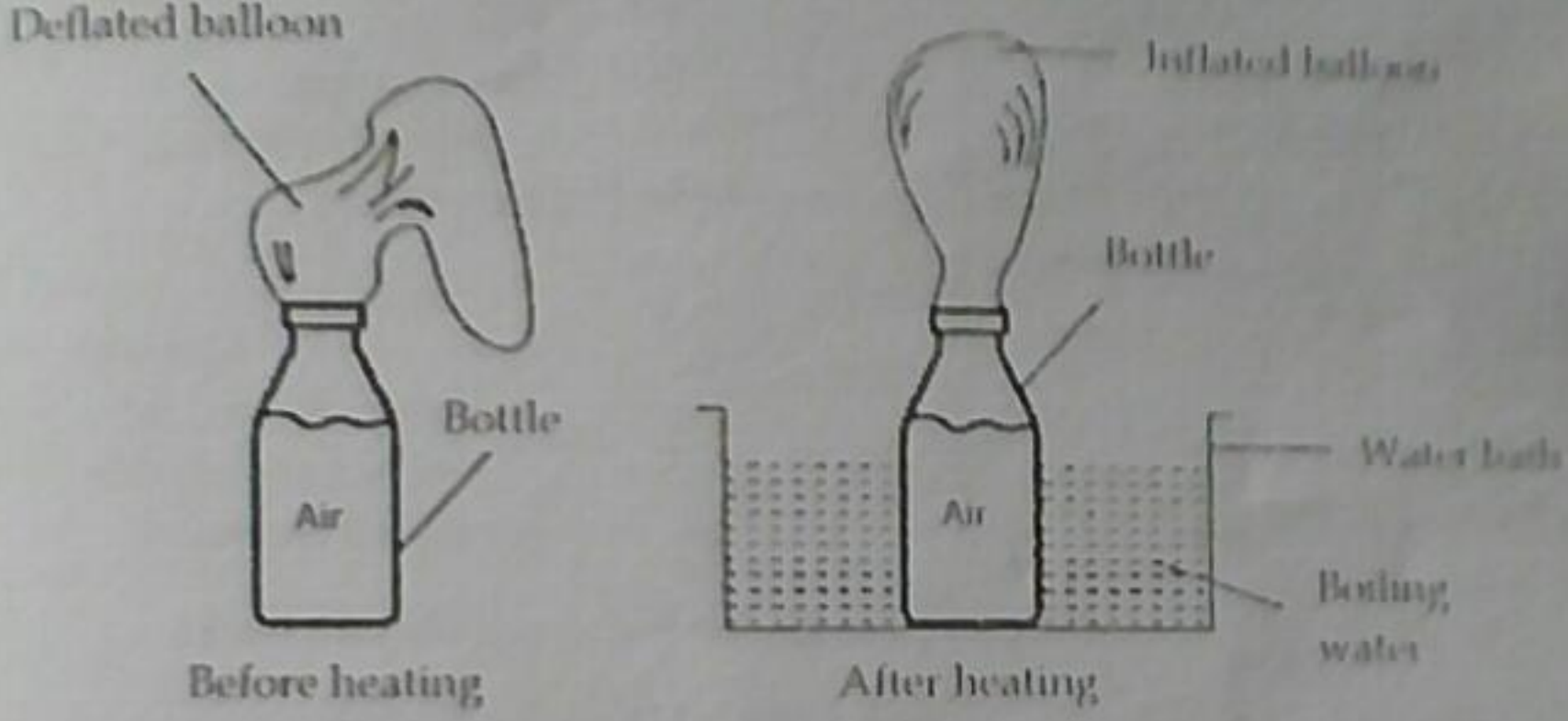
ii. With the aid of a well labelled diagram, describe an experiment that could be carried out to demonstrate the existence of atmospheric pressure using a tumbler or bottle on cardboard



Procedure

— Fill a tumbler or bottle with water up to brim
— Put a thick cardboard over the mouth of the tumbler or bottle
— Support the cardboard with a hand and turn the tumbler or bottle upside down while still holding the cardboard on the tumbler or bottle with a hand
— Remove the hand from the cardboard
— Observe results
— It will be observed that the cardboard does not fall down and water does not come out
— The explanation behind this observation is that atmospheric pressure applies an upward force on the cardboard that supports the cardboard to stay on the tumbler or bottle

47. With the aid of a well labelled diagram, describe an experiment that could be carried out to show that temperature affects air pressure



Before heating

After heating

Procedure

— Tie a balloon to an empty bottle

— The balloon will be deflated

— Put the bottle in a water bath with hot water

— Let the bottle stand upright

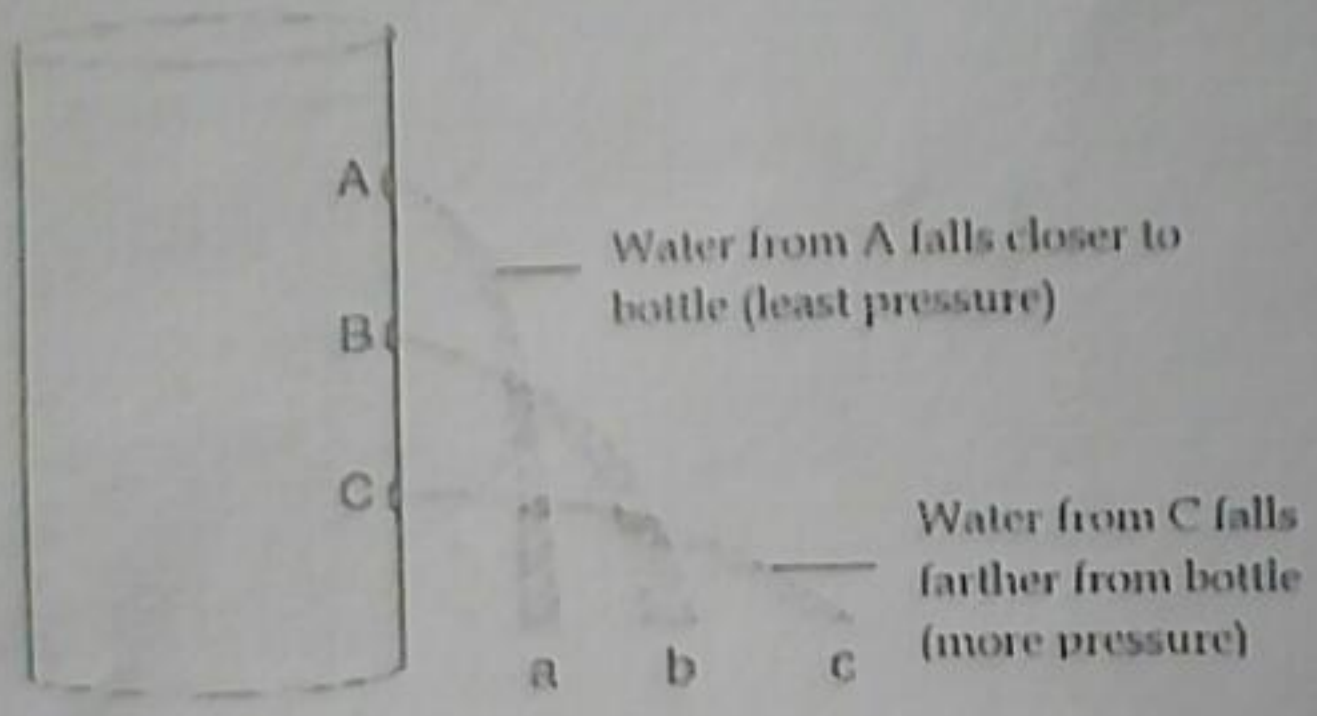
— Observe what happens to the balloon

— It will be observed that the balloon becomes inflated

— The explanation behind this observation is that high temperature from hot water gave enough kinetic energy to air molecules inside the bottle

— The air molecules hit the walls of the balloon frequently and with more force hence the balloon inflated due to high pressure

48 With the aid of a well labelled diagram, describe an experiment that could be carried out to show that liquid pressure increases with depth



Procedure

- Take a tall tin and make three small holes at different depths
- Fill the tin with water up to the top
- Observe the pressure of water coming out of the three holes
- It will be observed that water from bottom most hole is coming out with highest pressure and covers a longer distance
- It will also be observed that water coming out from the top most hole is coming out with the smallest pressure and covers shortest distance
- Water from the middle hole will come out with pressure that is larger than of top hole and less than of bottom hole
- Thus shows that liquid pressure increases with depth

49. With the aid of a well labelled diagram, describe an experiment that could be carried out to show that liquid pressure depends on density of liquid

Low density liquid

High density liquid

Procedure

— Take two tall tins and make one small hole on each tin

— The holes should be at the same depth

— Pour a liquid with low density like cooking oil in one tin

— Pour a liquid with high density like water in another tin

— The volume of water and oil should be the same in both tins

— Observe the pressure of oil and water coming out of the holes in their respective tins

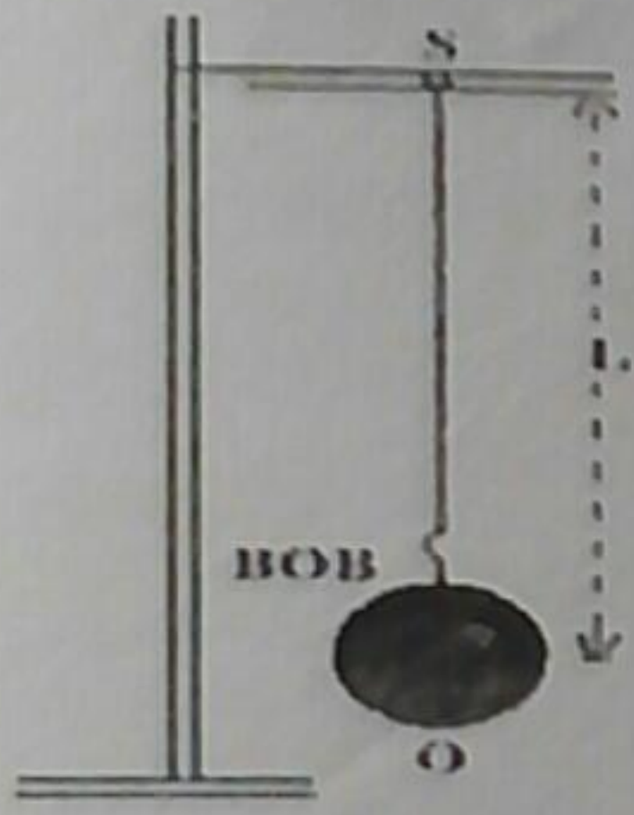
— It will be observed that water comes out with highest pressure and covers a longer distance while oil comes out with lowest pressure and covers short distance

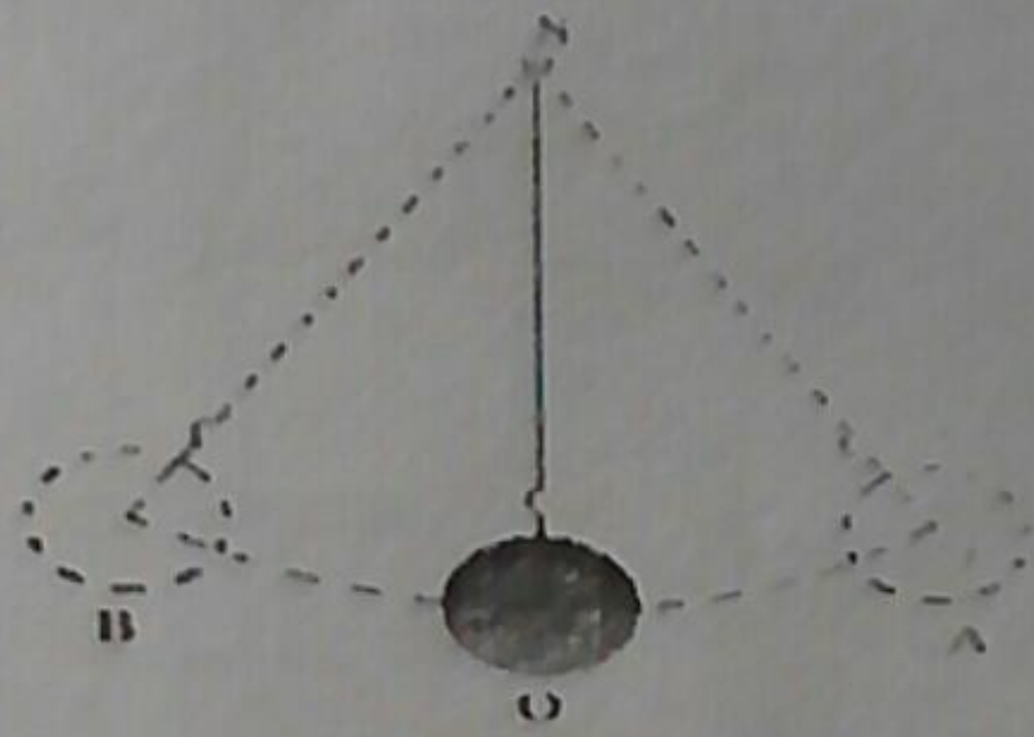
— Repeat the experiment with liquids of different densities

— It will be observed that fluids with high density have more pressure than fluids with less density

— This shows that liquid pressure increase with density

51 With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the acceleration due to gravity using a simple pendulum





Procedure

— Tie a metal bob to a string

— Tie the other end of the string to a support

— Lift the metal bob to point B and let it swing freely between A and B

— Count the time taken to complete 10 oscillations by the metal bob

— Find the periodic time (T) by the equation

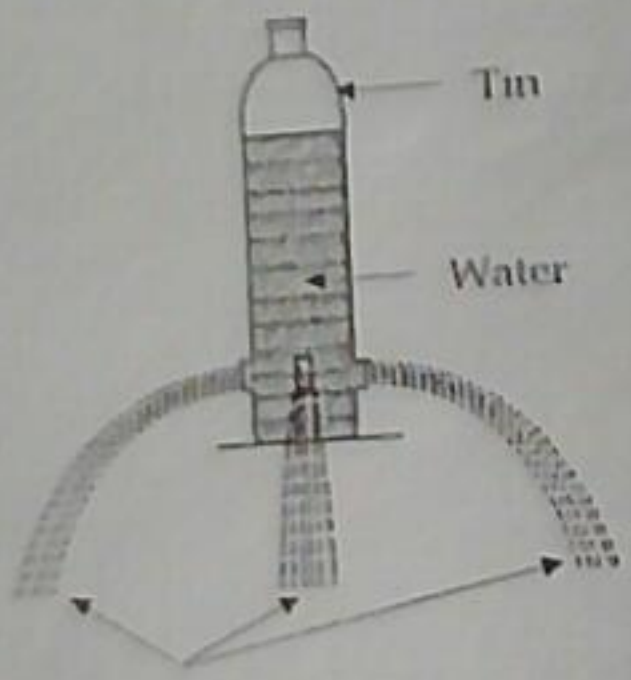
$$\text{Periodic time? (T)} = \frac{\text{Time taken}}{\text{10 oscillations}}$$

— Measure the length of the pendulum (L)

— The following equation is used to find the acceleration due to gravity

$$\text{Acceleration due to gravity} = 4\pi^2 \left[\frac{L}{T}\right]$$

5a With the aid of a well labelled diagram, describe an experiment that could be carried out to show that liquid pressure is equal at same depth and acts in all directions

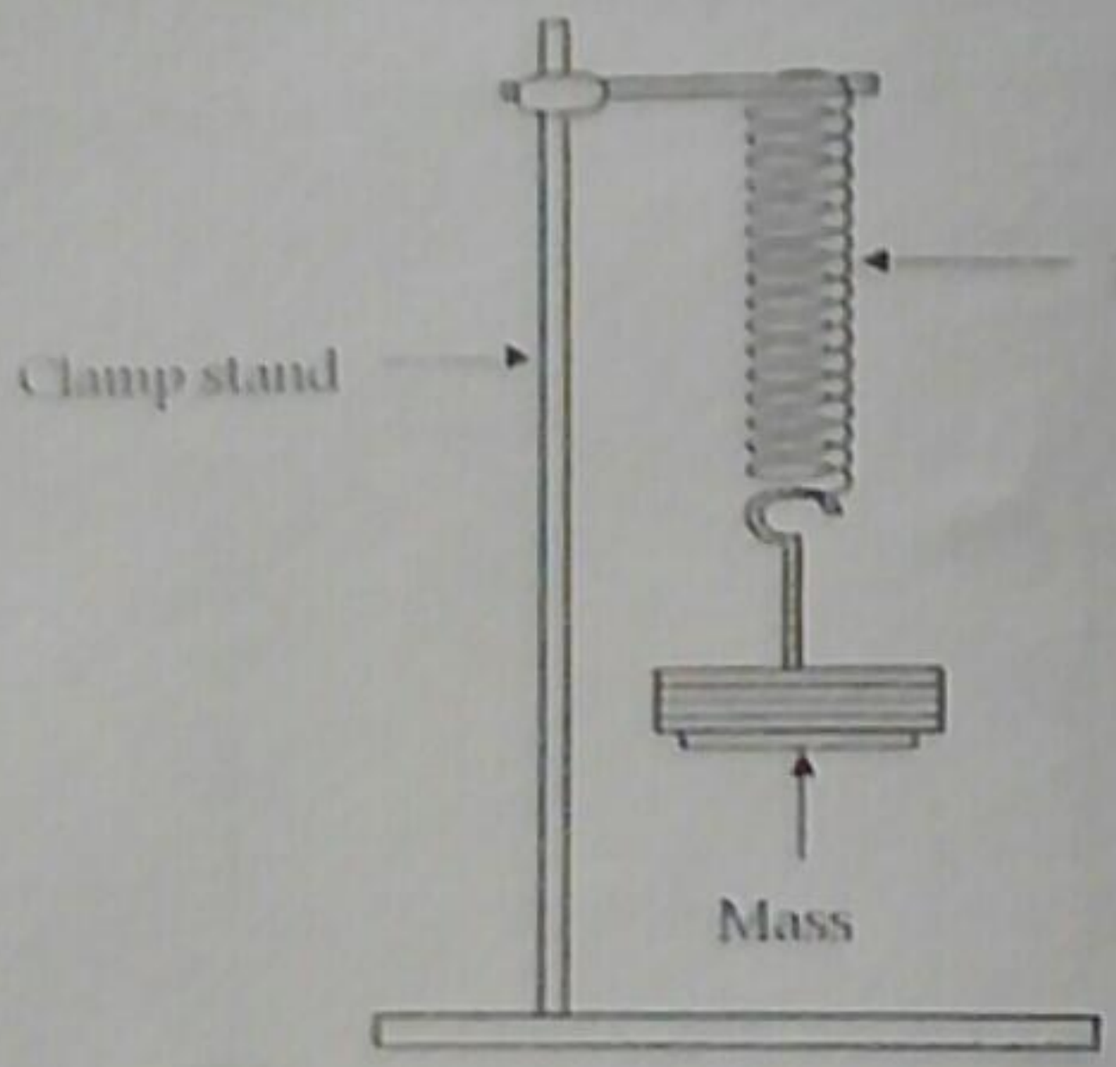


Equal liquid pressure

Procedure

- Take a tall tin and make three holes at same depth in three different directions
- Add water up to the top of the tin
- Observe results
- It will be observed that water comes out with same pressure in all directions
- The water will also cover equal distance
- Thus shows that liquid pressure acts in all directions and is equal at same depth

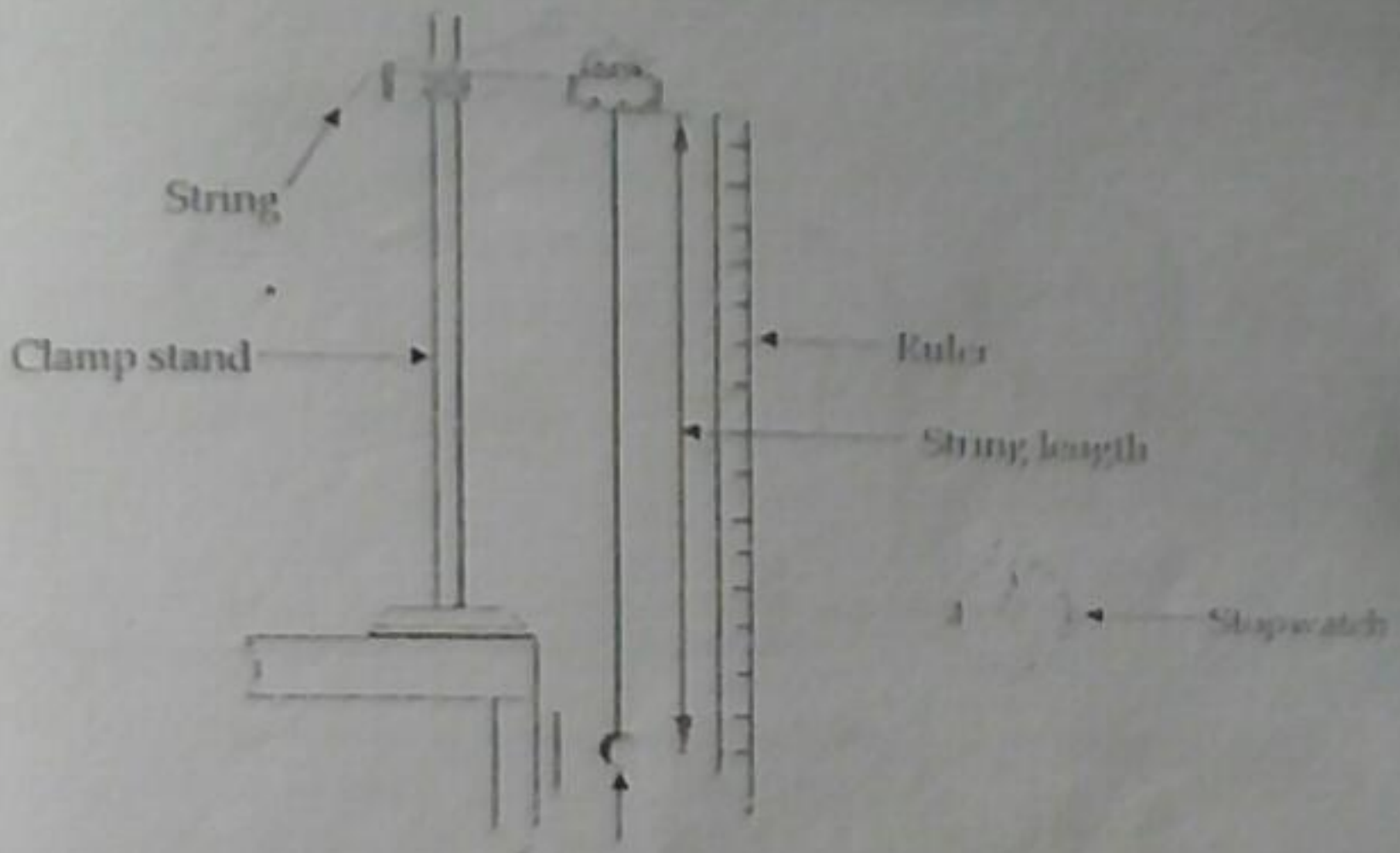
5.2 With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate how mass affects frequency of an oscillating loaded spring.



Procedure

- Hang a spring on a clamp stand as shown in the diagram
- Attach a 50g mass at the lower end of the spring
- Pull down the mass to a specified amplitude
- Let the mass oscillate up and down
- Start a stop watch instantly
- Count number of oscillations in 1 minute
- Record results in a suitable table
- Repeat the experiment with masses 100g, 150g, 200g and 250g
- It will be observed that increasing the mass reduces the number of oscillations per minute
- This experiment shows that an increase in the mass leads to a decrease in number of oscillations per unit time

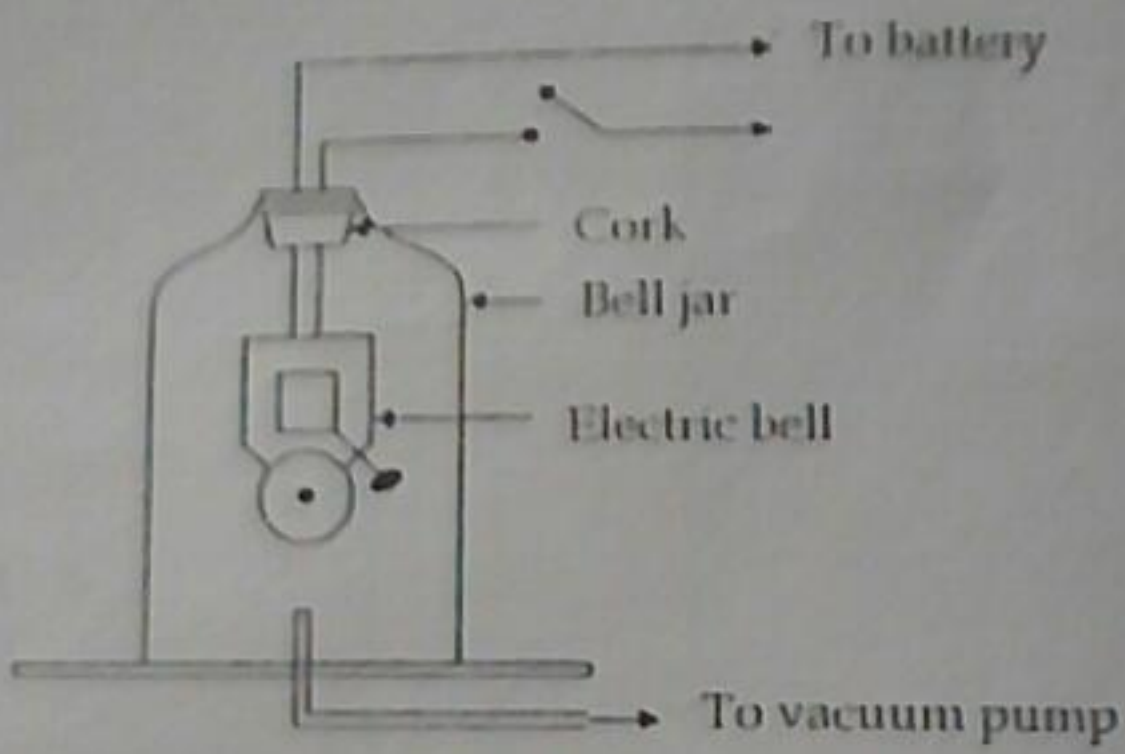
53. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate how the length of the pendulum's string affects periodic time of an oscillating/swinging pendulum



Procedure

— Tie a bob with a string of length L = 10 cm
— Tie the other side of string to a clamp stand
— The bob is pulled sideway with an angle 45°
— Release the bob so that it swings freely
— Instantly start a stopwatch
— Count 10 complete oscillations
— Stop the stopwatch
— Record time taken for 10 oscillations
— Calculate periodic time (T) by dividing time taken (t) with number of oscillations (10) e. g Periodic time = time taken (t) ÷ number of oscillations
— The experiment is repeated using different length of pendulum which are 20.0 cm, 30.0 cm, 40.0 cm and 50.0 cm
— Compare periodic time of different string length
— It will be observed that the longer the string the more periodic time per oscillation

53. With the aid of a well labelled diagram, describe an experiment that can be carried out to show that sound needs a medium to transmit e. g air



Procedure

— Put an electric bell inside a glass jar

— Connect an electric bell to power source and vacuum pump

— Turn on the switch of the electric bell

— It will be observed that the hammer hits the gong of the electric bell

— The electric bell will produce loud sound

— Start pumping out air from the glass jar using a vacuum pump

— It will be observed that sound starts becoming faint and eventually sound stops being heard despite seeing the hammer hitting the gong

— This sows that sound needs a medium like air to transmit

56. With the aid of a well labelled diagram, describe an experiment that can be carried out to investigate the speed of sound in air using a starter pistol that produces lit and sound at the same time.

500m distance

Student A with piston

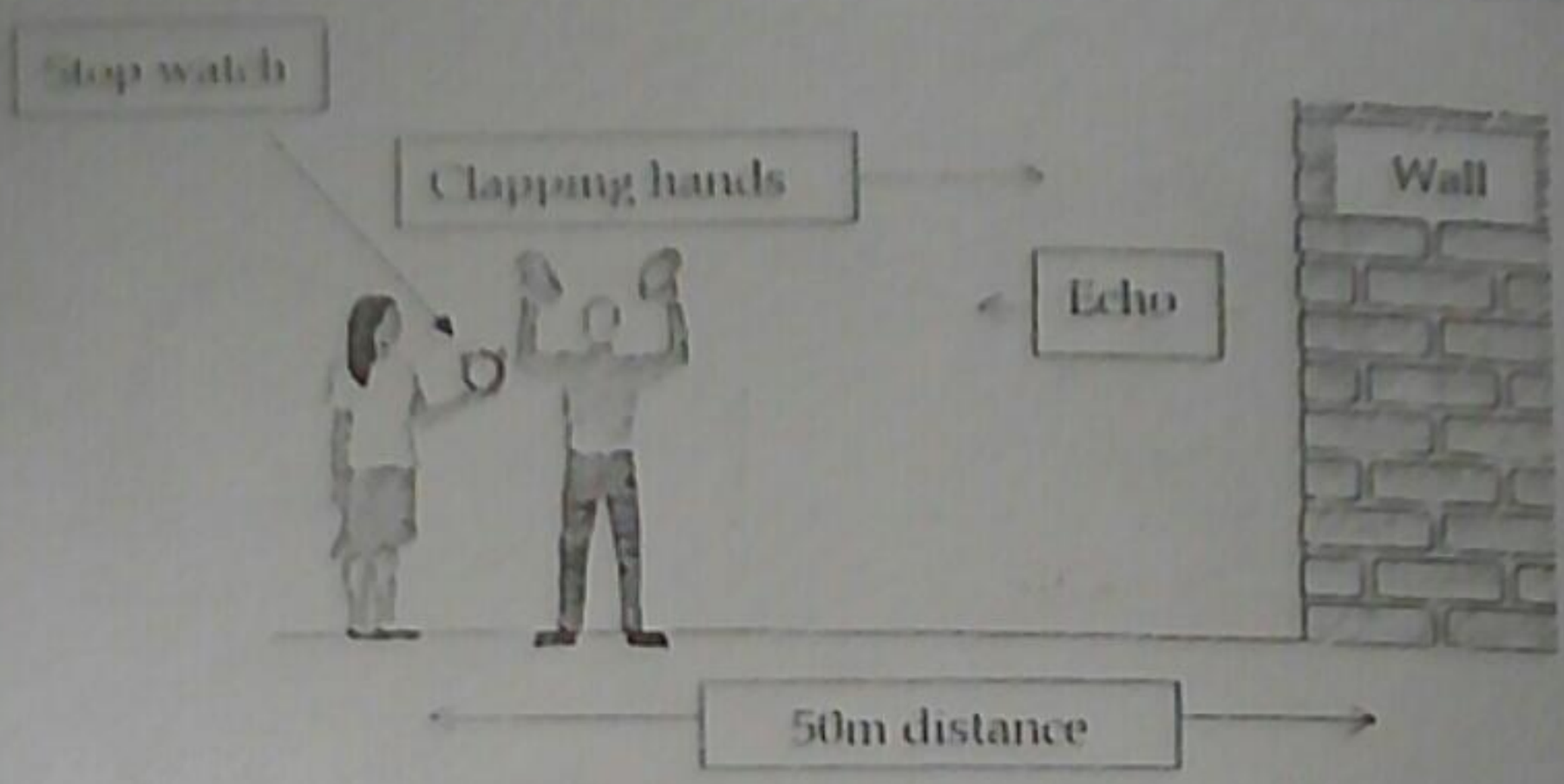
Student B with stopwatch

Procedure

— Using a measuring tape, mark a 500m distance on an open field
— Let two students stand at the ends of 500m distance
— One student should have a stop watch and the other student should have a starter pistol
— Using a measuring tape, mark a 500m distance on an open field
— Let two students stand at the ends of 500m distance
— Using a measuring tape, mark a 500m distance on an open field
— Let two students stand at the ends of 500m distance
— One student should have a stop watch and the other student should have a starter pistol
— Let the starter pistol be fired and the other student should start the stop watch instantly soon after seeing light from the pistol
— The student should stop the stop watch once sound from the starter pistol has been heard
— Time taken between seeing light and hearing the sound should be noted
— Speed of sound will be found by dividing the distance between the students with time taken by sound to be heard
— The following equation is used

$$\text{Speed of sound} = \frac{\text{Distance}}{\text{Time taken}}$$

(b) With the aid of a well labelled diagram, describe an experiment that can be carried out to investigate the speed of sound in air using echo method



Procedure

— Using a measuring tape, measure a distance of 50m from a tall wall

— Let two students stand at a distance of 50m away from the wall

— One student should clap hands and the other student should instantly start a stop watch

— Once the echo is heard, the stop watch should be stopped

— The time taken for the echo to be heard should be recorded

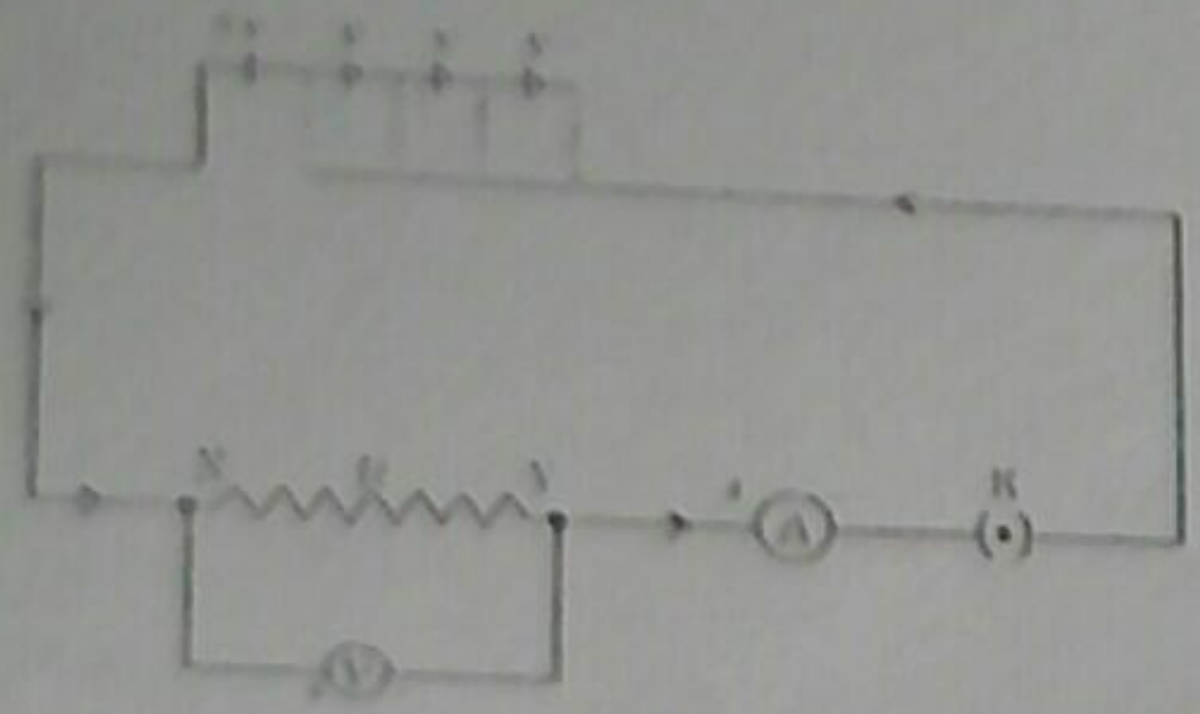
— Speed of sound will be found by dividing the distance between students times 2 then divided by time taken

— The equation for speed of sound using echo method is:

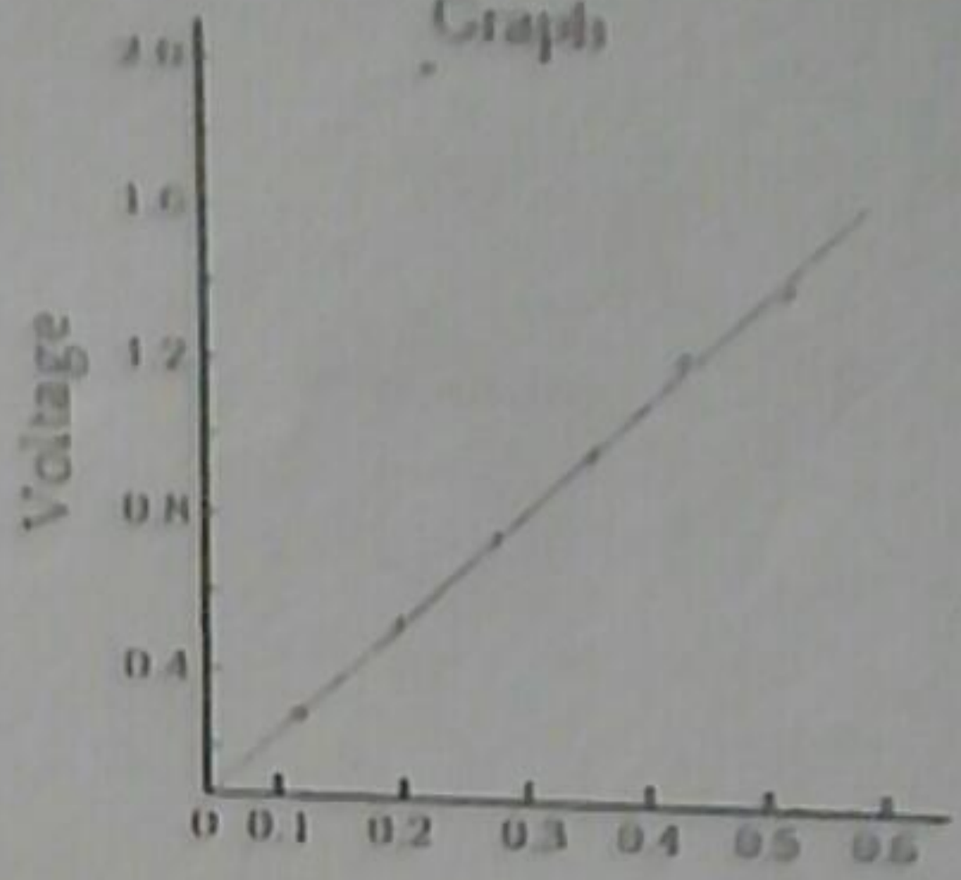
$$\text{Speed of sound} = \frac{\text{Distance} \times 2}{\text{Time taken}}$$

5) With the aid of a well labelled diagram, describe an experiment that could be carried out to verify ohms law

Circuit diagram



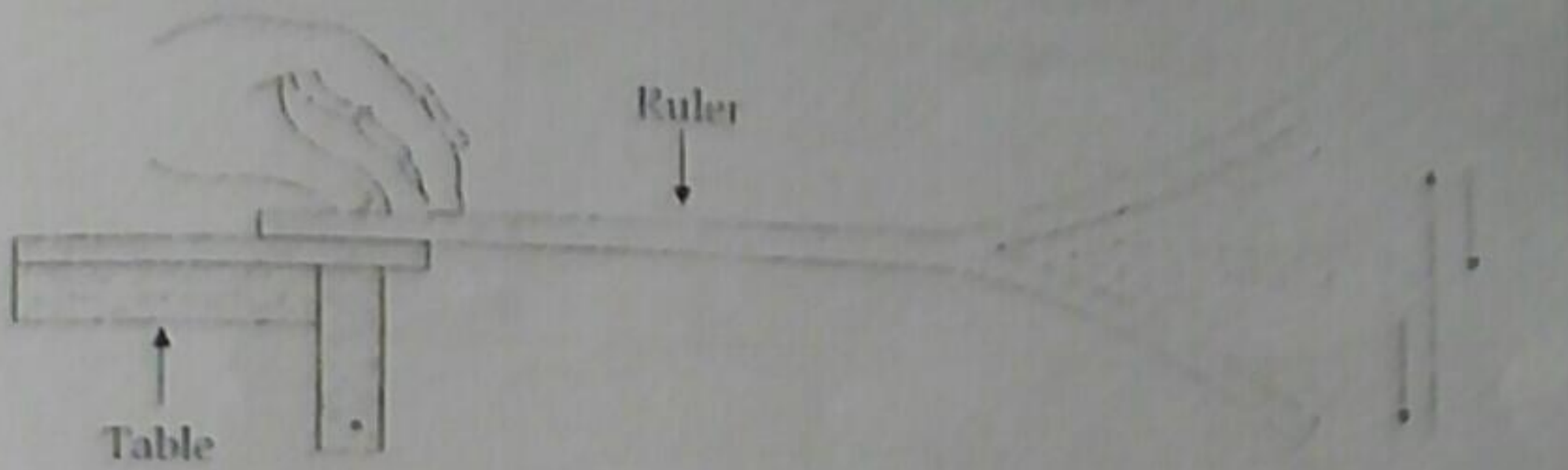
Graph



Procedure

- Set up a circuit consisting of a nichrome wire XY, an ammeter, a voltmeter and four cells of each 1.5V
- First use only one cell as the source in the circuit.
- Note the reading in the ammeter for current and reading in the voltmeter for voltage across the nichrome wire XY in the circuit
- Record the results in a suitable table
- Next connect two cells in the circuit and note the respective readings of the ammeter and voltmeter for the values of current through the nichrome wire and voltage across the nichrome wire.
- Repeat the above steps using three cells and then four cells in the circuit separately.
- Calculate the ratio of Voltage to current for each pair of voltage and current.
- It will be observed that approximately the same ratio is obtained in each pair
- Plot a graph of voltage against current
- It will be observed that the graph is a straight line that passes through the origin
- Thus, Voltage/Current is a constant ratio, which verifies Ohm's law.

58. With the aid of a well labelled diagram, describe an experiment that could be carried out to show that sound is produced by vibrations



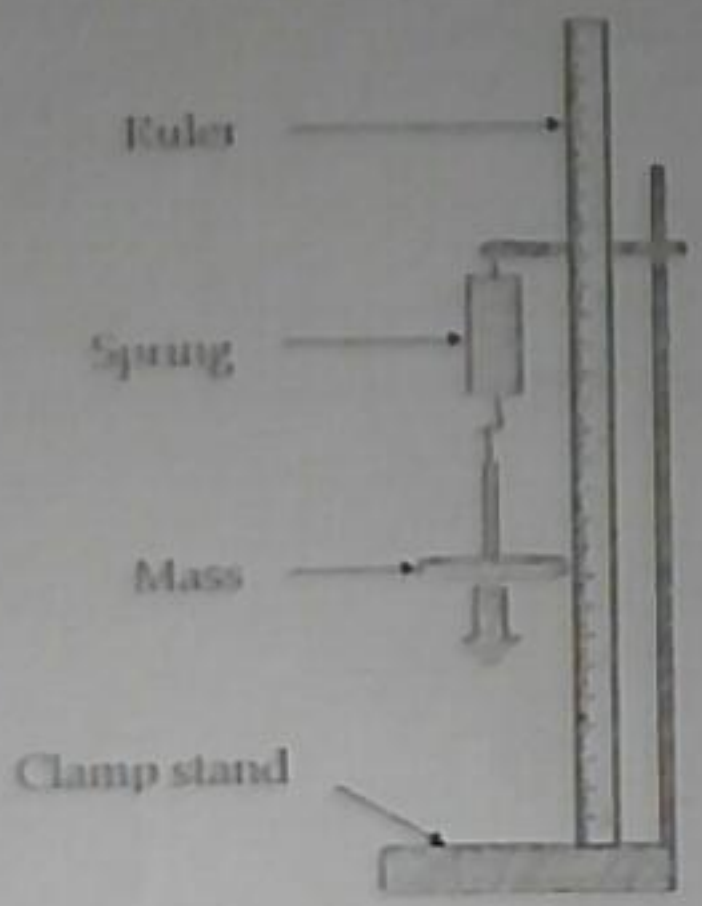
Procedure

— Press one end of a ruler on a table
— Use left hand to press the ruler on the table
— Pull down the other end of the ruler with the right hand
— Let the ruler vibrate
— It will be noticed that the ruler vibrates i.e. the ruler move to and fro and a humming sound is heard
— After some time, the ruler stops vibrating and no sound is heard
— This shows that the humming sound is produced only because of the vibrations of the ruler

Method 2

— Measure a distance of 120 cm using a measuring tape
— Fix a pole at each end of the distance marked
— Tie a string from one pole to the other
— The string should be tight
— Tap the string at the middle
— It will be observed that the string vibrates and at the same time sound is produced
— It will also be observed that as the string reduces vibrations, the sound becomes faint
— When the string completely stops vibrating, sound also stop being produced
— This shows that sound is produced by vibrations

a) With the aid of a well labelled diagram, describe an experiment that could be carried out to verify hookes law



Procedure

— Fix the apparatus as shown in the figure below.

— Measure the length of the helical spring which is also called a natural length by using the ruler.

— Put the different objects having different masses in to the weight holder

— Use the ruler to measure the extension of the helical spring

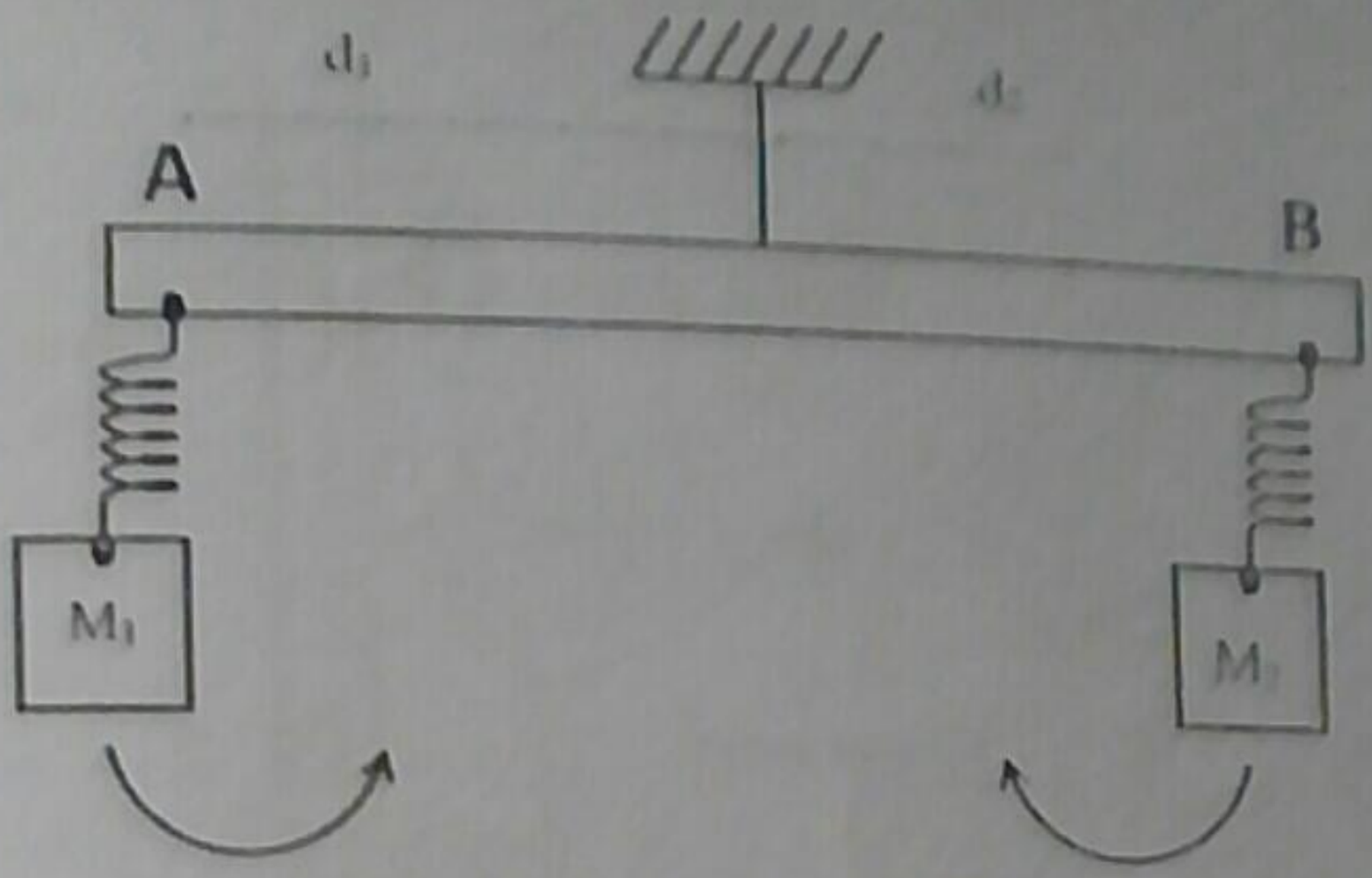
— Subtract the extension of the spring to the natural length in order to find out the changes in the extension.

— Record all these values in a table.

— Repeat 3, 4, 5 steps at least three times by using the different spring constant.

— Plot the graph between the force exerted on string to the extension of the spring.

(a) With the aid of a well labelled diagram, describe an experiment that could be carried out to verify principle of moments



Procedure

— Suspend the metre rule at the 50 cm mark so that it is balanced horizontally
The ruler is said to be in equilibrium. The 50 cm mark is the pivot

— Suspend a mass, m_1, from one side of the ruler a distance, d_1, from the pivot
Read the distance d_1 in cm, from m_1 to the pivot. Record in a suitable table
Record the value of mass m_1 in kg in the table too

— Suspend a second mass, m_2, from the other side of the pivot. Carefully move this mass backwards and forwards until the ruler is once more balanced horizontally. Read the distance d_2 in cm from the mass m_2 to the pivot
Record d_2 in cm, in the table, along with the mass m_2 in kg

— Repeat several times using different masses and distances

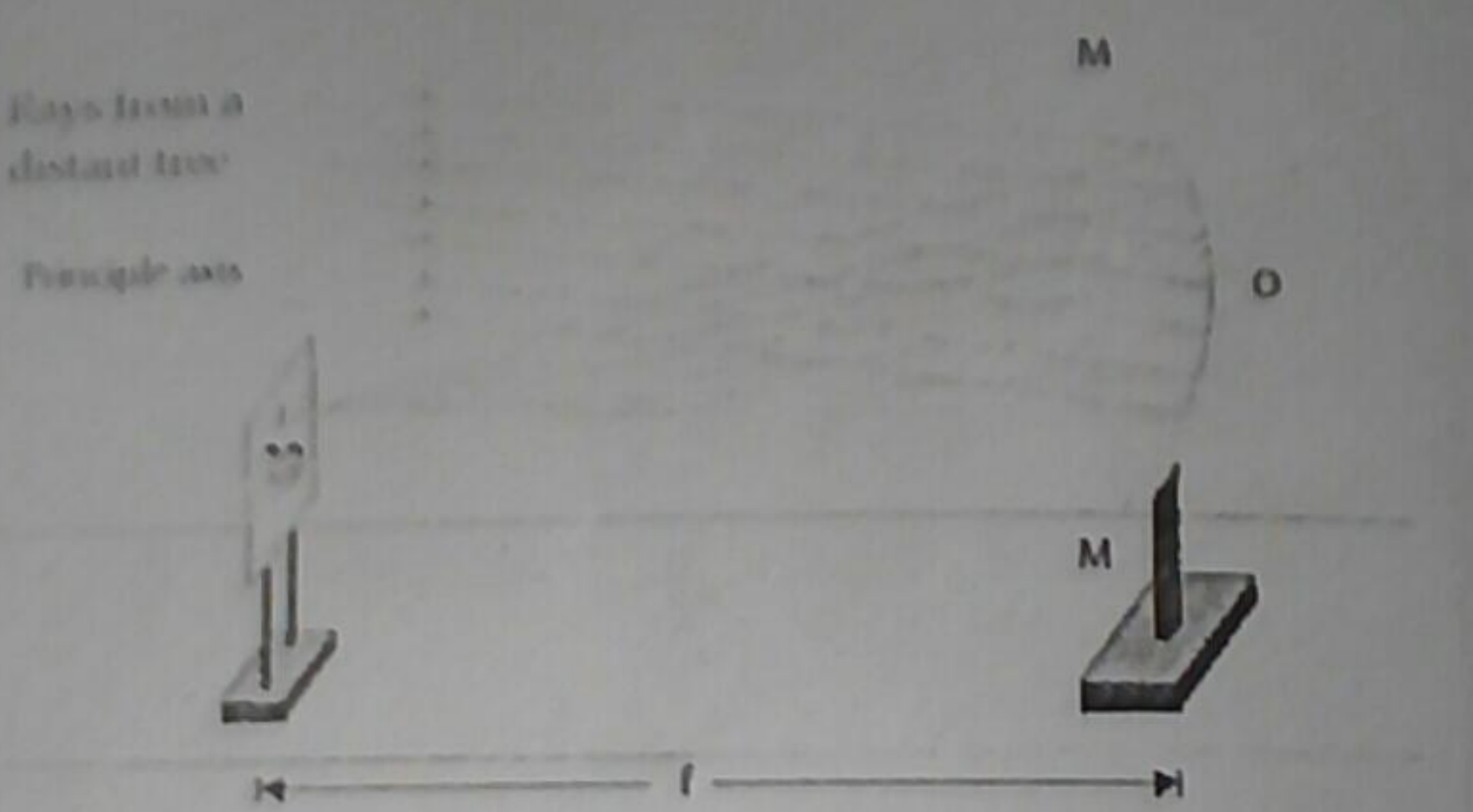
— Calculate the turning forces, F_1 and F_2, using $W = mg$

— Calculate the clockwise and anticlockwise moments

— It will be observed that clockwise moment is equal to anticlockwise moment

— Therefore principle of moments has been verified

a) With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the focal length of a convex lens using mirror method



Procedure

— Identify a distant object like a tree

— Support a mirror on a stand

— The mirror should face the distant object

— Put a screen along a path of the reflected rays of light from the mirror

— Move the screen forward and backward until a sharp image is formed

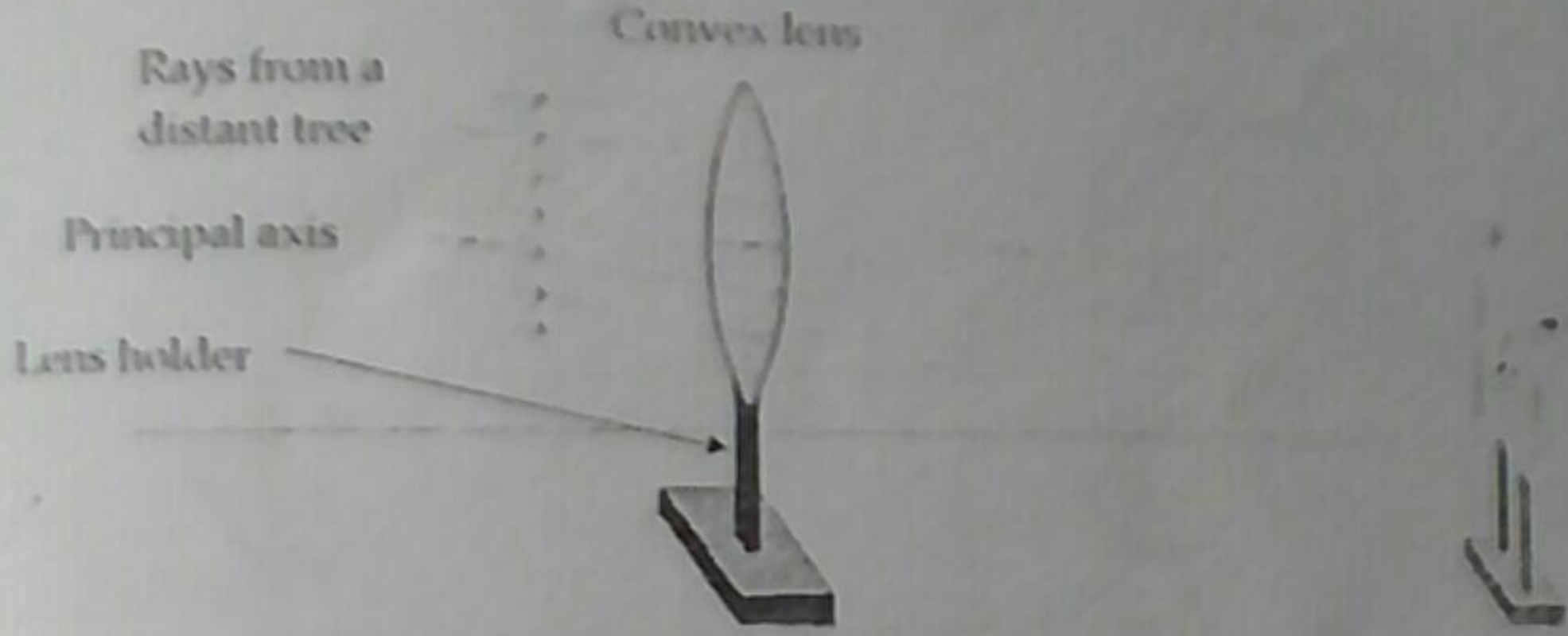
— Measure the distance between the screen and mirror

— Repeat this experiment five times

— Find the average distance between the mirror and screen

— This is focal length of the mirror

03. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the focal length of a convex lens using distant object method



Procedure

— Identify a distant object that is outside a building behind a window

— Put a convex lens on a support stand

— Position the convex lens inside the building facing the window

— Position a screen behind the convex lens

— Move the screen forward and backward until a sharp image forms on the screen

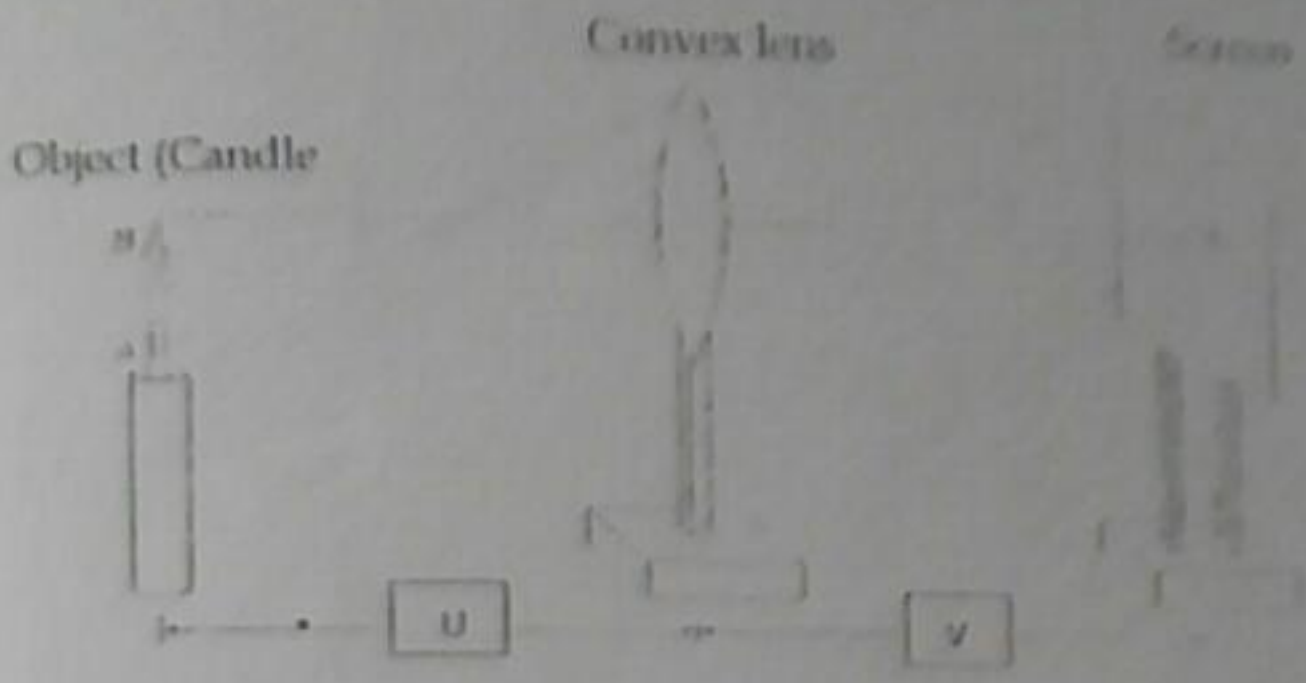
— Measure the distance between the convex lens and the screen

— Repeat the experiment five times

— Find the average distance between the convex lens and screen

— The average distance is the focal length of convex lens

65. With the aid of a well labelled diagram, describe an experiment that could be carried out to investigate the focal length of a convex lens using graphical method



Procedure

— Fix a convex lens vertically on the stand
— Place the stand on a table
— Place a lighting candle on the left side of the convex lens
— Measure the distance between the object and the lens (U) using a metre rule
— Record the distance in a suitable table
— Place a screen on the right of the convex lens
— Adjust the screen until a sharp, inverted and diminished image is obtained on the screen
— Measure the distance between the screen and the lens. This is image distance (V)
— Repeat the same procedure by changing the distance of the object (U) and measure the distance between the lens and screen
— Record results in a table
— Plot a graph of object distance (U) against image distance (V)
— Identify the point on the graph where the object distance is equal to image distance
— This point is twice the focal length
— Therefore, the focal length is found by dividing the distance by 2