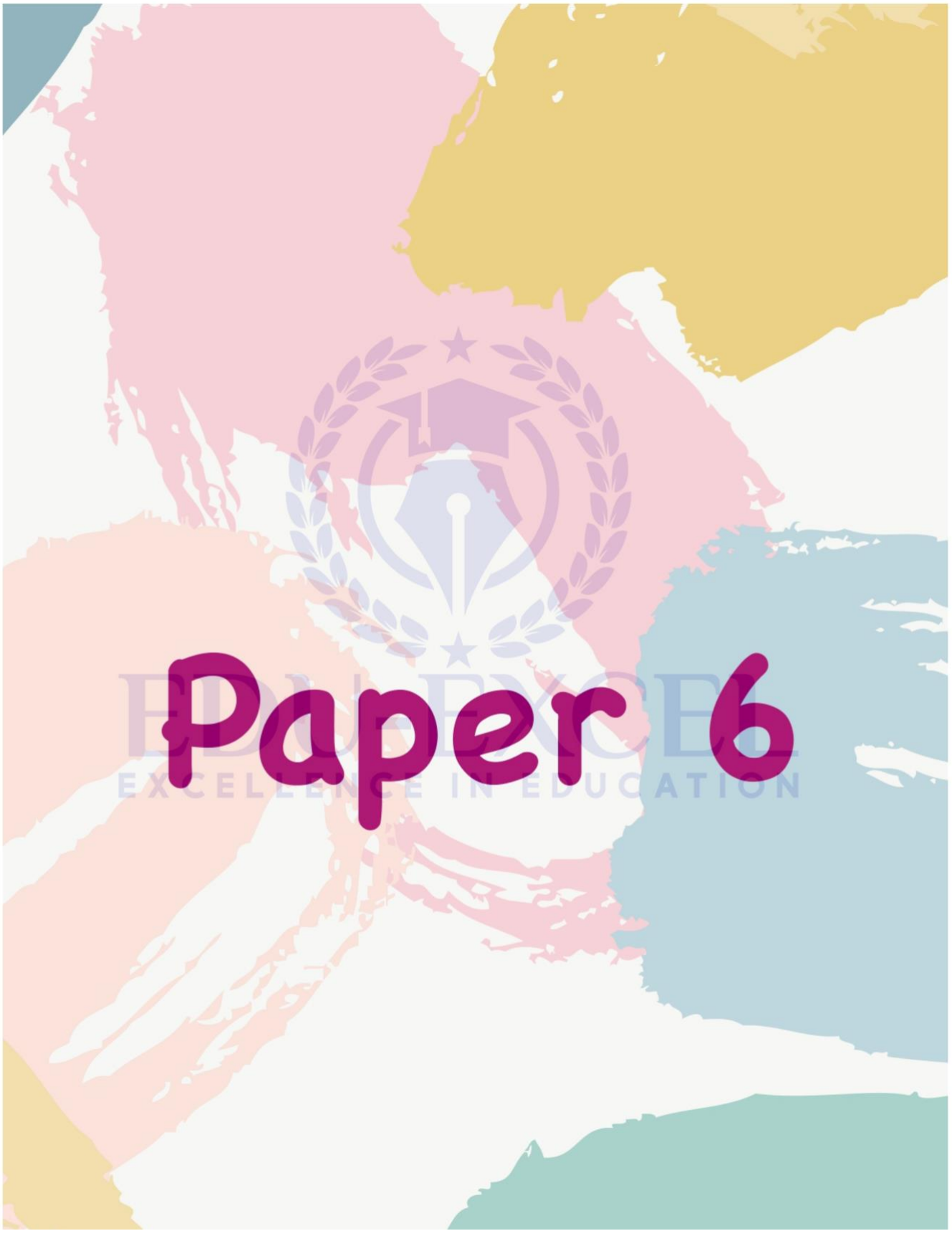
Edu-Excel

Subject - PHYSICS



Pendulum Experiment

Reading: Calculate **Time Taken** For 1 complete cycle

Steps:

1-Measure the **Time taken** (t) for **20 cycle** using Stopwatch

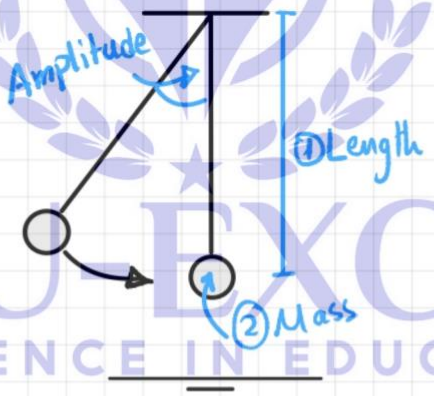
2-Calculate Time Taken (T) for 1 complete cycle t=T/20

Why measuring the time of 20 cycles instead of 1 cycle?
As 20 cycles Reduce the effect of human error (reaction time) when starting and stoping the stop watch as it distributes the error over 20 cycles instead of one cycle

Variables:
1-Length
2-Mass
3-Amplitude

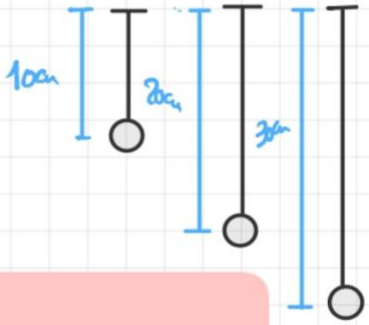
Apparatus
1-Meter ruler
2-sensitive Balance
3- Protractor

Why not measuring time for 200 cycles ?
1-Pendulum may stop
2-Student may lose count



Note: if one factor is tested other should be constant

Variable:
Length (10cm,20cm,30cm)
Reading: For each length
1 Measure the time for 20 cycles
2 Then calculate the **time for one complete cycle**

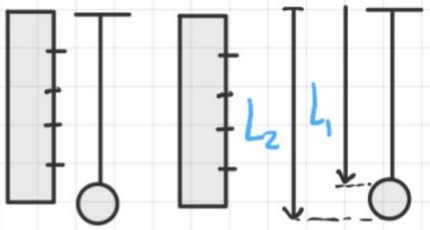


Precautions:
1-take the reading ⊥ on the meter ruler to avoid parallax error
2-use a set square for horizontal aid
3-Keep the ruler as close as possible to the bob

Difficulty in measuring the length to the center of the bob

Solution: calculate the average by taking the reading
Before the bob (L1) and after the bob (L2)

$$L = \frac{L_1 + L_2}{2}$$



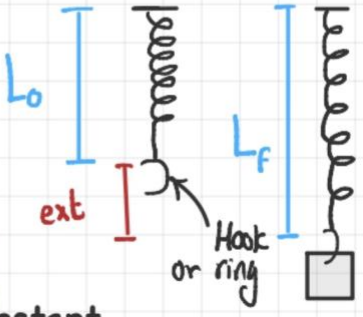
Spring Experiment

Reading: Calculate the extension (x)

Variables:

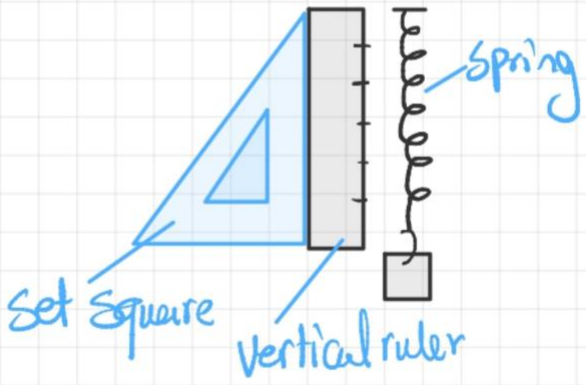
1-Loads
2-length of the spring
3-Area of the Spring
4-Material of the spring

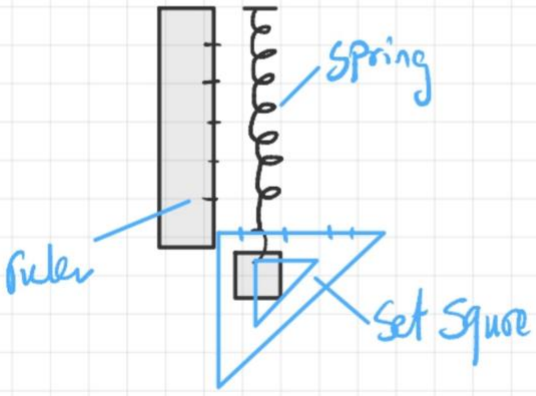
Note: if one factor is tested other should be constant



Precautions:

1-take the reading ⊥ on the meter ruler to avoid parallax error
2-use a set square to make sure the ruler is vertical
3-use a set set square at the end of the spring for horizontal aid
4-Keep the ruler as close as possible to the spring





Note: don't include the ring with length as it doesn't extend with the spring

Balanced meter ruler experiment

1 Difficulty obtaining Center of mass of the meter ruler

Pivot the meter ruler right and left until the center of mass of the meter ruler is above the pivot

2 Difficulty obtaining balance as ruler tips one way then the other

Allow the ruler to tip one way then the other way and take average

3 Difficult to achieve perfect balance with the load

Solution 1

Move the load right and left until a balanced position is obtained

Solution 2

Fix one mass,and then move the other until a balanced position is obtained

4 Load cover the scale on the meter ruler

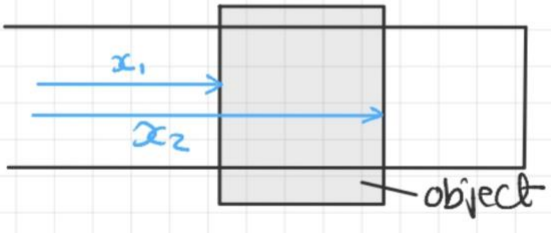
Solution 1

Mark the center of the mass so it can be read against ruler

Solution 2

Take the reading on both sides of the object & take average

$$\text{Exact Position} = \frac{x_1 + x_2}{2}$$



5 load may slip and fall off the meter ruler

Solution 1: Masses may be sticked

Solution 2: Use a meter ruler with a rough surface (made of wood)

Thermal experiment "Rate of cooling"

Reading: measure the temperature every 30 seconds (Rate of cooling)

Variables:

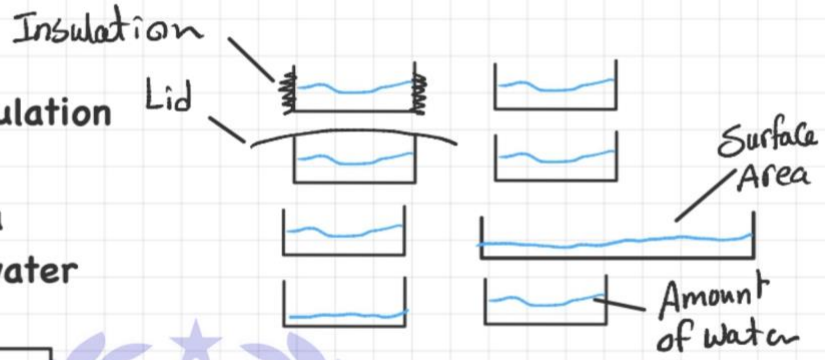
Beaker with

1-Insulation/without insulation

2-Lid/without lid

3-Different surface area

4-Different amount of water



time/s	θ_A/°C	θ_B/°C
0	87.5	88.0
30	84.5	86.0
60	82.0	84.5
90	80.5	83.0
120	79.0	82.0
150	78.0	81.0
180	77.0	80.5

Note

1. The rate of cooling increase as you get far from room temperature and decrease As you get near to room temperature
2. The rate of cooling of beaker A is higher than B as the temperature of beaker A decreased by 10.5 °c over 180s while in B is 7.5 °C over 180s

Variable must kept constant

1-Same initial temperature of water. 2-same room temperature.

Precautions:

1-take the reading ⊥ on the Thermometer to avoid parallax error

2-Stir before taking the reading on the thermometer

(to make sure that temperature is the same throughout the liquid)

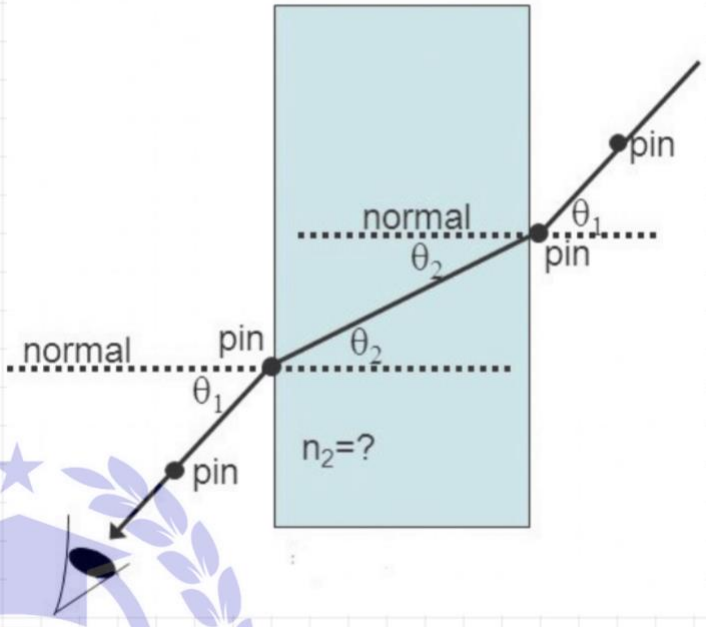
3-wait for the temperature reading to become constant

4-Ensure thermometer not touching the beaker sides

Hot to reduce heat loss

- Add lid
- Add insulation
- increase the room temperature
- Reduce the initial temperature of water
- Decrease the surface area of the beaker

Optical pins Experiment



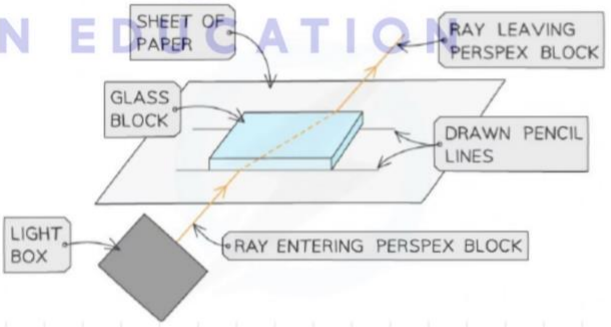
Difficulties and Source of errors

- Pins may be not vertical
- Pins may be thick
- Lines may be thick
- Mirror may be thick
- Difficultly of aligning pins correctly

Precautions

- Increase the distance between the pins more than 5 cm apart
- View the bases of the pins
- Use thin pencil line
- Use thin pins
- Use thin mirror

Ray box Experiment



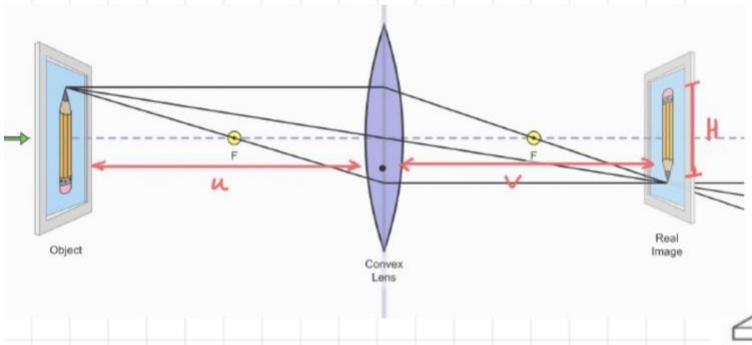
Difficulties and Source of errors

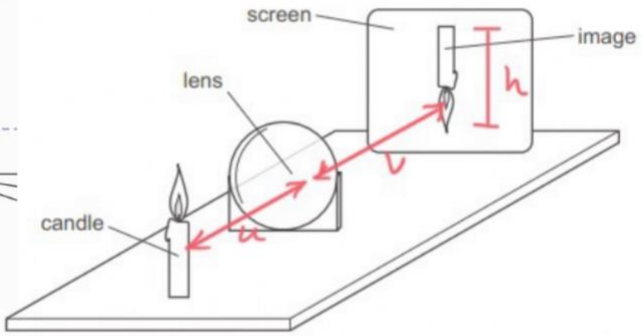
- Thickness of rays
- Making the experiment in a bright Room
- not taking the reading perpendicular On the protractor

Precautions

- make rays thin as possible
- make the experiment in dark room
- take the reading perpendicular to avoid parallax error

Convex lens Experiment





Reading: to measure the height of the image & get focused image
Variable: change the distance between object and lens (u)
Then measure 📏 the height and distance between the lens & image (V)

Difficulties and Source of errors

- 👉 difficulty in measuring to center of Lens
- 👉 reaching focused and sharp image Is not easy
- 👉 image appears focused only over a small range of values

Precautions

- 👉 mark the position of the center of the lens on the holder
- 👉 use a dark room and bright lamp
- 👉 move screen back and forth to obtain the sharpest image
- 👉 Move the lens back and forth to obtain the sharpest image
- 👉 make object,lens & screen on the same height
- 👉 make object,lens & screen are ⊥ on the Bench

Shadow of the meter ruler 📏 & hands of the student hide the image?

- 👉 Use a translucent screen and view the image from behind
- 👉 Use a scaled screen

What is the difference between the object and the image

- 👉 image is upside down (Inverted)
- 👉 image is less bright than the object

Electricity Experiment

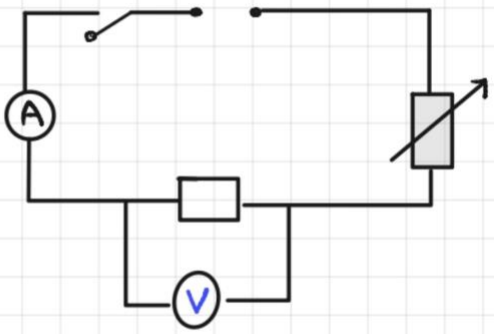
Reading: calculate the **resistance** of a wire/resistor

Steps:

1-Get volt by voltmeter

2-Get current by ammeter

3-Calculate the Resistance R=V/I



Variables

- 👉 Length of wire
- 👉 Area of the wires
- 👉 Material of the wire
- 👉 Resistors connecting in series or in parallel

Difficulties and Source of errors

- 👉 Wires become to hot 🔥 (Temperature increase)
- 👉 Difficult to judge position of the Crocodile clip due to it's thickness

Precautions

- 👉 reduce the current
- 👉 switch off the circuit between each reading

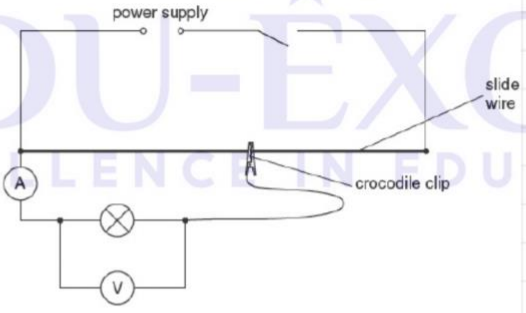


Fig. 3.1

we use **variable resistor** to vary resistance so **current** changes so:

- 👉 To give multiple sets of reading to calculate average
- 👉 To prevent overheating of wires

Note: 👉 Brighter lamps have more temperature

👉 Ammeter is connected in series while voltmeter in parallel

Plan an Experiment

1-Draw
2-Variable
3-Reading
4-Apparatus
5-Precautions
6-Variable must kept constant
7-Table
8-Graph
9-Conclusion

Variable/unit	Reading/unit

Repeated statements

- Repeat the experiment for every (variable) at least 5 times and take average
- Plot a graph between each (variable) and (reading) and compare results

---

$$\% \text{ Error} = \frac{L-S}{S} \times 100$$

error ≤ 10% yes
error > 10% no

- X1=15.3 cm
- X2=15.0 cm

$\frac{15.3-15}{15} \times 100 = 2\%$

Statement: yes they are equal
Justification: (x) & (y) are close to each other within the limit of experimental accuracy

- X1=11 cm
- X2=15.0 cm

$\frac{15-11}{11} \times 100 = 36\%$

Statement: no they are not equal
Justification: (x) & (y) are not close to each other beyond the limit of experimental accuracy

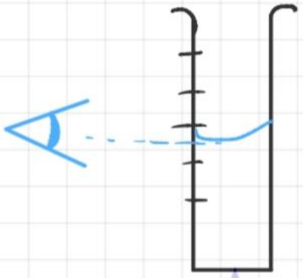
Important notes

Measuring volume using a measuring cylinder

1-Take the reading perpendicular to the scale to avoid parallax error

2-Take the reading from the bottom of the meniscus

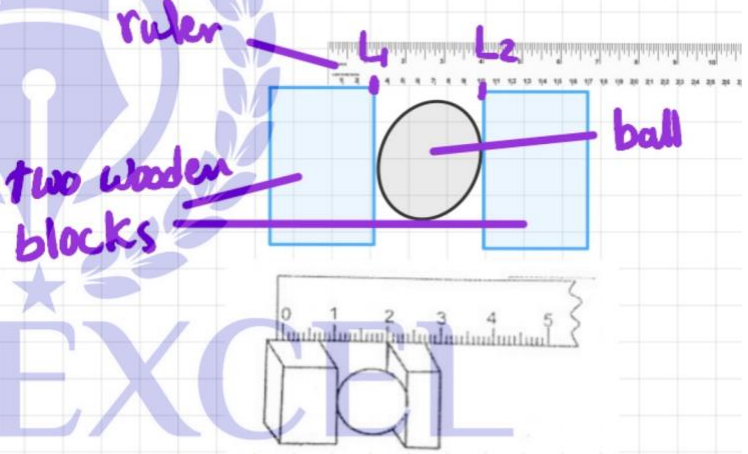
3-immerse the object in the water slowly to avoid splash of water



Measuring the diameter of a ball or a lens

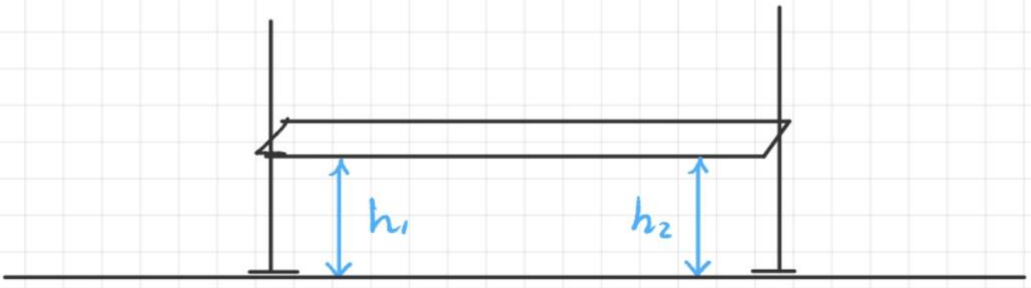
get two wooden blocks and measure spacing between Them

Daimter of sphere $= L_2 - L_1$



To ensure bench is horizontal

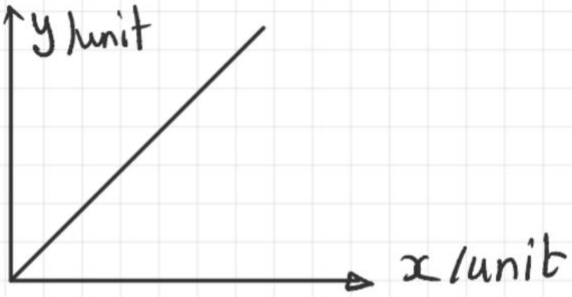
Measure the vertical height between the bench and the ruler From both ends of the bench are equal



Directly proportional

Graph

must start from the origin



Table

The results of division equal to a constant value

x	y
1	10
2	20
3	30

$10/1 = 10$

$20/2 = 10$

$30/3 = 10$

Inversely proportional

Graph

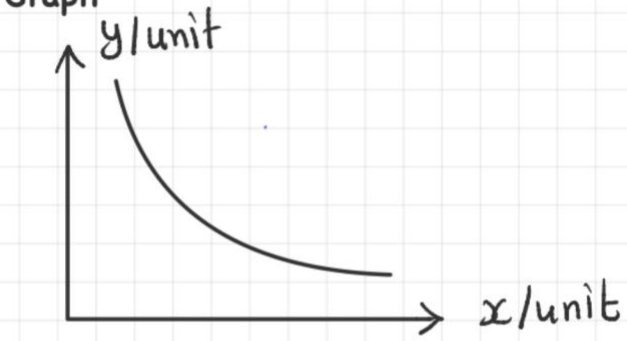


Table The multiplication equal to a constant value

x	y
2	10
4	5
6	3.33

$2 \times 10 = 20$

$4 \times 5 = 20$

$6 \times 3.33 = 20$

Graph

Notes:

Label the y & x axis with unit

Take 50% from the graph

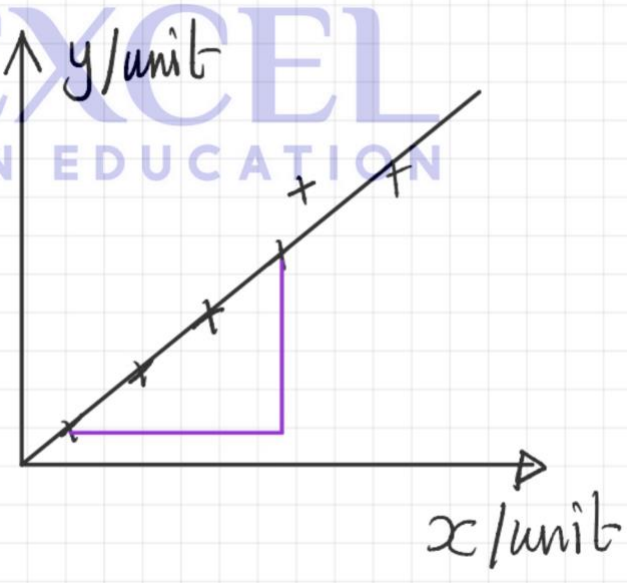
Draw a line of best fit

Gradient

you must make a triangle

take two points far apart

Two points must be on the line



Tip: $\text{Scale} = \frac{\text{Max} - \text{Min}}{\text{no. of squares}}$