

Name: Simple Pendulum.

Aim: Determination the value of the acceleration of Gravity by using simple Pendulum.

Theory: The simple Pendulum consists of metallic ball of mass (m) connected to string of fixed end at (A).

- simple Harmonic motion (S.H.M): Is the motion that repeats itself at equal periods.

- Periodic time: Is the time required to make one complete oscillation.

- Amplitude (A): Is the maximum distance the pendulum moves away from its mean position.

- complete oscillation: is one full motion, it returns back to the starting point.

$$T = 2\pi \sqrt{\frac{L}{g}}$$

$$g = 4\pi^2 \frac{L}{T}$$

Apparatus: Ruler stop watch Simple Pendulum.

Steps

1. measure the Length of the string (l).
2. move the metal by a small angle which less than 15° .
3. measure the time of (10) complete oscillation by using of stop watch then find the time of one complete oscillation.
4. Repeat the last step changing the length of pendulum and measuring the time (10) oscillator.
5. calculate the Results and put in table.

$$\frac{1}{T^2} \propto \frac{1}{l}$$

$$\frac{1}{T^2} \propto \frac{1}{l} \Rightarrow T^2 \propto l$$

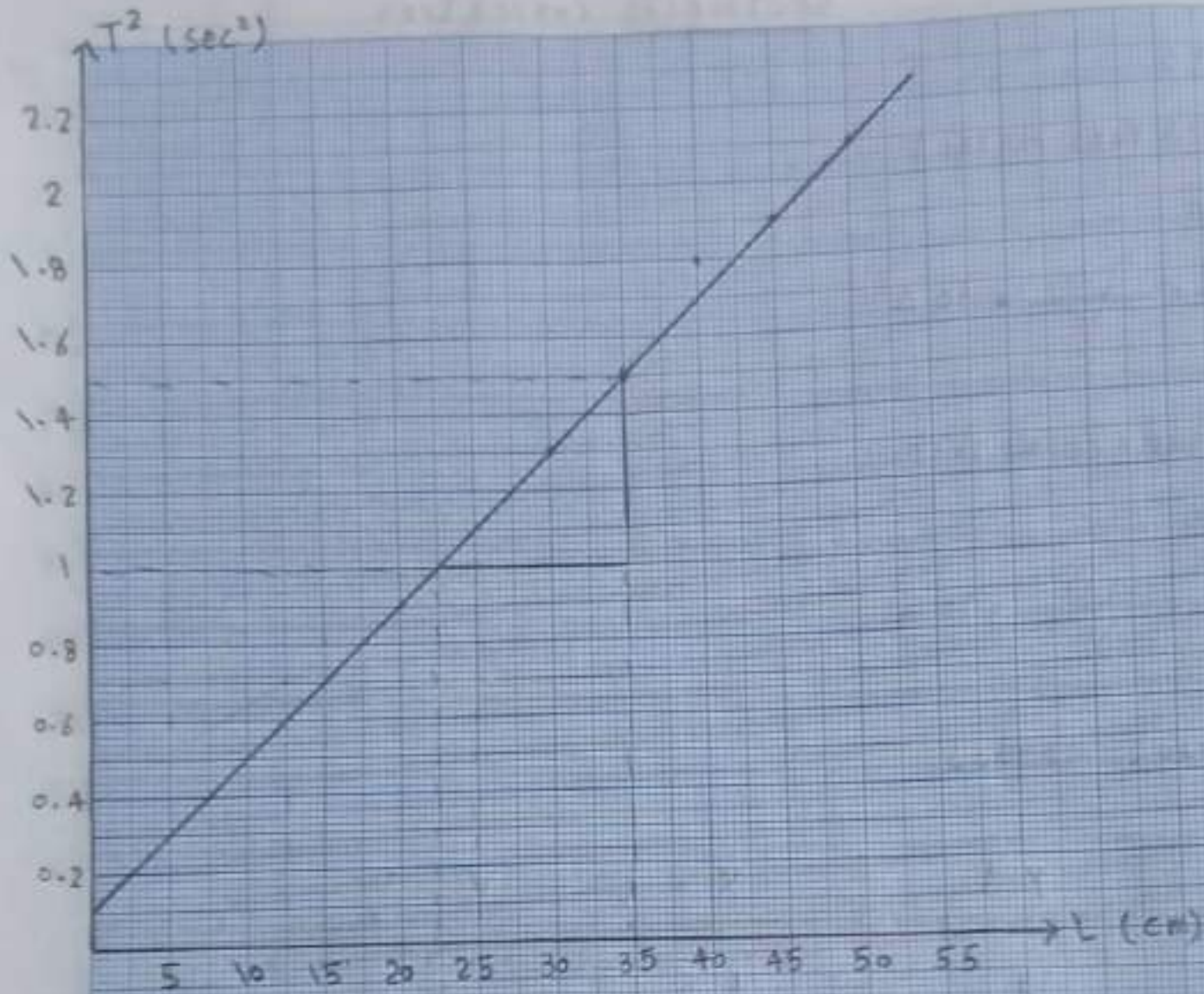
Section (1) Simple Pendulum

Results

L (cm)	T_{10} (sec)	$T = \frac{T_{10}}{10}$ (sec)	T^2 (sec ²)
30	11.43	1.143	1.3
35	12.22	1.222	1.49
40	13.4	1.34	1.79
45	13.89	1.389	1.92
50	14.5	1.45	2.1

$$\text{slope} = \frac{\Delta T^2}{\Delta L} = \frac{1.7 - 1}{40 - 22.5} = 0.04$$

$$g = \frac{4\pi^2}{\text{slope}} = \frac{4\pi^2}{0.04} = 987 \text{ cm/s}^2 = 9.87 \text{ m/s}^2$$



Name: convex Lens

Aim: Determination of the Power of a convex lens.

Theory: 1. Lens: Transparent medium refract the incident rays

2. convex lens: converging lens, consists of the inter-reaction between two spheres.

3. optical axis: Axis which passes by the two centers of the two spheres include the two faces of the lens.

4. Focal Point: converging point of the refracted rays when they incident parallel to each other and parallel to the optical axis.

5. Focal length: Distance from the focal point to the center of the lens.

6. Power of convex lens: Ability of lens to converge rays, equal to reciprocal of focal point by meters.

$$P = \frac{1}{F} \quad m^{-1}$$

Apparatus: convex lens mirror ruler screen holder.

Steps

A Parallel Rays Method:

1 Put the Lens in front of the window, move the screen behind the lens to get very small inverted image of the window.

2 measure the distance from the center of lens to the screen This distance is (Focal length).

3 calculate the Power of the lens from:

$$P = \frac{1}{F(m)} = \frac{100}{F(cm)} \quad \text{unit} = m^{-1}$$

B concidence method:

1 Put the lens in front of the source and behind it a mirror, move the lens and the mirror together to get the most clear image on the source.

2 measure the distance from the lens to the source This distance is (Focal length).

3 calculate the Power of the lens from:

$$P = \frac{1}{F(m)} = \frac{100}{F(cm)} \quad \text{unit} = m^{-1}$$

C. General Method:

1. Put the Lens in front of the source at distance (x) it more than double the focal length ($x > 2F$), move the screen behind the lens to get the most clear image of the source on the screen.
2. Measure the distance from the lens to the screen (y)
3. Repeat the previous steps for different distance (x) and measure (y) for each one of them.

Section (2) Convex lens

Results

1 Parallel Rays method

$$F = 10 \text{ cm}$$

$$P = \frac{100}{F} = \frac{100}{10} = 10 \Delta$$

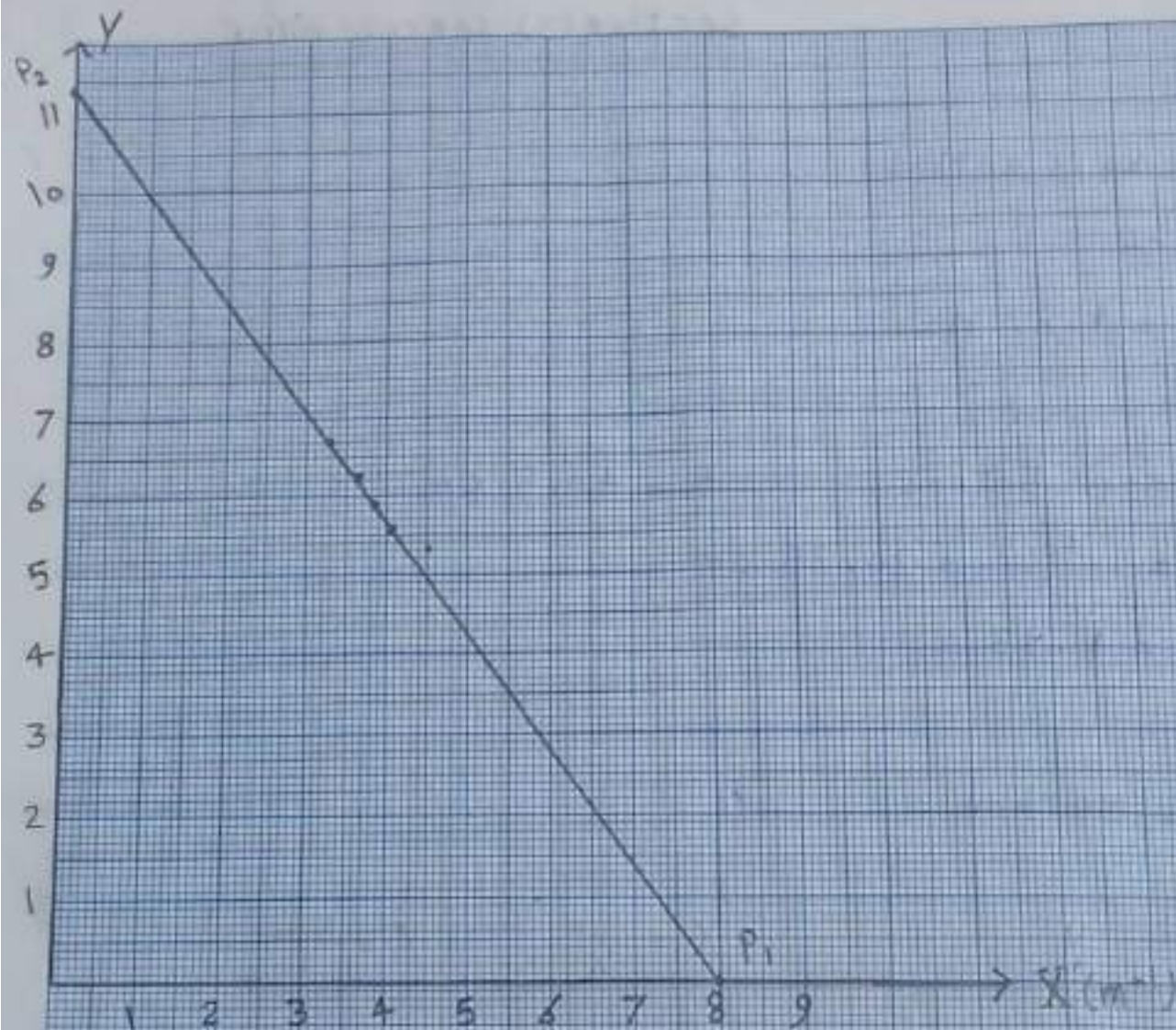
2 Concidence method

$$F = 10 \text{ cm}$$

$$P = \frac{100}{F} = \frac{100}{10} = 10 \Delta$$

3 General method

X	y	$X = \frac{100}{x}$	$y = \frac{100}{y}$
22	19	4.5	5.3
24	18	4.1	5.6
26	17	3.8	5.9
28	16	3.6	6.3
30	15	3.3	6.7



$$P = \frac{P_1 + P_2}{2} = \frac{8 + 11.4}{2} = 9.7 \text{ A}$$

Name : con cave mirror

Aim : Determination of the Power of the concave mirror.

Theory : 1 Mirror : It is a surface capable of reflecting all the incident rays on it.

2 concave mirror : is a curved mirror formed by a part of a hollow sphere with the reflecting surface on the hollow side.

3 optical axis : It is the axis which passes on the centers of the hollow sphere and the center of the mirror.

4 center of the mirror (the Pole) : It is the geometric center of the curved mirror surface.

5 Focal Point : It is the point of the focus of incident ray when they are incident parallel to each other and parallel to optical axis.

6 Focal Length : It is the distance between the focal point and the center of the mirror pole.

7 Radius of curvature : It is the distance between centers of the hollow sphere and the center of the mirror

(Pole) $R = 2F$

ROX

8 - Power of the mirror: It is the ability of the mirror to converge rays $P = \frac{1}{F(m)} = \frac{100}{F(cm)} \text{ unit} = m^{-1}$

Apparatus: optical bench Ruler mirror optical source screen.

Steps

A - Parallel Rays Method:

1 - Put the mirror in front of parallel rays source (sun), move the screen in front of the mirror to get very small inverted image of the window.

2 - Measure the distance from the mirror to the screen. This distance is Focal Length (F).

3 - Calculate the Power of the mirror from:

$$P = \frac{100}{F(cm)} \quad \text{unit} = m^{-1}$$

B - Coincidence Method:

1 - Put the mirror in front of the source of light, move the mirror to get the most clear image on the source.

2 - Measure the distance from the mirror to the source. This distance is (Radius of curvature) R, cm

ROX

3 calculate the Focal Length From: $F = \frac{R}{2}$

4 calculate the Power of the mirror From:

$$P = \frac{100}{F(\text{cm})} \quad \text{unit} = \text{m}^{-1}$$

C General Method:

- 1 Put the mirror in front of the source at distance (x) more than double the Focal Length of the mirror ($x > 2F$),
move the screen in front of the mirror to get the most clear image of the source on the screen.
- 2 measure the distance from the mirror to the screen (y)
- 3 Repeat the previous steps for different distance (x) and measure (y) for each one of them.

Section (3) concave mirror

Results

1 Parallel Rays Method

$$F = 20.5 \text{ cm}$$

$$P = \frac{100}{20.5} = 4.87 \Delta$$

2 Coincidence Method

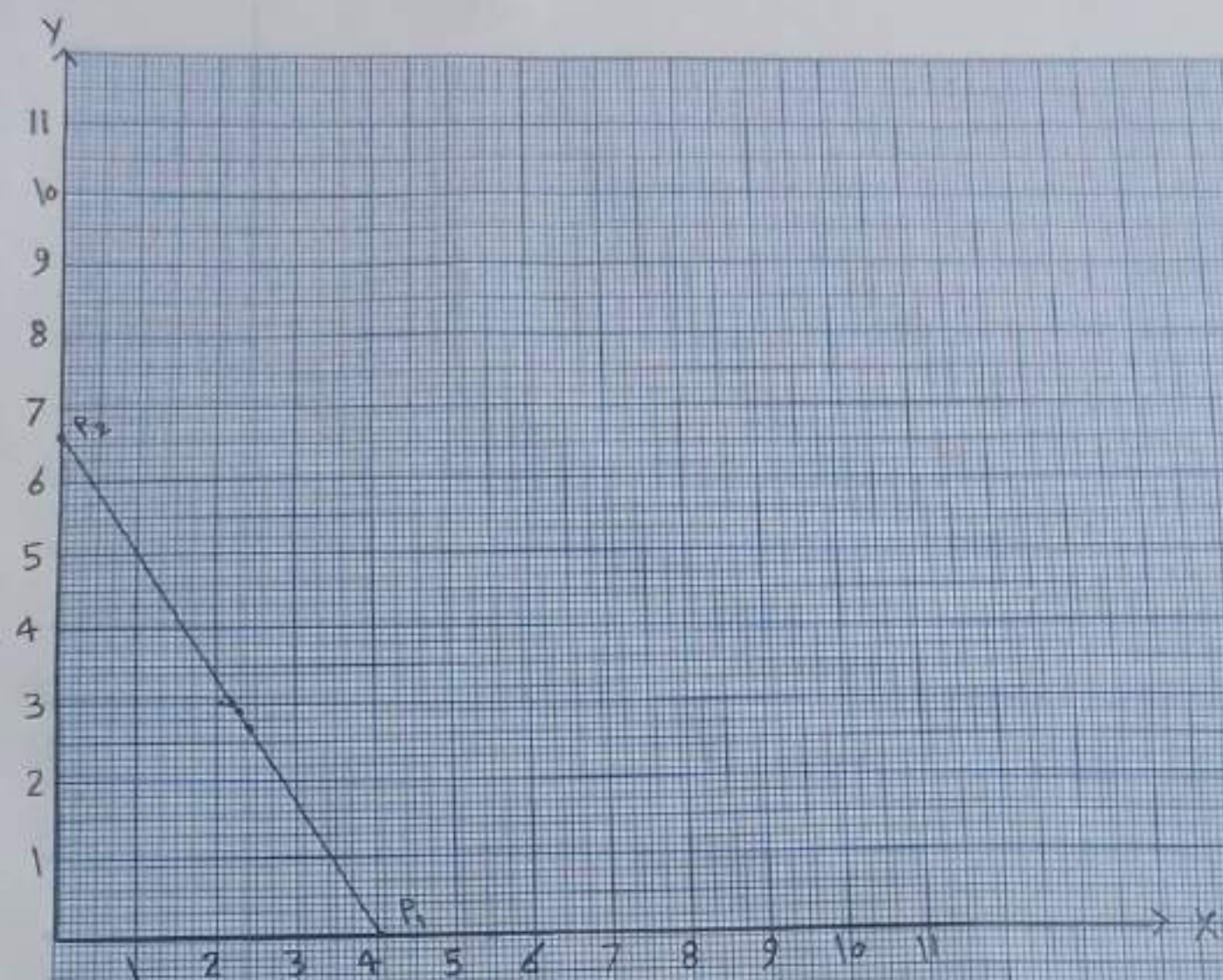
$$R = 40.5 \text{ cm}$$

$$F = \frac{R}{2} = \frac{40.5}{2} = 20.25 \text{ cm}$$

$$P = \frac{100}{20.25} = 4.93 \Delta$$

3 General Method

X	Y	$X = \frac{100}{x}$	$Y = \frac{100}{y}$
42	36.5	2.38	2.73
44	34	2.27	2.94
46	33.5	2.17	2.98
48	33	2.08	3.03



$$P = \frac{P_1 + P_2}{2} = \frac{4 + 6}{2} = 5 \Delta$$

Name : concave Lens (Diverging Lens).

Aim : Determination of the Power of the concave lens.

Theory : 1 Lens : it is the transparent medium that refract rays incident on it.

2 concave lens : Geometrically is the space between non intersected of two spheres.

3 Focal Length : It is the distance between the focal point and the center of the lens.

4 Focal Point : It is the point of the focus of the extensions of out coming rays at reverse direction when they are incident parallel to each other.

5 Optical axis : It is the axis which passes on the two centers of two spheres which include the lens surfaces.

6 Power (P) : It is the ability of the lens to diverge rays.

$$P = \frac{1}{F(m)} = \frac{100}{F(cm)} \text{ unit } m^{-1} = D$$

Apparatus : optical bench Ruler Mirror optical source screen convex lens concave lens.

Steps

1 Combination Method:

a. Determination the Power of convex Lens (P_c):

1. Put the lens in front of the source and behind it mirror, Move the lens and the mirror together to get the most clear image on the source.

2. Measure the distance from the convex lens to the source, This distance is focal length of convex lens (F_c).

3. Calculate the Power of the convex lens from:

$$P_c = \frac{100}{F_c \text{ (cm)}} \quad \text{Unit } \Delta = m^{-1}$$

b. Determination the Power of group (P_g):

1. Put the concave lens between the convex lens and the plane mirror, Move the group together to get the most clear image on the source.

2. Measure the distance from the GP to the source. This distance is focal length of GP (F_g).

3. Calculate the Power of the GP from:

$$P_g = \frac{100}{F_g \text{ (cm)}} \quad \text{Unit } \Delta = m^{-1}$$

C Determination the Power of Diverging Lens (P_d):

$$\therefore P_g = P_c + P_d$$

We can determine the Power of Diverging Lens From:

$$\therefore P_d = P_g - P_c$$

$$P_g > P_c$$

[2] - Direct Method

1. Put the convex lens in front of the source at distance ($F_c + 2$ cm), move the screen behind the convex lens to get clear large image of the source.

2. Put the concave lens and behind it plane mirror to get the most clear image on the source.

3. Measure the distance from the concave lens and the mirror to screen, this distance is the focal length of the concave lens (F_d)

4. calculate the Power of the concave lens From:

$$P_d = \frac{100}{F_d \text{ (cm)}}$$

$$\text{Unit} \rightarrow \Delta = m^{-1}$$

(Results)

$$F_c = 12 \text{ cm}$$

$$P_c = \frac{100}{12} = 8.3 \Delta$$

$$F_g = 26.5 \text{ cm}$$

$$P_g = \frac{100}{26.5} = 3.77 \Delta$$

$$P_d = P_g - P_c = 3.77 - 8.3 = -4.5 \Delta$$

$$F_d = 22 \text{ cm}$$

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$$P_d = \frac{100}{22} = 4.5 \Delta$$

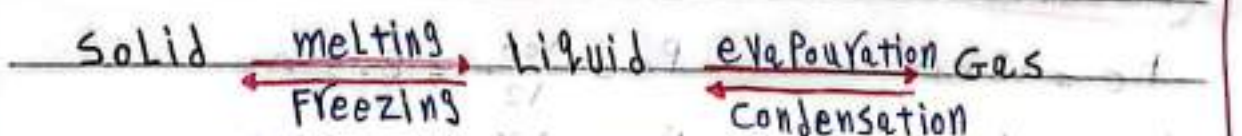
Name: Latent Heat (Wax).

Aim: determination of the melting Point of Wax.

Theory: 1. There are three Phases of matter:

Solid	Liquid	Gas
1. Attractive Force between molecules is the greatest.	1. Attractive Force between molecules is less than solid.	1. Attractive Force between molecules is approximately zero.
2. Intermolecular distance is very small.	2. Intermolecular distance is more than solids.	2. Intermolecular distance is very large.
3. Constant shape and Volume.	3. constant Volume but different shape.	3. Variable Volume and shape.

2. Phase transition:



ROX

Heat : is transferred between two substances at different temperatures energy flow is from the substance of higher temperature to lower temperature.

units of Energy : calories, or Joules, or erg.

melting Point : Temperature at which the material converts from solid to liquid phase.

Freezing Point : Temperature at which the material converts from liquid to solid phase.

Temperature : is the measure of hotness or coldness of matter or is the average kinetic energy per molecule of a substance, is measured in degrees on the Celsius (C) or Fahrenheit (F) or in Kelvins (K).

Tools : Thermometer, heater, tube filled with wax, stopwatch, water bath.

Steps :

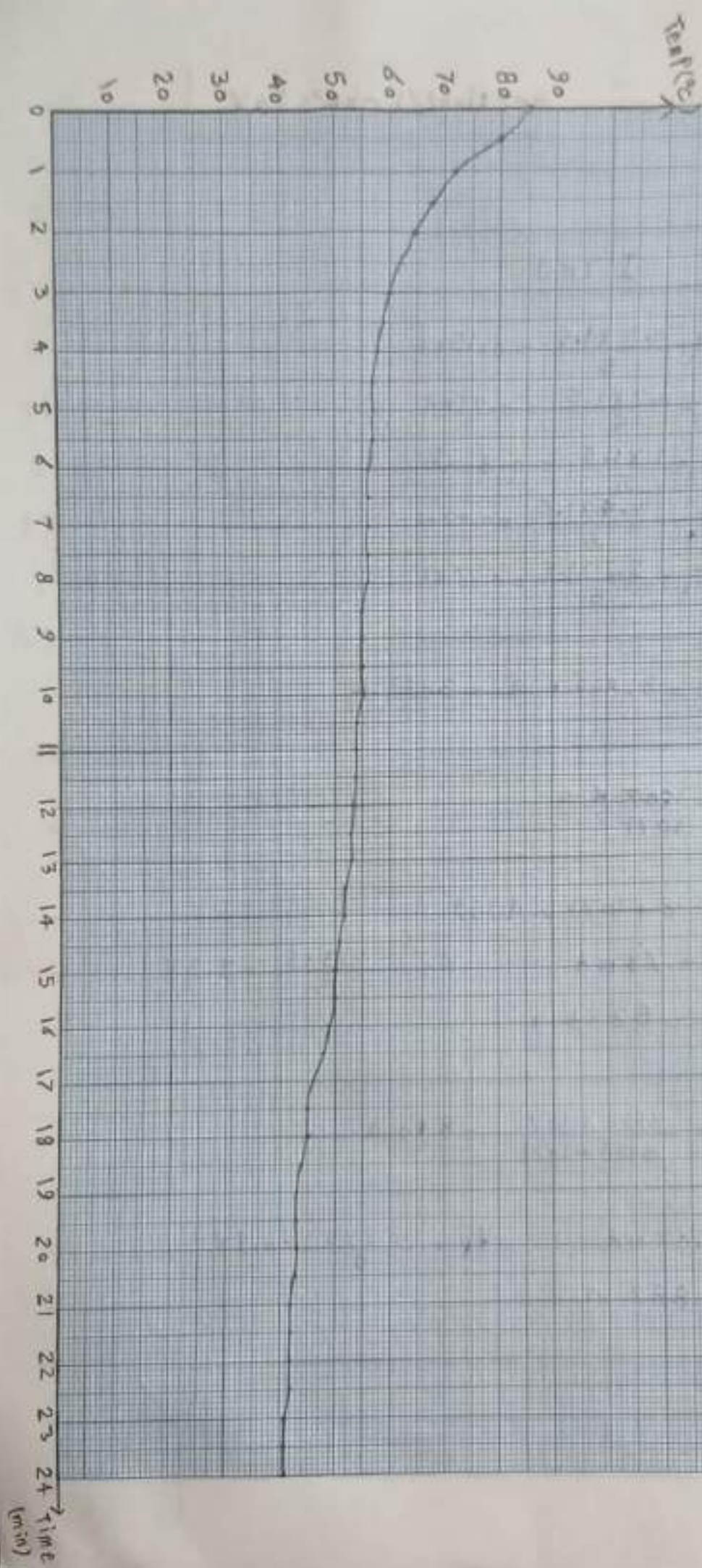
- 1- نضع الشمع في حمام مائي ونقوم بتسخين الشمع حتى يصل إلى درجة حرارة 90° ثم نخرج من الحمام المائي ونضعه بعيداً عن الحرارة.
- 2- عندما تصل درجة الحرارة إلى 80° نبدأ بتشغيل ساعة إيقاف وننسى الزمن.
- 3- ننسى درجة الحرارة كل 30 ثانية حتى درجة حرارة 40° ثم نسجيل النتائج.

نحسب العلاقة بين الزمن على المحور الأفقي والحرارة على المحور الرأسي.

نحدد في الحرارة تثبت عند نقطة **ROX** الخط عند الثبات، ليقطع المحور الرأسي في نقطة تسمى نقطة الانصهار.

Section (5) Wax

Time (min)	Temp (°C)	Time (min)	Temp (°C)	Time (min)	Temp (°C)
0	85°C	11	54°C	22	42°C
0.5	80°C	11.5	54°C	22.5	42°C
1	72°C	12	53.5°C	23	41.5°C
1.5	68°C	12.5	53°C	23.5	41°C
2	65°C	13	52.9°C	24	41°C
2.5	62°C	13.5	52°C	24.5	41°C
3	60°C	14	51.9°C	25	40.5°C
3.5	59°C	14.5	51.°C	25.5	40°C
4	58°C	15	50.5°C		
4.5	57°C	15.5	50°C		
5	57°C	16	49°C		
5.5	57°C	16.5	48°C		
6	56°C	17	46.5°C		
6.5	56°C	17.5	45.5°C		
7	56°C	18	45°C		
7.5	56°C	18.5	44°C		
8	56°C	19	43.5°C		
8.5	55°C	19.5	43°C		
9	55°C	20	43°C		
9.5	55°C	20.5	43°C		
10	55°C	21	42.5°C		
10.5	54°C	21.5	42°C		



Name : ohm's law

Aim : ① Verification ohm's law

② Determination unknown Resistance directly

③ Determination series Resistance ^(R₁) exp. and theo.

④ Determination Parallel Resistance exp. and theo.

Theory : ① ohm's Law : at constant temperature the electrical Potential difference (V) is directly Proportional to the current intensity (I) in the conductor.

$$V \propto I, \quad V = IR$$

② Resistance (R) is the opposition of current flow through an electrical element. $R = \frac{V}{I}$

③ Electric current $(I = \frac{Q}{t})$, C/sec = A.

④ Electric Voltage (V)

Apparatus : Battery - Rheostat - Voltmeter - Ammeter - connection Wires - Board of Resistance.

steps: For Aim (1)

- 1- connect the circuit
- 2- using the rheostat to take different values for V and corresponding I
- 3- Tabulate your results at table, Plot a curve between I and V
- 4- calculate the slope $R_1 = \text{slope} = \frac{V}{I}$

For Aim (2)

- 1- connect R_2 instead of R_1 in the circuit $\therefore$
- 2- take one value of V and I , and calculate $R_2 = \frac{V}{I}$

For Aim (3)

- 1- connect the two resistors R_2 and R_1 in series
- 2- Take one value of V and I بمسلك توصيل واحد
and calculate $R_s = \frac{V}{I} = R_1 + R_2$

For Aim (4)

- 1- connect the two resistors R_2 and R_1 in parallel
- 2- Take one value of V and I بمسلكين توصيل
and calculate $R_p = \frac{V}{I} = \frac{R_1 \cdot R_2}{R_1 + R_2}$

عند حساب القراءة من الجهاز

القراءة = المفتاح $\times$ المؤشر

نهاية التدريج

ROX

Section (6) ohm's Law

Results:

V (Volt)	I (mA)
$V_1 = \frac{0.5 \times 5}{5} = 0.5 \text{ V}$	$I_1 = \frac{0.5 \times 1.5}{5} = 0.15 \text{ mA}$
$V_2 = \frac{0.8 \times 5}{5} = 0.8 \text{ V}$	$I_2 = \frac{0.7 \times 1.5}{5} = 0.21 \text{ mA}$
$V_3 = \frac{1.2 \times 5}{5} = 1.2 \text{ V}$	$I_3 = \frac{1 \times 1.5}{5} = 0.3 \text{ mA}$
$V_4 = \frac{1.6 \times 5}{5} = 1.6 \text{ V}$	$I_4 = \frac{1.4 \times 1.5}{5} = 0.42 \text{ mA}$
$V_5 = \frac{2.6 \times 5}{5} = 2.6 \text{ V}$	$I_5 = \frac{2.2 \times 1.5}{5} = 0.66 \text{ mA}$

$$R_1 = \frac{2.6 - 1.2}{0.66 - 0.3} = 3.888 \text{ K } \Omega = 3888 \Omega$$

$$R_2 = \frac{0.9}{0.84 \times 10^{-3}} = 1071 \Omega$$

$$R_s = R_1 + R_2 = 3888 + 1071 = 4959 \Omega$$

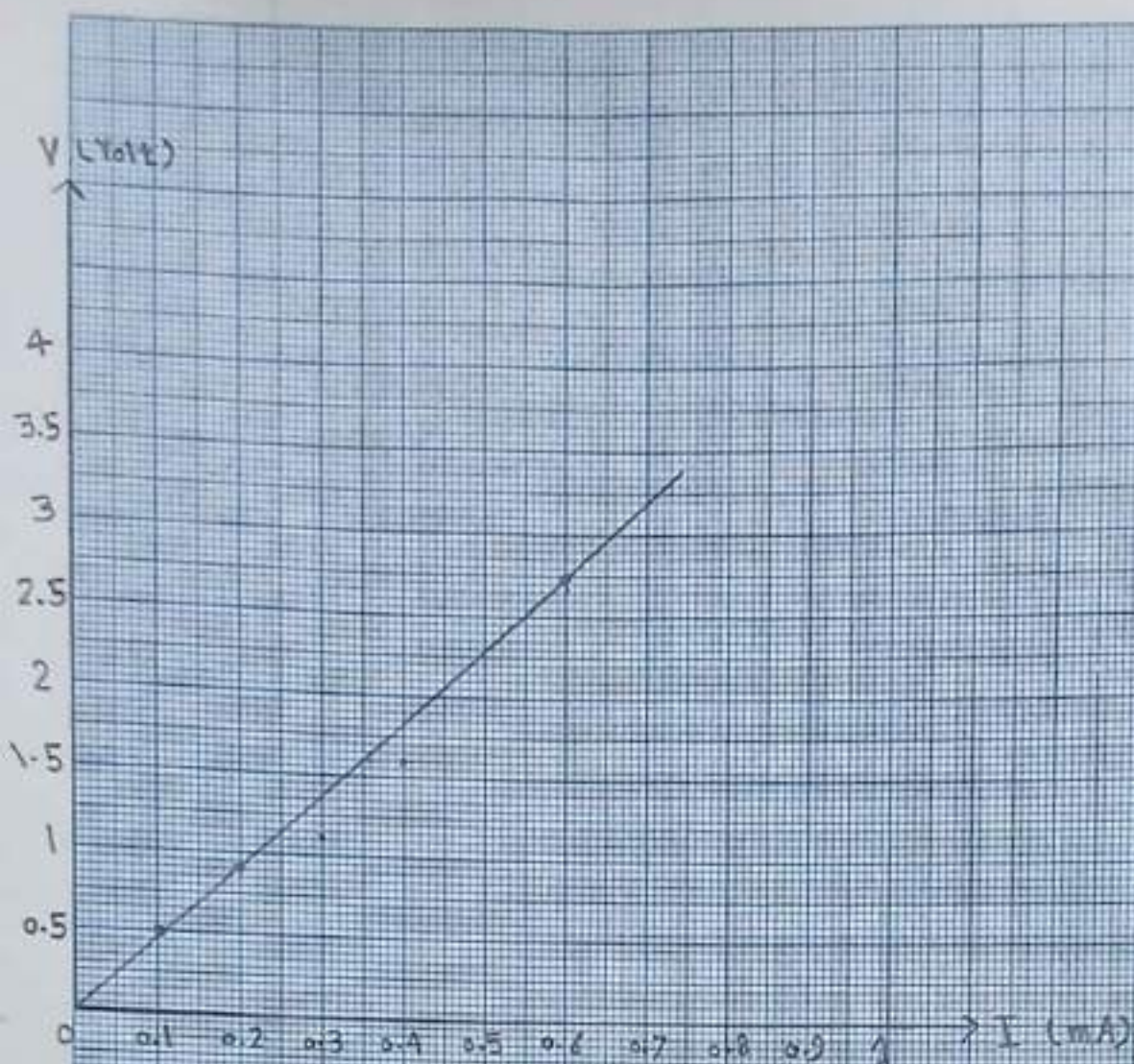
$$I_s = \frac{2.1 \times 1.5}{5} = 0.63 \text{ mA} \quad V_s = \frac{3.3 \times 5}{5} = 3.3 \text{ V}$$

$$R_{s \text{ عملي}} = \frac{3.3}{0.63 \times 10^{-3}} = 5238 \Omega$$

$$R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{3888 \times 1071}{3888 + 1071} = 840 \Omega$$

$$I_p = \frac{3.4 \times 1.5}{5} = 1.02 \text{ mA} \quad V_p = \frac{0.9 \times 5}{5} = 0.9 \text{ V}$$

$$R_{p \text{ عملي}} = \frac{0.9}{1.2 \times 10^{-3}} = 882 \Omega$$



Name: Hook's Law

- Aim:
- ① Verification Hook's Law.
 - ② Determination Hook's constant.
 - ③ Determination the specific weight of solid object.

Theory: Hook's law: Within the Limit of Elasticity the increase ΔL in an elastic body of length L is directly proportional to

$$F = K \Delta L \quad \therefore K = \frac{F}{\Delta L} \text{ dyne/cm}$$

$$\therefore K = \frac{mg}{\Delta L}$$

Apparatus: Spring - Weights - Scale - Solid cube of Water

Steps

(A) Verification of Hook's Law

1. Take the zero reading of the Pointer on the scale.
2. Add a weight of 10 grams. Read the reading.
3. Repeat the last step by increasing the weights and record the reading of Pointer.
4. Record these results in a table.
5. Draw a graph between m & ΔL .

$$K = \text{slope} \times g_{80} = \text{dyne/cm}$$

(B) Determination of the specific gravity of solid by using Hook's Law.

1. Put the solid in the end of spring & calculate (ΔL) .
2. Immerse the solid completely in the water beaker, without touching the walls of bottom, Find $(\Delta L)_w$.
3. Calculate m_a and m_w .

$$\text{Specific Weight} = \frac{m_a}{m_a - m_w}$$

ROX

Section(7) Hook's Law

Results:

M (g)	ΔL (cm)
10	0.5
20	1
30	1.5
40	2
50	2.5

$$K = \text{slope} \cdot 980 = \frac{30}{1.5} \times 980 = 19600 \text{ dyne/cm}$$

$$\Delta L_e = 3 \text{ cm}, \Delta L_w = 2.5 \text{ cm}$$

$$M_e = 60 \text{ g}, M_w = 50 \text{ g}$$

$$\text{Specific Weight} = \frac{m_e}{m_e - m_w} = \frac{60}{60 - 50} = 6$$

