ElCoM
ELECTRICAL COMPUTER MECHATRONICS

تقدم لجنة ElCoM الاكاديمية

حلول تقارير مختبر:

فيزياء عامة 1

جزيل الشكر للمهندس:

بشار العقايلة

LAB REPORT FOR EXPERIMENT 1

Date: 9/2/2017

Name: بشار عبد القادر العقايلة

Partner's Name: ———

Registration No: 1440224

Registration No: ———

Physics Section: 16

Instructor's Name: سماح النمر

a.5

PHYSICS LAB EXPERIMENT 1: COLLECTION AND ANALYSIS OF DATA

I. PURPOSE :

We make this Imaginary Experiment to: (1) know the relationship between the diameter of a hole in the bottom of the container [d], the depth of water in the container [h] and the time needed to empty the container [t].

II. DATA : (2) Convert Non-Linear relationship to Linear.

Table (1.1)

h (cm)	t in seconds			
	d = 1.5 mm	d= 2.0mm	d=3.0mm	d=5.0 mm
30.0	73.0	41.2	18.4	6.8
10.0	43.5	23.7	10.5	3.9
4.0	26.7	15.0	6.8	2.2
1.0	13.5	7.2	3.7	1.5

Using data inTable (1.1) fill in Table (1.2) below:

Table (1.2)

d (mm)	t in seconds			
	h = 30.0 cm	h=10.0cm	h=4.0cm	h=1.0cm
5.0	6.8	3.9	2.2	1.5
3.0	18.4	10.5	6.8	3.7
2.0	41.2	23.7	15	7.2
1.5	73.0	43.5	26.7	13.5

for h = ~~30~~ 10 cm , fill in Table 1.3 below:

Table(1.3)

t (s)	d (mm)	$1/d^2$ (mm^{-2})
3.9	5.0	0.04
10.5	3.0	0.11
23.7	2.0	0.25
43.5	1.5	0.44

for d = ~~2~~ 3 mm fill in Table 1.4 below:

Table(1.4)

log t	log h
0.568	0
0.833	0.6
1.021	1
1.265	1.5

III. ANALYSIS OF DATA :

Graph your results. **Independent** variables will be the diameter of hole and depth of water in the container. Time is the **dependent** variable and will depend on the previous two independent variables.

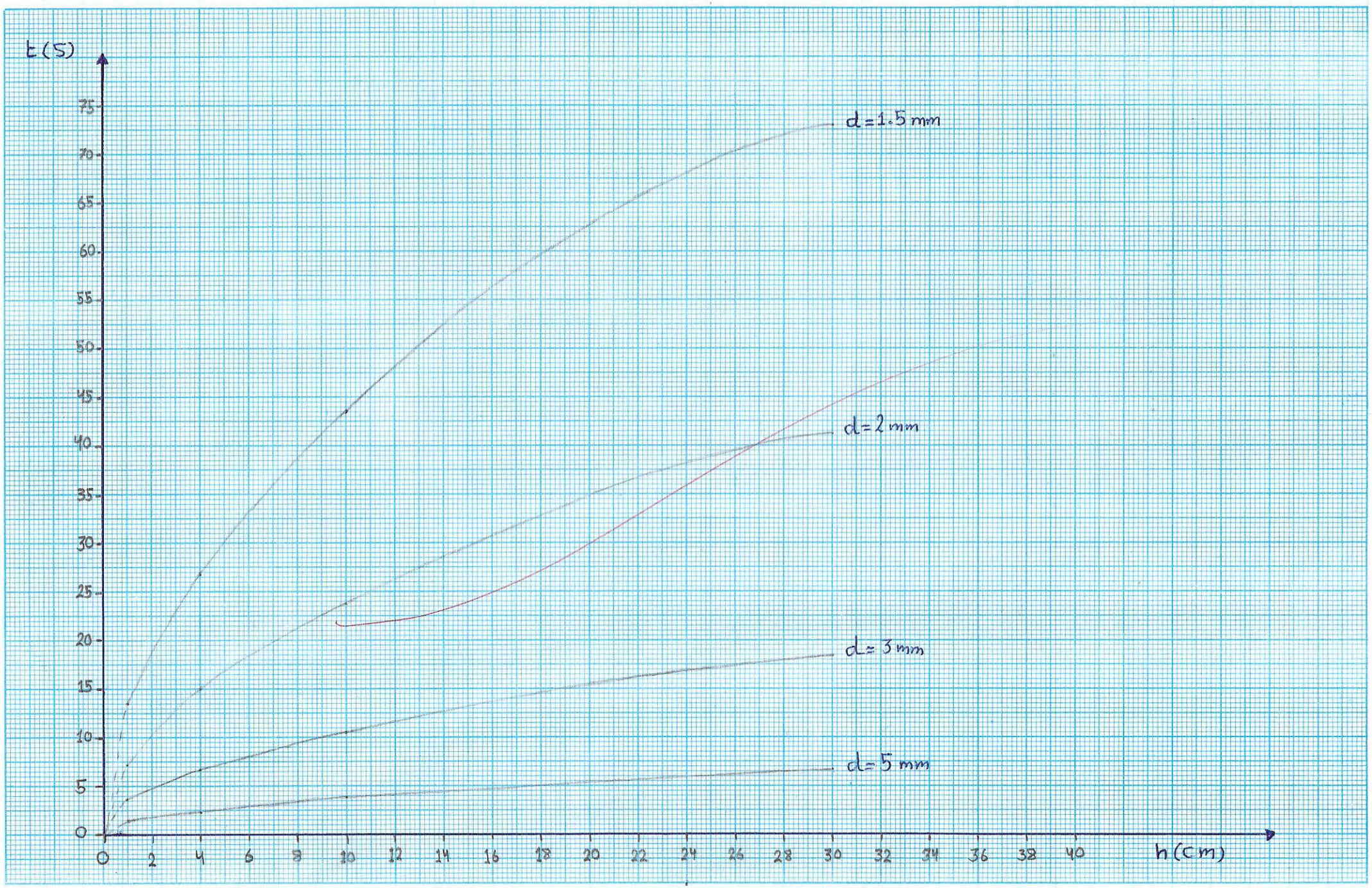
A. Plot the time (t) versus the depth (h) for each diameter (d) used. Do four graphs on one sheet, using the same set of axes, connecting points in a smooth curve for each and labeling them d_1 , d_2 , d_3 and d_4 .

B. On a second sheet of graph paper, plot the time (t) versus diameter (d) for each value of depth (h). Connect the points in a smooth curve and label the curves h_1 , h_2 , h_3 and h_4 .

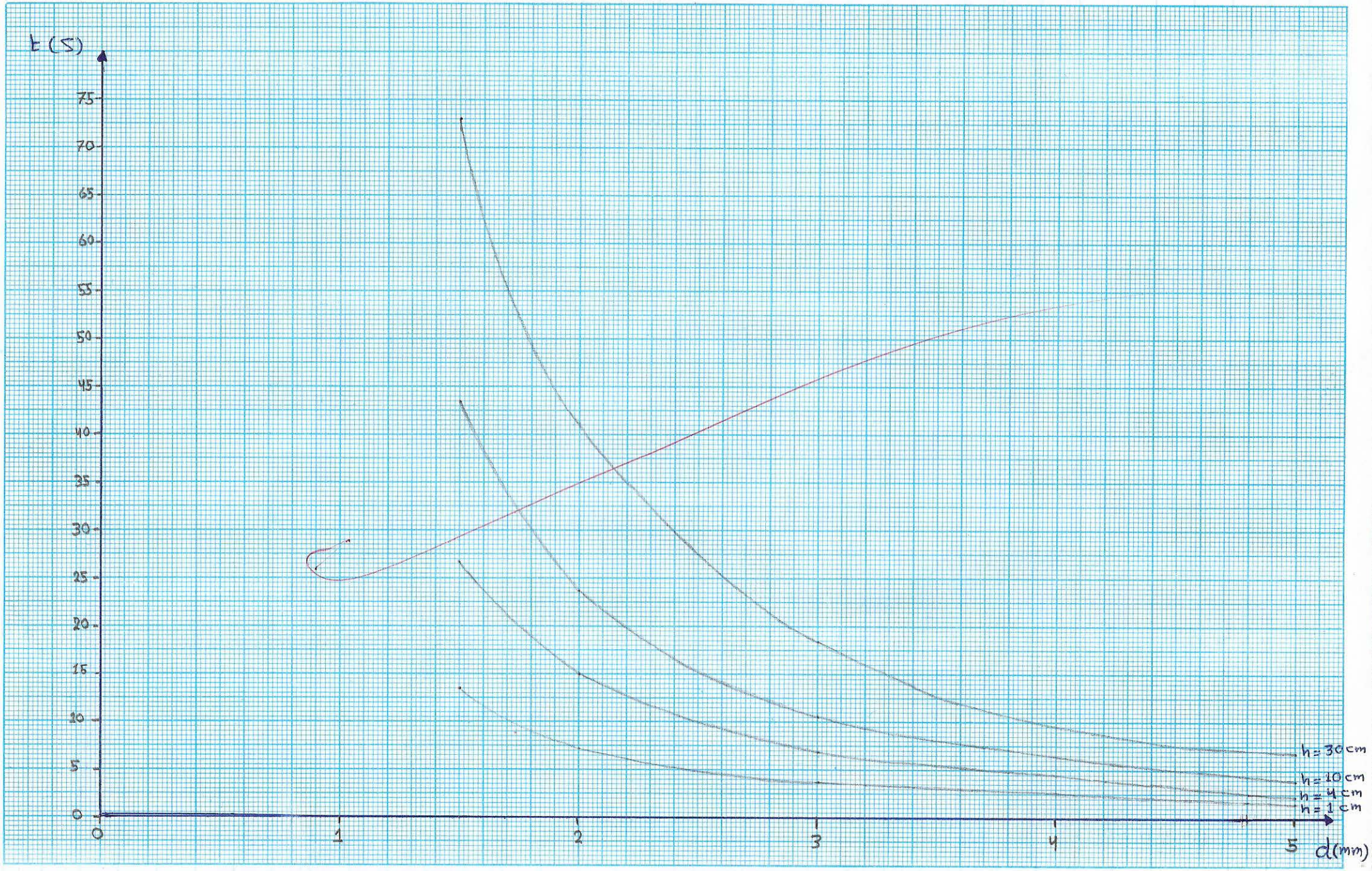
C. Plot t versus $1/d^2$ for h = ~~30~~ 10 cm

D. plot log t versus log h for d = ~~2~~ 3 mm.

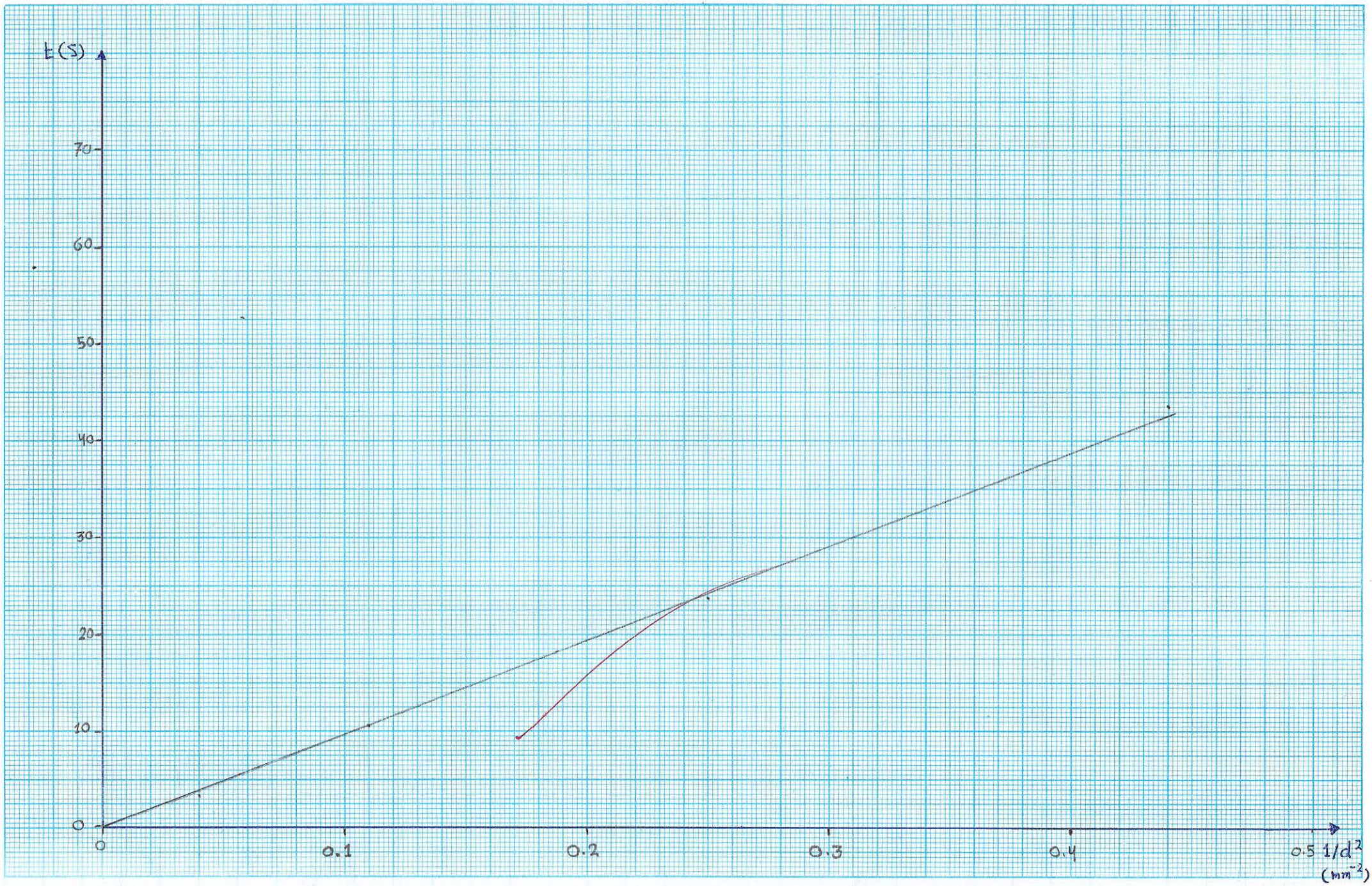
A. The Relation between (t) and (h) at constant (d) [Table 1.1]



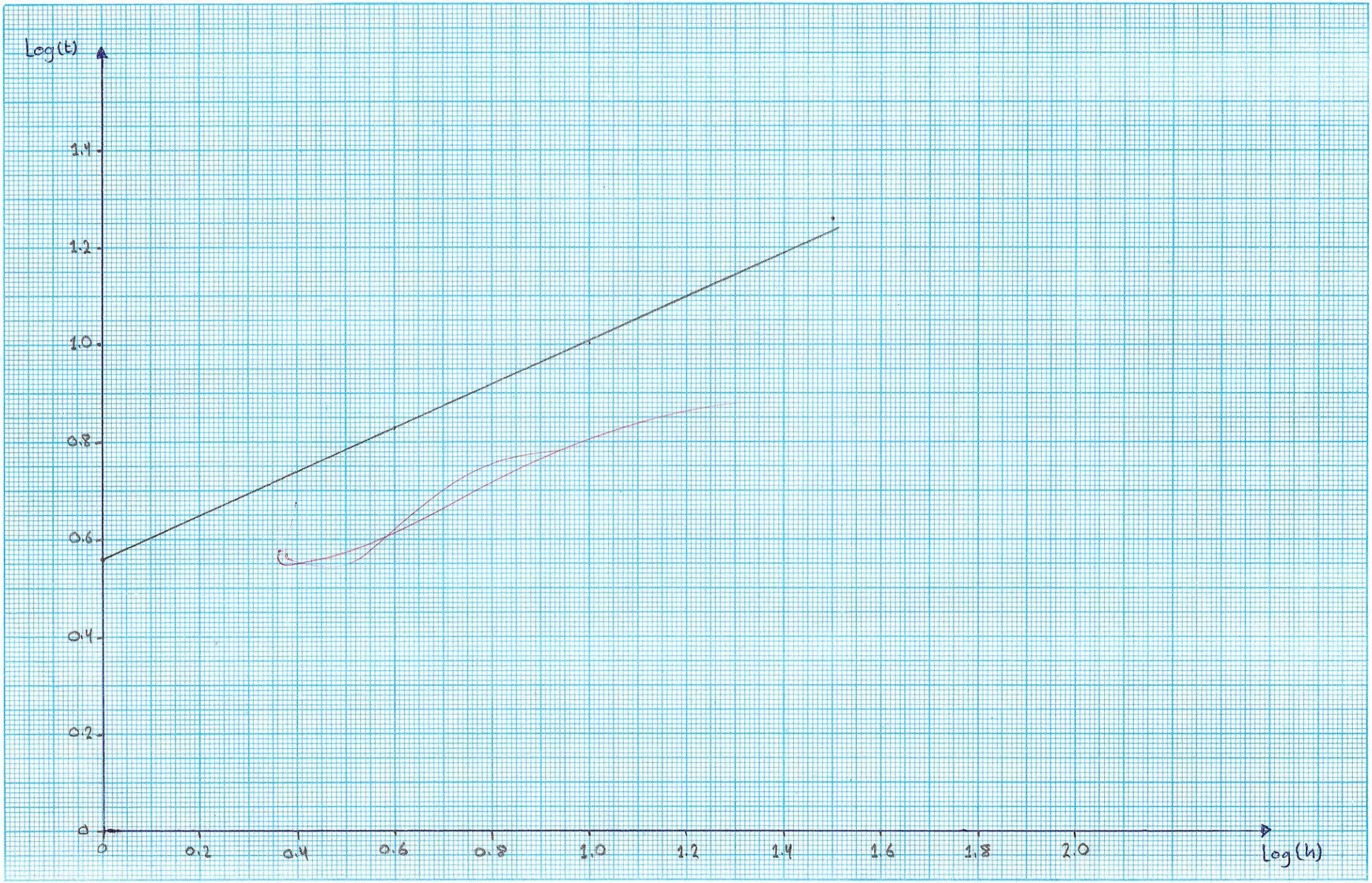
B. The Relation between (t) and (d) at constant (h) [Table I.2]



C. (t) versus $(1/d^2)$ for h = 10 cm [Table 1.3]



D. (Log(t)) versus (Log(h)) for d= 3mm [Table 1.4]



IV. CONCLUSIONS

1. From your graph (t) versus (h) for d = 1.5 mm, extrapolate the curve toward the origin. Does it pass through it ? Would you expect it to do so?

   Yes; because when there is no water in the container (h=0), the time needed to empty the container equals zero (t=0).

2. What type of relationship do you see between the time and diameter? Is it direct or inverse?

   It's Inverse and non-Linear Relation.

3. From t versus $1/d^2$ graph, find the empirical relationship between time (t) and hole diameter (d) for h = ~~30~~ 10 cm .

   • Slope (m) $= \frac{\Delta t}{\Delta(1/d^2)} = \frac{9.6 - 0}{0.1 - 0} = 96\ s.mm^2$, • y-intersept = 0

   $\Rightarrow t = m \times \frac{1}{d^2} + \text{y-intersept} \Rightarrow t = 96 \times \frac{1}{d^2}$

   find the slope on the graph

   -0.5

4. From the previous relation, can you predict the time needed to empty the container if the diameter of the opening was 4 mm, 8 mm?

   Yes; $t(4) = 96(1/4^2) = 6\ s$

   $t(8) = 96(1/8^2) = 1.5\ s$

5. From the log t versus log h graph, find the empirical relationship between time (t) and depth (h) for d = ~~2~~ 3 mm .

   • Slope (m) $= \frac{\Delta \log t}{\Delta \log h} = \frac{0.65 - 0.56}{0.2 - 0} = 0.45$, • y-intersept = 0.56

   $\Rightarrow \log t = 0.45 \log h + 0.56$

   $\Rightarrow \log t - \log h^{0.45} = 0.56$

   $\log(t/h^{0.45}) = 0.56$

   $t/h^{0.45} = 10^{0.56} \Rightarrow t = 3.63 h^{0.45}$

6. Can you predict the time needed to empty the container if the depth of water was 25 cm, 80 cm?

Yes; $t(25) = 3.63 * (25)^{0.45} = 15.5$ s

$t(80) = 3.63 * (30)^{0.45} = 26.1$ s

* ملاحظة : كلّما كررنا القراءات زادت الدقة

LAB REPORT FOR EXPERIMENT 2

Date: 23/12/2017

Name: بشار عبد القادر أبو العقايلة

Partner's Name:

Registration No: 1440224

Registration No:

Physics Section: 16

Instructor's Name: سماح النمر

8.5

PHYSICS LAB EXPERIMENT 2 : MEASUREMENTS AND UNCERTAINTIES

I. PURPOSE :

a) We will make some elementary measurment of Length and mass; and from our measurments we will derive other quantities, such that: (volume, density,...)

b) To estimate the inaccuracy or the error in each measurment.

II. DATA AND DATA ANALYSIS :

A. Measurement of π

Record your data in Table (2.1) below:

Table (2.1)

Trial No	d (cm) (By Caliber)	$\lvert d-\bar{d}\rvert$ (cm)	c (cm) (By a Piece of paper tape. (نلفها ب) محيط القرص)	$\lvert c-\bar{c}\rvert$ (cm)
1	3.715	$2.5 * 10^{-3}$	12.0	0.1
2	3.710	$2.5 * 10^{-3}$	11.8	0.1
3	———	———	———	———
4	———	———	———	———
5	———	———	———	———
Average	$\bar{d}$ = 3.7125	cm	$\bar{c}$ = 11.9	cm
Error	$\Delta\bar{d} = \pm\ 2.5 * 10^{-3}$	cm	$\Delta\bar{c} = \pm$ 0.1	cm

الخطأ لأخذي قراءتين لـ d بدلاً من ثلاثة

1. Calculate the error, $\Delta \bar{d}$, in measuring the diameter of the disk, and, $\Delta \bar{c}$, in measuring the circumference and enter the values calculated in Table 2.1
Example for one calculation ($\Delta \bar{d}$) or ($\Delta \bar{c}$):

$$\Delta \bar{d} = \pm \sqrt{\frac{\sum_{i=1}^{n} |d_i - \bar{d}|^2}{n(n-1)}} = \sqrt{\frac{2*(2.5*10^{-3})^2}{2(1)}} = 2.5 * 10^{-3} \text{ cm}$$

$$\Delta \bar{c} = \pm \sqrt{\frac{\sum_{i=1}^{n} |c_i - \bar{c}|^2}{n(n-1)}} = \sqrt{\frac{2*(0.1)^2}{2(1)}} = 0.1 \text{ cm}$$

2. Using your average measured values of $\bar{d}$ and $\bar{c}$, calculate $\bar{\pi}$.

$$\bar{\pi}_{exp} = \frac{\bar{c}}{\bar{d}} = \frac{11.9}{3.7125} = 3.205$$

$(c = \pi d)$

3. Calculate the error, $\Delta \bar{\pi}$, in the measured value, $\bar{\pi}$.

Note: $\Delta \bar{\pi} = \bar{\pi} [(\Delta \bar{d} / \bar{d})^2 + (\Delta \bar{c} / \bar{c})^2]^{1/2}$ (2.1)

$$\Delta \bar{\pi} = 3.205(4.535 * 10^{-7} + 706.165 * 10^{-7})^{1/2} = 0.027$$

$$* \frac{\Delta \bar{d}}{\bar{d}} = 6.734 * 10^{-4} \qquad * \frac{\Delta \bar{c}}{\bar{c}} = 8.403 * 10^{-3}$$

4. Which error contributes most to $\bar{\pi}$? (give a quantitative answer)

$(\Delta \bar{d} / \bar{d} = 6.734 * 10^{-4}) < (\Delta \bar{c} / \bar{c} = 8.403 * 10^{-3})$; as you can see the $(\frac{\Delta \bar{c}}{\bar{c}})$ contributes more than $(\frac{\Delta \bar{d}}{\bar{d}})$ to $(\bar{\pi})$, since it's the largest.

5. Does the measured average value of $\bar{\pi}$ agree with the accepted value of $\bar{\pi}$ (3.14159) within the calculated experimental error.

$$p.e = \left| \frac{\bar{\pi}_{exp} - \pi_{acc}}{\pi_{acc}} \right| * 100 = \left| \frac{3.205 - 3.14159}{3.14159} \right| * 100\%$$

$= 2.02\%$; it's agree with the accepted value of π approximatly.

B. Determination of Density

Record your data in Table (2.2) below:

Table (2.2)

Trial No	h (cm)	$\lvert h-\bar{h}\rvert$(cm)	d (cm)	$\lvert d-\bar{d}\rvert$(cm)
1	9.97	———	0.541	17.3×10^{-3}
2	———	———	0.500	23.7×10^{-3}
3	———	———	0.530	6.3×10^{-3}
4	———	———	———	———
5	———	———	———	———
Average	$\bar{h}$= 9.97 cm		$\bar{d}$ = 0.5237 cm	
Error	$\Delta\bar{h} = \pm\ 2.5 \times 10^{-3}$ cm		$\Delta\bar{d} = \pm\ 12.252 \times 10^{-3}$ cm	
mass	m = 16.15 g		$\Delta m = \pm\ 0.01$ g	

1. Calculate the error, $\Delta\bar{h}$, in the average measured length and enter the result in Table (2.2).

$$\Delta\bar{h} = \frac{1}{2}(0.05) = 0.025 \text{ mm} = 2.5 \times 10^{-3} \text{ cm}$$

2. Calculate the error, $\Delta\bar{d}$, in the average measured diameter and enter the result in Table (2.2).

الخطأ لهذا توضيح النتيجة

$$\Delta\bar{d} = \sqrt{\frac{\sum_{i=1}^{n}|d_i-\bar{d}|^2}{n(n-1)}} = \sqrt{\frac{9.0067 \times 10^{-4}}{6}} = 12.252 \times 10^{-3} \text{ cm}$$

$$\sqrt{\frac{(17.3\times10^{-3})^2+(23.7\times10^{-3})^2+(6.3\times10^{-3})^2}{6}}$$

3. Take Δm to be half the smallest division of the balance used .

4. Using your average measured values of $\bar{h}$,$\bar{d}$, $\bar{\pi}$ determined in part A , and the measured value of mass m, calculate $\bar{\rho}$.

$$\bar{\rho} = \frac{4m}{\bar{\pi}\bar{d}^2\bar{h}} = \frac{4 \times 16.15}{3.205 \times (0.5237)^2 \times 9.97} = 7.37 \text{ g/cm}^3$$

5. Calculate the error, $\Delta\bar{\rho}$, in the average value for the measured density, $\bar{\rho}$.

Note: $$\Delta\bar{\rho} = \bar{\rho}\left[\left(\frac{\Delta m}{m}\right)^2 + \left(\frac{\Delta\bar{h}}{\bar{h}}\right)^2 + \left(\frac{2\Delta\bar{d}}{\bar{d}}\right)^2 + \left(\frac{\Delta\bar{\pi}}{\bar{\pi}}\right)^2\right]^{\frac{1}{2}} \qquad (2.2)$$

and use for $\bar{\pi}$ and $\Delta\bar{\pi}$, the values determined in part A.

$\Delta\bar{\rho} = 7.37(3.834 * 10^{-7} + 6.2876 * 10^{-8} + 2.189 * 10^{-3} + 7.097 * 10^{-5})^{1/2}$

$= 0.35\ g/cm^3$

6. Which error in m, $\bar{h}$, $\bar{d}$, or $\bar{\pi}$ contributes most to $\bar{\rho}$? (give a quantitative answer)

* $\frac{\Delta m}{m} = 6.19195 * 10^{-4}$ * $\frac{\Delta\bar{h}}{\bar{h}} = 2.5075 * 10^{-4}$

* $2\frac{\Delta\bar{d}}{\bar{d}} = 46.79 * 10^{-3}$ * $\frac{\Delta\bar{\pi}}{\bar{\pi}} = 8.4243 * 10^{-3}$

as you can see the $(2\frac{\Delta\bar{d}}{\bar{d}})$ contributes most to $\bar{\rho}$; since it's the largest.

7. Using your calculations in (6), which error in m, $\bar{h}$, $\bar{d}$, or $\bar{\pi}$ contributes the least to $\bar{\rho}$?

$(\frac{\Delta\bar{h}}{\bar{h}})$ contributes the least to $\bar{\rho}$; because it's the smallest

8. Compare the measured value of $\bar{\rho} \pm \Delta\bar{\rho}$ with the accepted value of ρ ($\rho_{accepted} = 8.6\ g/cm^3$)

$$p.e = \left|\frac{\bar{\rho}_{exp} - \rho_{acc}}{\rho_{acc}}\right| * 100\% = \left|\frac{7.37 - 8.6}{8.6}\right| * 100\%$$

$= 14.3\ \%$

LAB REPORT FOR EXPERIMENT 3

Date: 16/2/2017

Name: بشائر عبد القادر الحمايك

Partner's Name: _____

Registration No: 1440224

Registration No: _____

Physics Section: 16

Instructor's Name: سماح نمر

١٠

PHYSICS LAB EXPERIMENT 3: VECTORS (FORCE TABLE)

I. PURPOSE :

* عمل (addition) لمجموعة من المتجهات بأكثر من طريقة

Measure the magnitude and direction of the resultant of three forces experimentally by (the force table), graphically, and by the method of components.

II. DATA AND DATA ANALYSIS :

- Record the **experimentally** measured value of the resultant of the two forces in step one of the procedure (magnitude and direction) .

- Determine the resultant of the **two forces** in step one of the procedure **graphically**. How does it compare with the measured value?

- Again determine the resultant of the **two forces** in step one by the **method of components**. How does it compare with the measured value?

4. Record the experimentally measured value of the resultant of the three forces in step two of the procedure (magnitude and direction) .

$F_1 = 0.1 * 9.8 = 0.98N$, $F_2 = 0.15 * 9.8 = 1.47N$, $F_3 = 0.2 * 9.8 = 1.96N$

$\theta_1 = 30^\circ$ $\theta_2 = 315^\circ$ $\theta_3 = 210^\circ$

$\Rightarrow F_R = 0.153 * 9.8 = 1.4994 N$, $\theta_R = \underbrace{100}_{\theta_{equ}} + 180 = 280^\circ$

5. Determine the resultant of the three forces in step two of the procedure graphically using the polygon method . Compare it with the measured value.

Scale: 5 cm = 1N , $F_{R\,graph} = \frac{7.7\,cm * 1N}{5\,cm} = 1.54 N$, $\theta_R = 360 - 80.3 = 279.7^\circ$

$$P.e = \left| \frac{\overset{(F_{R\,graph})}{1.54} - \overset{(F_{R\,exp})}{1.4994}}{(1.54 + 1.4994)/2\ (\bar{F})} \right| * 100\% = 2.67\%$$

* من الممكن أن نقارن الزوايا

6. Again, use the method of components to determine the resultant for the three forces in step two of the procedure. Compare with experimental findings.

1* $F_1 = 0.98 \cos 30^\circ \hat{i} + 0.98 \sin 30^\circ \hat{j} = [0.85 \hat{i} + 0.49 \hat{j}] N$

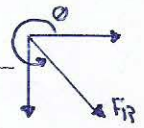
$F_2 = 1.47 \cos 315^\circ \hat{i} + 1.47 \sin 315^\circ \hat{j} = [1.04 \hat{i} + -1.04 \hat{j}] N$

$F_3 = 1.96 \cos 210^\circ \hat{i} + 1.96 \sin 210^\circ \hat{j} = [-1.697 \hat{i} + -0.98 \hat{j}] N$

$F_{Rx} = 0.85 + 1.04 - 1.697 = 0.193 N \longrightarrow$

$F_{Ry} = 0.49 - 1.04 - 0.98 = -1.53 N \downarrow$

$\Rightarrow |F_R| = \sqrt{(0.193)^2 + (-1.53)^2} = 1.54 N$, $\tan^{-1} \frac{1.53}{0.193} = 82.81^\circ \Rightarrow \theta = 277.19^\circ$



2* $$P.e = \left| \frac{1.54 - 1.4994}{(1.54 + 1.4994)/2} \right| * 100\% = 2.67\%$$

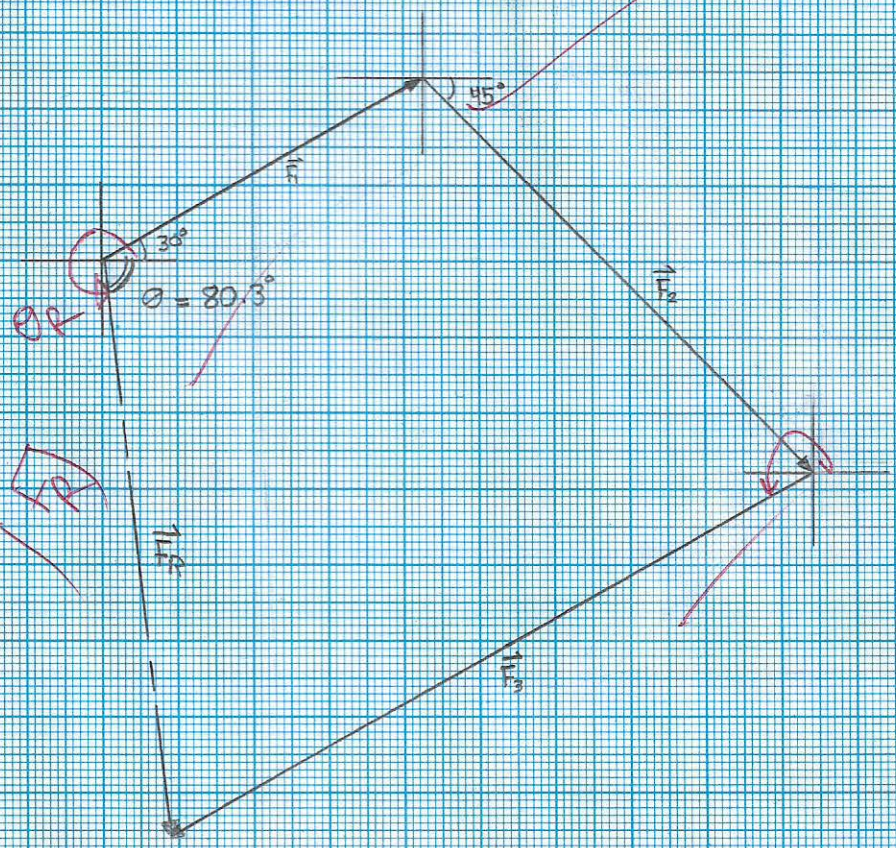
7. State the major source(s) of inaccuracy in the experimental results?

1. friction between the strig and the pully.

2. Errors in reading the scale.

3. The force table may be not horizontal.

5cm = 1N



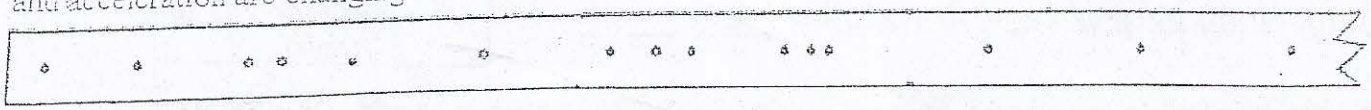
Kinematics of Rectilinear Motion

Name: بشار عبد القادر الحمايلة Instructor: سماح النمر

ID#: 1440224 Section: 16

10

Purpose: To study regular and irregular motion of objects by determining how the distance, velocity and acceleration are changing with time.



A. Fill in table (1) with data from your tape. Then, draw a graph of x versus t .

B. Use data from table (1) to fill table (2) . Then, draw a graph of $\bar{v}$ versus t . Draw the curve of the instantaneous velocity. {Assume that the instantaneous velocity at the interval's mid-point equals the average velocity in that interval, and that the acceleration is constant between each two interval.}

C. Use data from table (1) to fill table (3) .

Table(1)

Total time t (sec)	Total distance x (cm)
0.0	0.0
0.1	2.7
0.2	6.1
0.3	9.6
0.4	13.3
0.5	17.1
0.6	20.9
0.7	24.2

Table(2)

«أخذ فترات متقاربة» Time interval (s)	Average velocity $\bar{v} = \frac{\Delta x}{\Delta t}$ (cm/s)
0.0 – 0.1	27
0.1 – 0.2	34
0.2 – 0.3	35
0.3 – 0.4	37
0.4 – 0.5	38
0.5 – 0.6	38
0.6 – 0.7	33

Table (3)

t_{mid} (s)	$v_{mid} \cong \bar{v}$ (cm/s)	$\bar{a} \cong \frac{\Delta v}{\Delta t}$ (cm/s^2)
0.05	27	
		70
0.15	34	
		10
0.25	35	
		20
0.35	37	
		10
0.45	38	
		0
0.55	38	
		-50
0.65	33	

Use ($\overset{y}{x}$-$\overset{x}{t}$) graph to answer the following questions:

a) Determine one interval in which:

1- The velocity is increasing: at the interval [0-0.2]s

2- The velocity is decreasing: at the interval [0.6-0.7]s

3- The velocity is constant: at the interval [0.4-0.5]s

b) Find the instantaneous velocity at t = 0.4 s from the slope of the tangent of the (x-t) graph.

$v|_{t=0.4} = \frac{\Delta x}{\Delta t} = \frac{15.6 - 7}{0.465 - 0.24} = 38.2 cm/s$

Fill in table (4) below using data from table(1), and then answer the following questions:

«أخذ فترات متباعدة»

Table (4)	
Average velocity (cm/s)	$\bar{v} = \frac{\Delta x}{\Delta t}$
$\bar{v}_{7-1} = \frac{x_7 - x_1}{t_7 - t_1}$	35.83
$\bar{v}_{6-2} = \frac{x_6 - x_2}{t_6 - t_2}$	37
$\bar{v}_{5-3} = \frac{x_5 - x_3}{t_5 - t_3}$	37.5

c) The midpoint for the given intervals is t_{mid} = 0.4 s.

d) As the time interval is shortened, is there any relation between average velocities in table (4) and instantaneous velocity at the midpoint? Yes ; the instantaneous velocity at the midpoint approximately equals the average velocity for the smallest interval

e) Write down the approximate instantaneous velocity at t_{mid} from table (4).

* $v(t\,mid) \cong \bar{v}$ at smallest interval

$v|_{t=0.4} \cong \bar{v}_{5-3} = 37.5$ cm/s

f) Compare this result with that you have found in question (b) above?

$$p.e = \left| \frac{\overset{(v \text{ in } Q_b)}{38.2} - \overset{(v \text{ in } Q_e)}{37.5}}{\underset{(\bar{v})}{(38.2+37.5)/2}} \right| * 100\% = 1.85\%$$

Use (v-t) graph to answer the following questions:

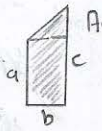
g) Determine one interval in which the acceleration is positive: [0.2-0.3] s

h) Find the instantaneous velocity at $t = 0.4$ sec from the graph. 37.4 cm/s

i) And compare it with the result in question (b).

$$p.e = \left| \frac{38.2 - 37.4}{(38.2+37.4)/2} \right| * 100\% = 2.12\%$$

j) Calculate the area under the instantaneous velocity in the interval [0.2-0.4] sec.



Area = $\frac{1}{2} b(c-a) + b*a = (\frac{a+c}{2})b$

$$Area = \overset{(1)}{\frac{(35+34.5)}{2} * 0.05} + \overset{(2)}{\frac{(37+35)}{2} * 0.05} + \overset{(3)}{\frac{(37+37.4)}{2} * 0.05} = 5.4 \text{ cm}$$

k) What does this area represent? Δx_{4-2} (the distance moved in the interval [0.2-0.4])

l) Compare it with the distance moved in the interval [0.2-0.4] sec from table (1).

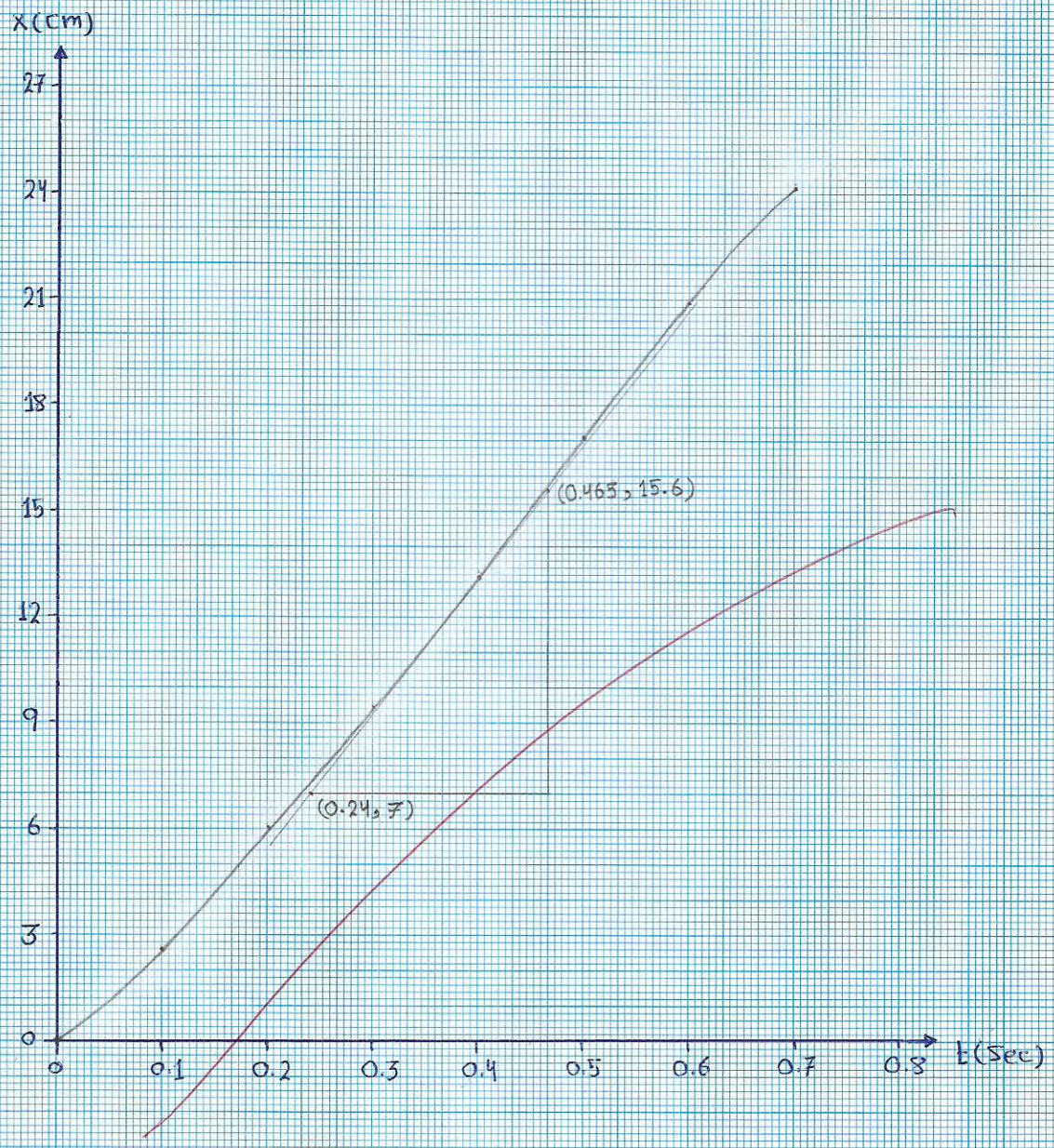
$$p.e = \left| \frac{7.2 - 5.4}{(7.2+5.4)/2} \right| * 100\% = 28.57\%$$

Use Table (3) to answer the following questions:

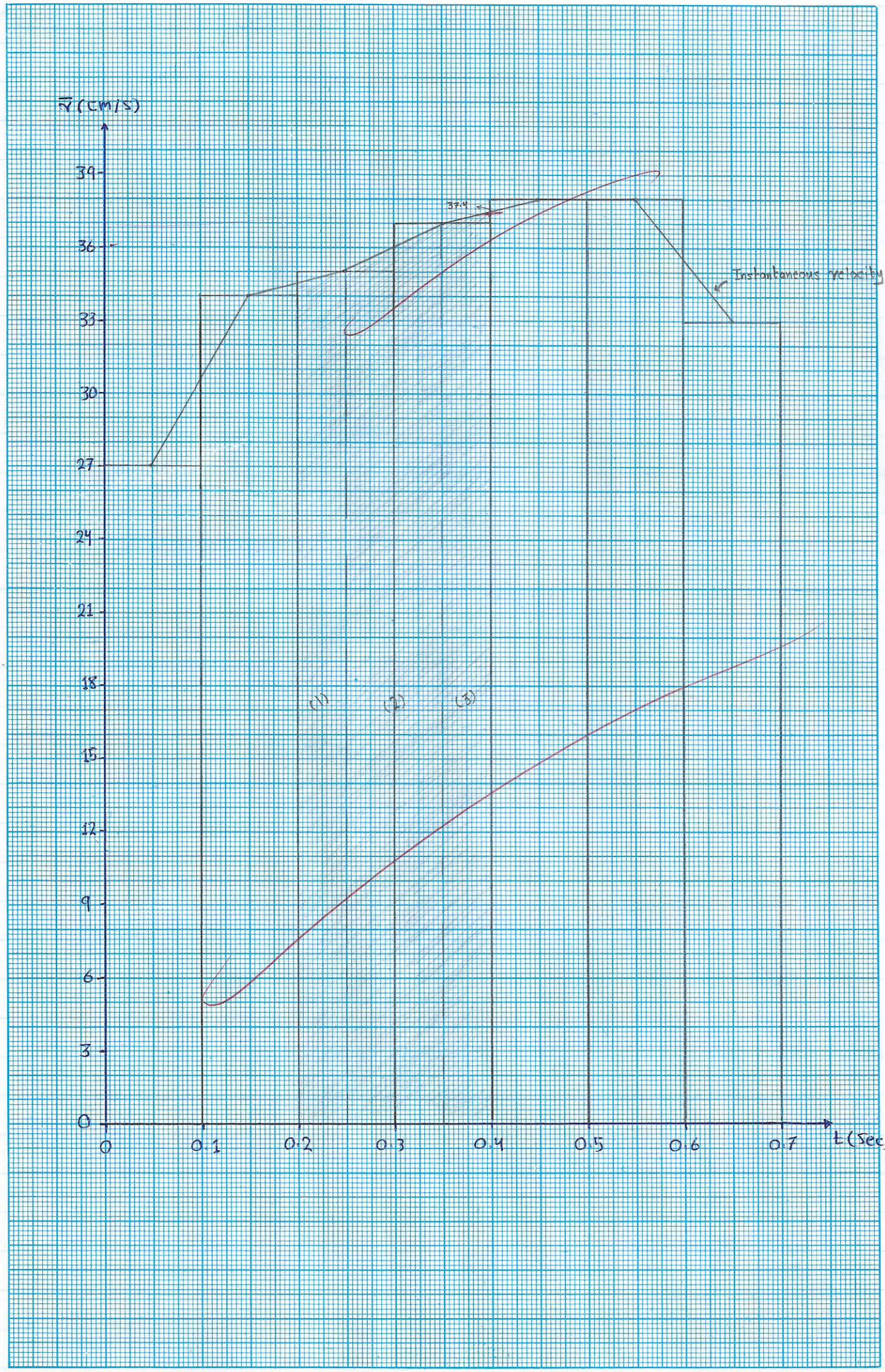
m) How does the acceleration change from one interval to the other (is it uniform or regular)?

The acceleration is changing irregularly.

Total distance (X) Versus Total time (t) graph



Average velocity ($\bar{v}$) versus (t) graph



Force and Motion: Newton's Second Law

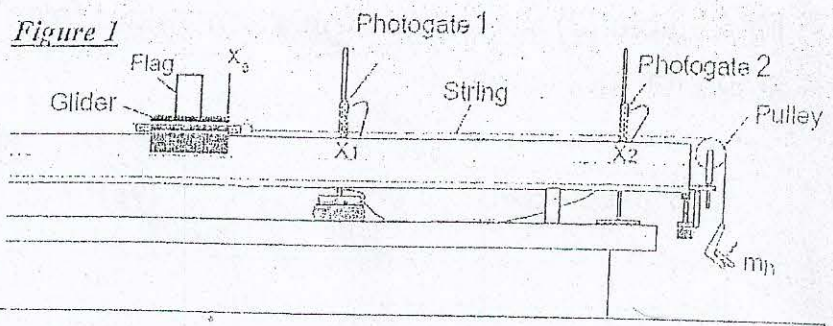
Name: بشار عبد القادر العقايلة Partners: ..... Instructor: سماح النمر

ID#: 1440224 ..... Section: 16

Purpose: To investigate Newton's second law: How a given force accelerates different masses and how different forces accelerate a given mass.

In figure (1)
M: mass of glider
m_a: added mass on glider
m_h: hanging mass

Figure 1



The theoretical equation of motion for the system in **figure (1)** is: $m_h g = (M + m_a + m_h)a$

Part (I): Acceleration and added mass with constant driving force.

Fill in table (1) with data from your experiment.

Table (1) m_h (hanging mass) = 50g : بثبوت

Glider's mass = 0.1 kg			
Air pressure# (قوة المضخة)	Added mass m_a (kg)	Acceleration a (m/s^2)	1/a $(m/s^2)^{-1}$
4	0.000	3.189	0.3136
5	0.020	2.825	0.3539
6	0.050	2.206	0.4533
7	0.100	1.823	0.5485

لـ تضاف على جانبي الـ glider

Make a graph for m_a versus 1/a. Then answer the following questions.

a) What is your conclusion about the way in which the acceleration depends on the magnitude of the added mass? When we increase the magnitude of the added mass the acceleration decreases. (the relation is inverse and Linear)

b) Find the slope of your (m_a-1/a) graph. Slope $= \frac{\Delta m_a}{\Delta a^{-1}} = \frac{0.0335 - 0.025}{0.4 - 0.37} = 0.45\,N$

What does the slope represent? The slope represents the driving force ($m_h * g$). وزن الكتلة المعلقة

c) Determine the value of the glider mass (M) from the (m_a-1/a) graph. And compare it with the real value.

* $y = \text{slope}\, x + y_{intercept} \Rightarrow m_a = \frac{0.45}{a} + y \Rightarrow$ when $m_a = 0$: $0 = 0.45 * 0.3136 + y \Rightarrow$ y-intercept $= -0.14$ Kg

* Slope $= m_h g \Rightarrow m_h = 0.45/9.81 \Rightarrow m_h = 0.0459$ Kg * $|y\text{-intercept}| = M + m_h \Rightarrow M = 0.0941$ Kg

* $P.e = \left|\frac{M_{acc} - M}{M_{acc}}\right| * 100\% = \left|\frac{0.1 - 0.0941}{0.1}\right| * 100\% = 5.9\%$

Part (II): Acceleration and driving force with constant total mass.

Fill in table (2) with the acceleration values from your experiment. Then, draw a graph for $m_h g$ versus a.

Table (2) M (mass of glider) = 100 g ثبوت :

Air pressure#	m_a (g)	m_h (g)	$m_h g$ (dyne)	a (cm/s^2)
7	100	لا يعمل تجربة 50	49000	185.1
6	50	100	98000	360.1
5	20	130	127400	527.1
4	0	150	147000	608

a) What is your conclusion about the way in which the acceleration depends on the magnitude of the hanging mass?

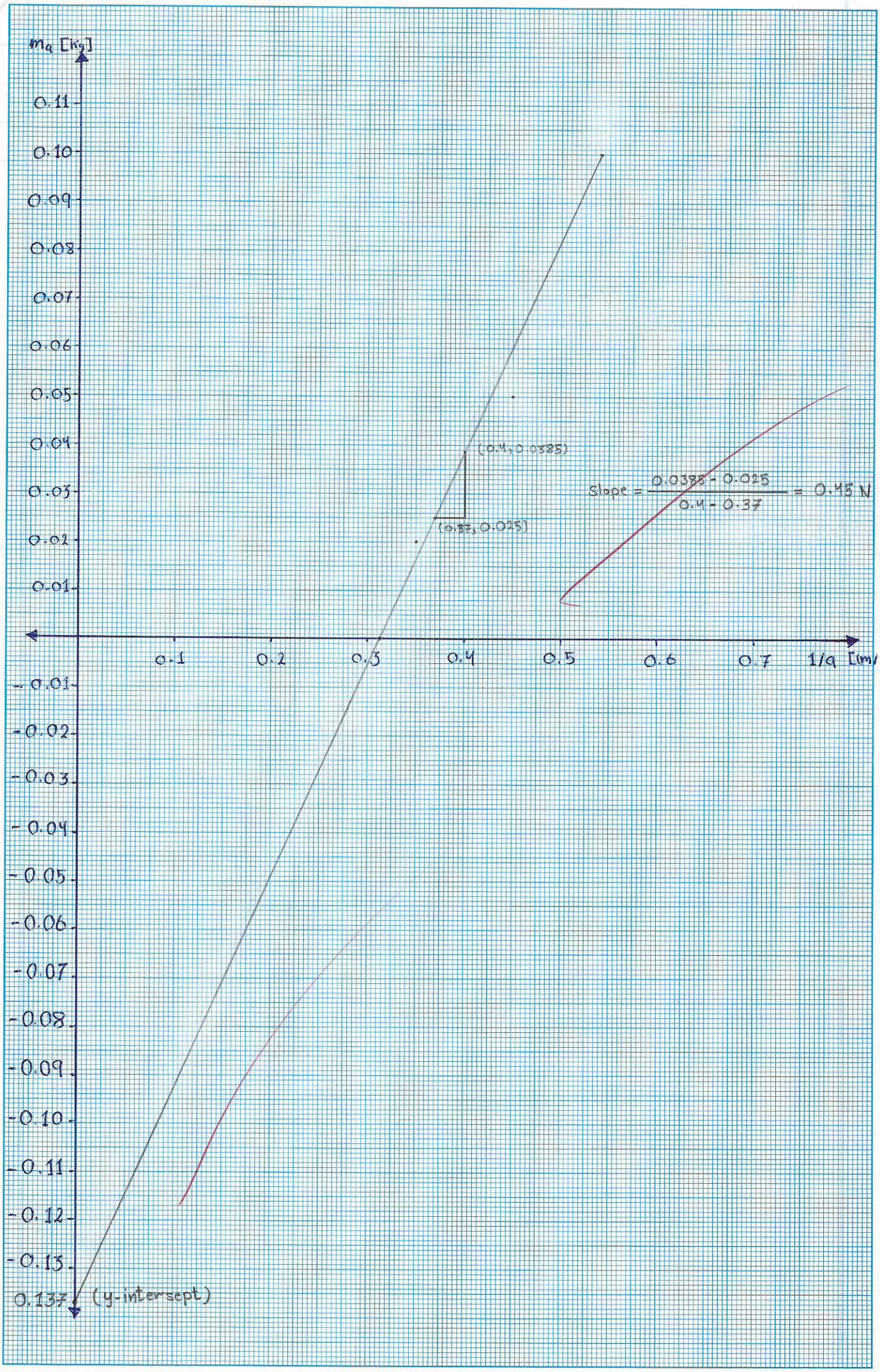
When we increase the magnitude of the hanging mass, the acceleration increases (the relation is direct and linear).

b) Find the slope of your $m_h g$ versus a graph. What does the slope represent?

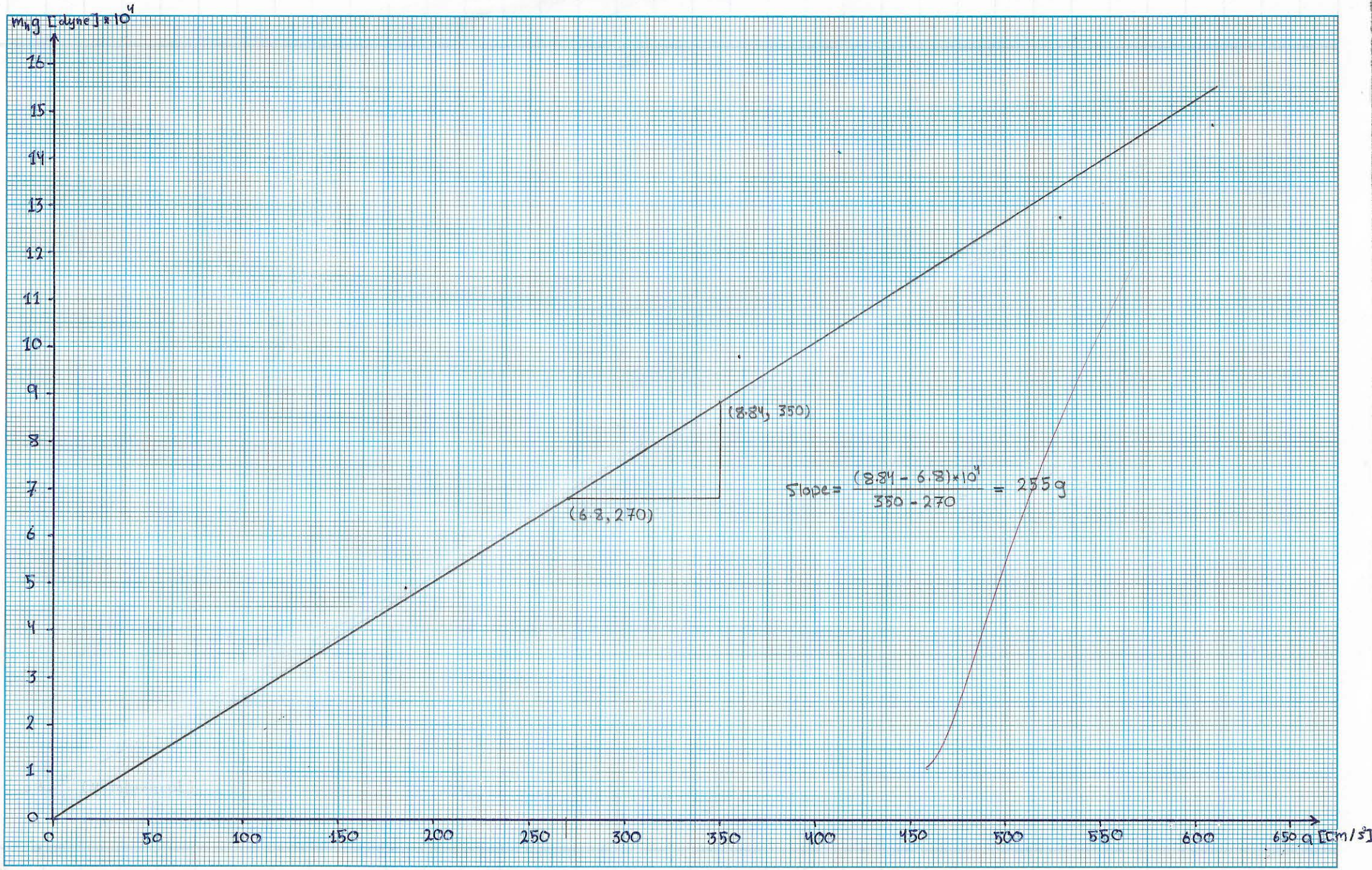
$$\text{Slope} = \frac{\Delta m_h g}{\Delta a} = \frac{(8.84 - 6.5) * 10^4}{350 - 270} = 255 \text{ g}$$; It represents the total Mass ($M + m_a + m_h$).

c) Do you expect that the curve should pass through the origin? **Explain** your answer.

Yes, I do ; When there is no hanging mass, the acceleration will be zero (0, 0) → a, $m_h g$



" m_a Versus 1/a graph "



« $m_h g$ versus a graph »

2) أحمد عبد اللطيف الحاج
1533493

LAB REPORT FOR EXPERIMENT 8

Date: 30/3/2017

Name: بشار عبد القادر الحنابلة

Partner's Name: 1) عثمان ناصر الخلايلة

Registration No: 1440224

Registration No: 1438579

Physics Section: 16

Instructor's Name: ٣. سماح النمر

PHYSICS LAB EXPERIMENT 8: SIMPLE HARMONIC MOTION : THE SIMPLE PENDULUM

I. PURPOSE :

Study the relation between the period of oscillation (T) and the length of the pendulum (L)

قياس الجاذبية للكواكب

II. DATA AND DATA ANALYSIS :

1. Compute the average of the period for each length of the pendulum and record them in Table 8.1.

2. Fill in the average periods $\overline{T}$ and the lengths L in table 8.2.

Table 8.1

	L_1= 30 cm	L_2= 45 cm	L_3= 60 cm	L_4= 75 cm	L_5 = 90 cm	L_6 = cm
Trial No.	t /20 (s)	t /20 (s)	t /20 (s)	t /20 (s)	t /20 (s)	t /20 (s)
1	1.11	1.34	1.53	1.73	1.88	—
2	1.10	1.31	1.54	1.75	1.94	—
3	1.06	1.33	1.50	1.74	1.89	—
4	—	—	—	—	—	—
5	—	—	—	—	—	—
	$\overline{T}_1$ = 1.09 s	$\overline{T}_2$ = 1.33 s	$\overline{T}_3$ = 1.52 s	$\overline{T}_4$ = 1.74 s	$\overline{T}_5$ = 1.90 s	$\overline{T}_6$ = — s

عشر دورات (t/10)

تعبر عن الزمن الدوري لكل طول

Table 8.2

L (cm)	$\overline{T}$ (s)	$\overline{T}^2 (s^2)$
30	1.09	1.1881
45	1.33	1.7689
60	1.52	2.3104
75	1.74	3.0276
90	1.90	3.61

3. Compute the square of the average period for each length and record it in Table 8.2.
4. Use your data in Table 8.1 to plot $\bar{T}$ versus L. What conclusion can you obtain from your graph?

The relation between $\bar{T}$ and L is direct but non-Linear.

5. Now plot $\bar{T}^2$ versus L using Table 8.2. What kind of relationship do you obtain?

The relation between $\bar{T}^2$ and L is direct and Linear.

6. Compute the slope of your graph plotted in 4 above.

$$\text{Slope} = \frac{\Delta \bar{T}^2}{\Delta L} = \frac{2 - 1.625}{50 - 41} = 0.042 \ s^2/cm$$

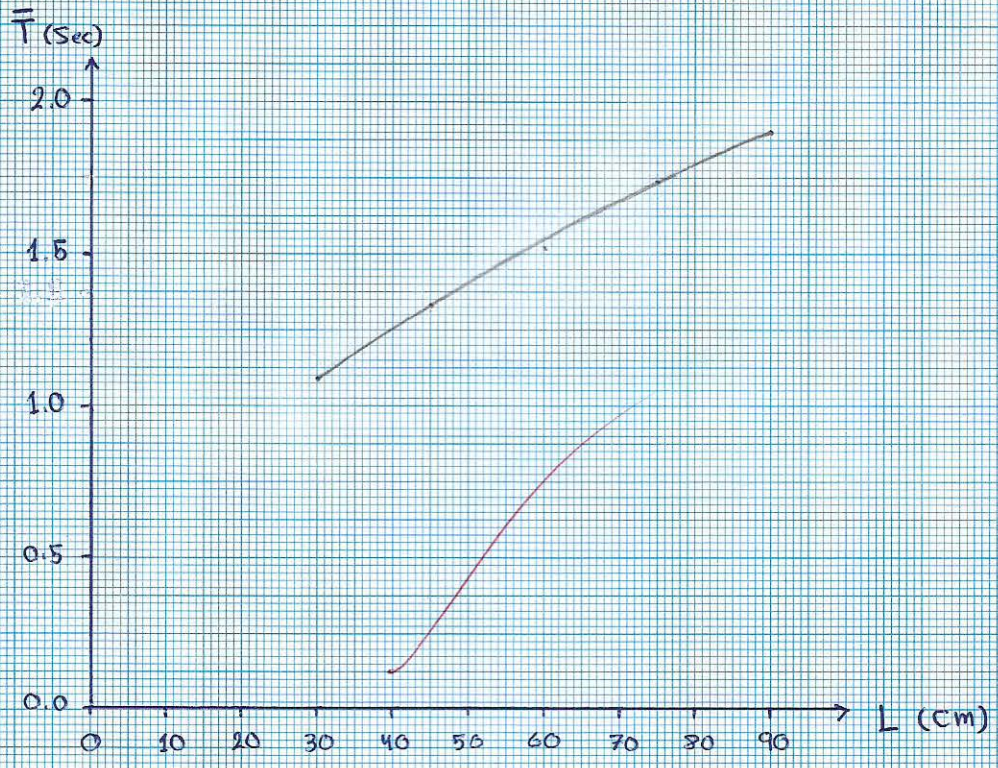
7. Using the value of the slope you obtained calculate g, the acceleration due to gravity.

$$\text{Slope} = \frac{4\pi^2}{g} = 0.042 \Rightarrow g = \frac{4\pi^2}{0.042} = 939.96 \ cm/s^2$$

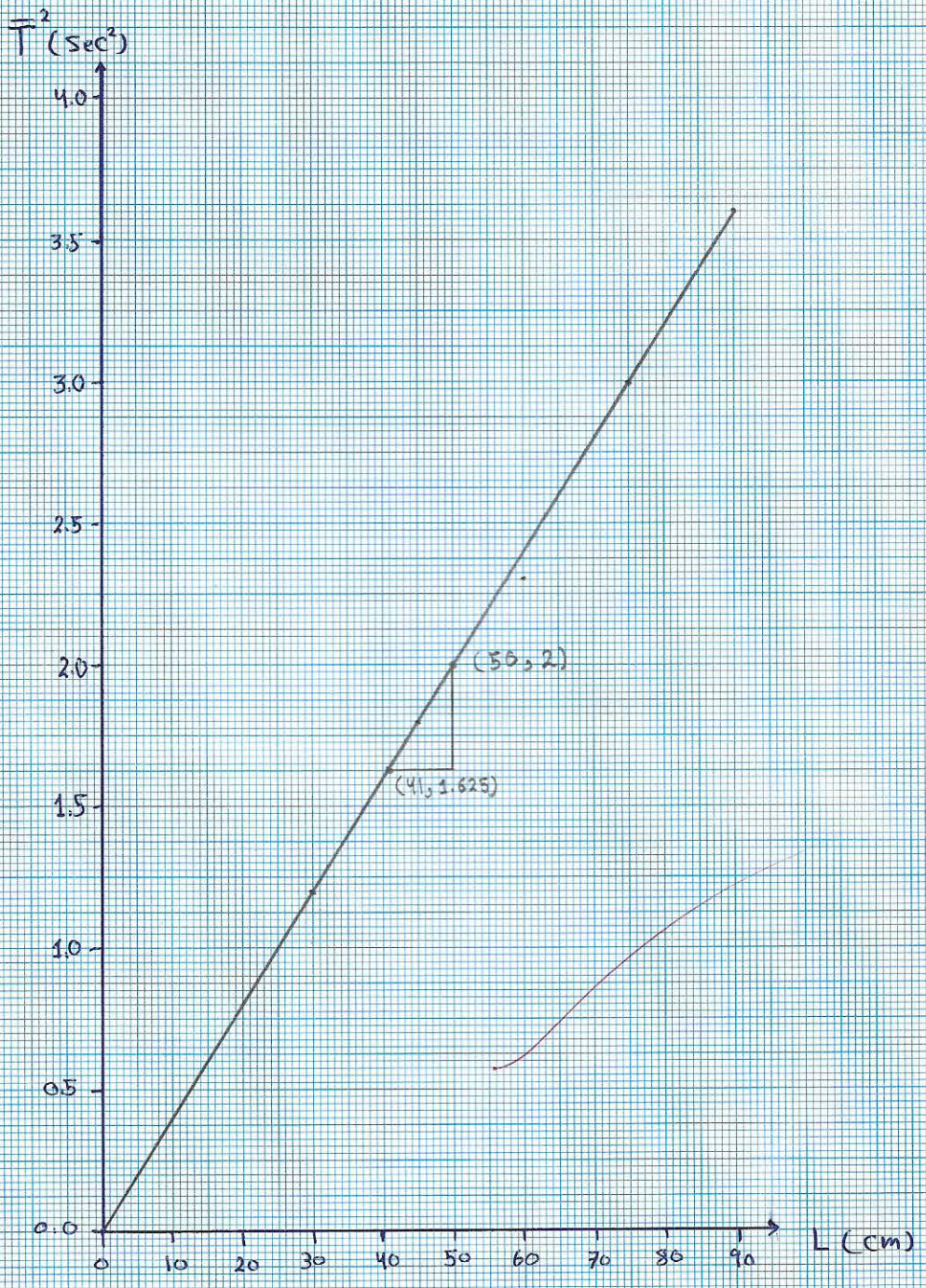
8. Estimate the error in g. $g_t = 981 \ cm/s^2$

$$p.e = \left| \frac{981 - 939.96}{981} \right| * 100\% = 4.2\%$$

$\bar{T}$ v.s L graph



T^2 v.s L graph.


T² (sec²)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
(50, 2)
(41, 1.625)
0
10
20
30
40
50
60
70
80
90
L (cm)

LAB REPORT FOR EXPERIMENT 9

Date: 30/3/2017

Name: بشار عبد القادر العقايلة

Partner's Name: ———

Registration No: 1440224

Registration No: ———

Physics Section: 16

Instructor's Name: م. سمية النمر

PHYSICS LAB EXPERIMENT 9: THE LAWS OF GASES

I. PURPOSE :

Investigate the variation in the volume of entrapped gas (air) with pressure under constant room temperature, and find the atmospheric pressure.

II. DATA AND DATA ANALYSIS :

A. Boyle's Law

1. Enter the data in Table (9.1) below:

Table (9.1)

Scale Readings (mm)		L = B-X (mm)	h = Y-X (mm)	1/L (mm^{-1})
X	Y			
165	120	435	-45	$2.30 * 10^{-3}$
171	140	429	-31	$2.33 * 10^{-3}$
195	210	405	15	$2.47 * 10^{-3}$
211	288	389	77	$2.57 * 10^{-3}$
230	345	370	115	$2.70 * 10^{-3}$
245	400	355	155	$2.82 * 10^{-3}$
—	—	—	—	—
—	—	—	—	—
B = 600 mm				
Average Room Temp. = 20 °C				

← الخطأ لعدم ارفاقي ورقة التقويم التي تحوي القراءات

-1

2. Plot 1/L as independent variable against h. Use the graph to find the value of the atmospheric pressure $P_a \pm \Delta P_a$.

$P_a = 915$ mm Hg (1y-intersept)

3. Calculate the pressure of the entrapped gas P in each case, using the relation: $P = (P_a + h)$ and also calculate the quantity PL and enter their values in Table (9.2) below :

Table (9.2)

L (mm)	$P = P_a + h$ (mm Hg)	P L (mmHg . mm)
435	915 + (−45) = 870	378450 = 37.85 × 10^4
429	915 + (−31) = 884	379236 = 37.92 × 10^4
405	915 + 15 = 930	376650 = 37.67 × 10^4
389	915 + 77 = 992	385888 = 38.59 × 10^4
370	915 + 115 = 1030	381100 = 38.11 × 10^4
355	915 + 155 = 1070	379850 = 37.99 × 10^4

4. Plot a second graph between L as independent variable and $P = (P_a + h)$. What do you conclude from such a curve?

PV = constant
↓ ↑

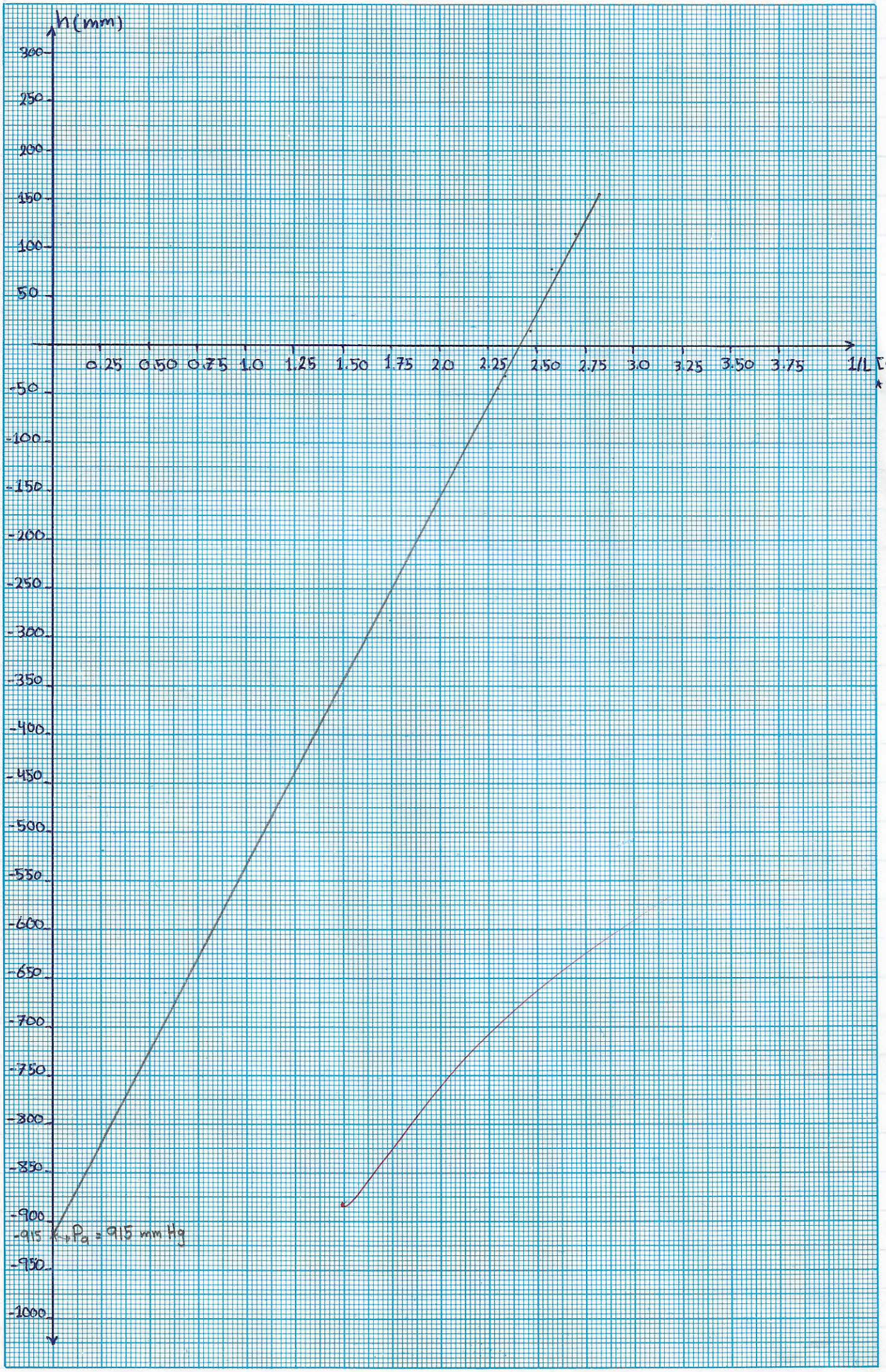
The relation between (L) and (P) is an inverse and non-linear relation

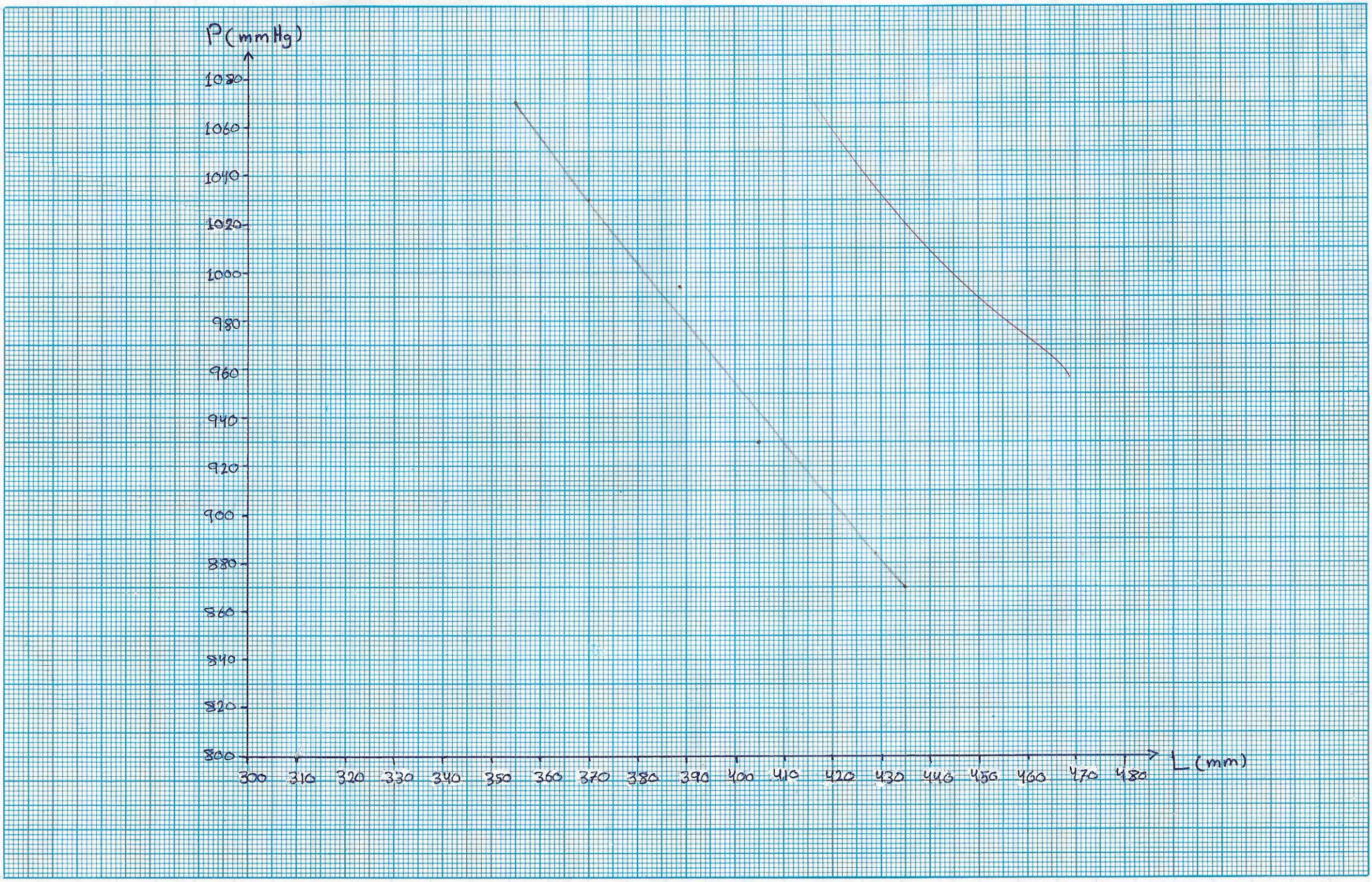
5. Plot a third graph between L as independent variable against PL . What do you conclude from this graph?

PV = constant
↓ ↑

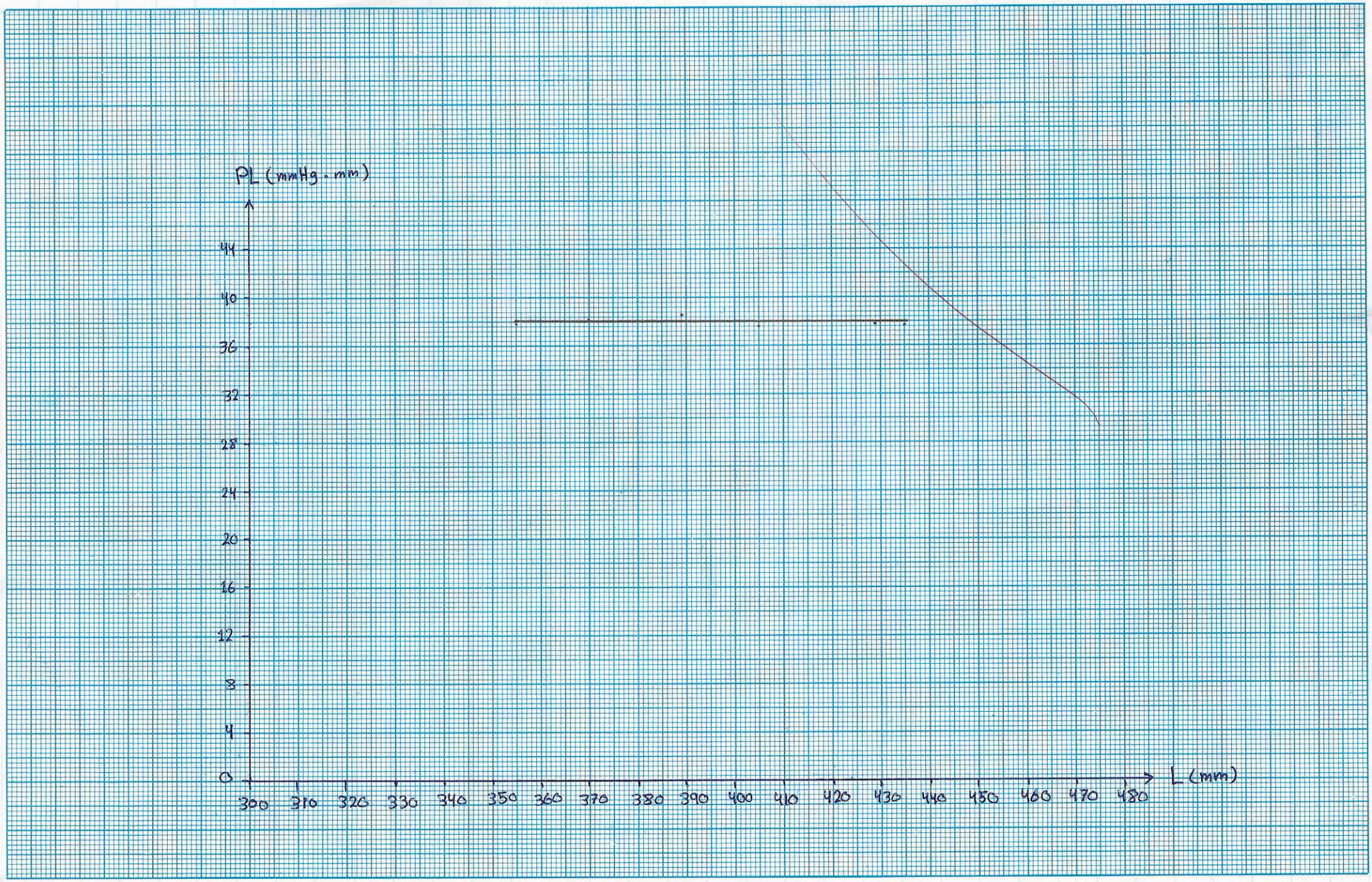
The relation between (L) and (PL) is a constant relation.

graph (h) vs (1/L)


h (mm)
300
250
200
150
100
50
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
-600
-650
-700
-750
-800
-850
-900
-915
-950
-1000
0.25
0.50
0.75
1.0
1.25
1.50
1.75
2.0
2.25
2.50
2.75
3.0
3.25
3.50
3.75
1/L [mm⁻¹] * 10⁻³
P_a = 915 mm Hg


P (mmHg)
1080
1060
1040
1020
1000
980
960
940
920
900
880
860
840
820
800
300
310
320
330
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
L (mm)

(P) v.s (L) graph


PL (mmHg . mm)
44
40
36
32
28
24
20
16
12
8
4
0
300
310
320
330
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
L (mm)

(PL) v.s (L) graph

LAB REPORT FOR EXPERIMENT 11

Date: 06/04/2017

Name: بشار عبدالقادر العقايلة

Partner's Name: ———

Registration No: 1440224

Registration No: ———

Physics Section: 16

Instructor's Name: أ.سما النمر

PHYSICS LAB EXPERIMENT 11: SPECIFIC HEAT CAPACITY OF METALS

I. PURPOSE :

To Determine the specific heat capacity of unknown metal based on the principle of calorimetry.

II. DATA AND DATA ANALYSIS :

1. Enter the data in Table (11.1) below:

Table (11.1)

Specific heat capacity of calorimeter C_1	= 0.22 cal/g °C
Specific heat capacity of water C_w	= 1 cal/g °C
Mass of calorimeter M_1	= 63.15 g
Mass of calorimeter + water	= 96.96 g
Mass of water M_w	= 33.81 g
Temp. of calorimeter. +water T_1	= 21 °C
Temp. of metal T_2	= 95 °C
Final Equilibrium Temp. T_f	= 26 °C
Mass of metal M_2	= 36.66 g

2. What are the possible sources of error in this experiment?

1. error in measuring substance weight.

2. Loss of heat

3. Some personal errors.

3. Calculate the specific heat capacity (C_2) of the metal using the following equation:
Heat gained (by calorimeter + water) = Heat lost (by metal)

$$C_1M_1(T_f-T_1)+C_wM_w(T_f-T_w)=-C_2M_2(T_f-T_2)$$

$$(C_1M_1+C_wM_w)(T_f-T_1)=C_2M_2(T_2-T_f)$$

$$(0.22\times 63.15+1\times 33.81)(26-21)=C_2\times 36.66(95-26)$$

$$\Rightarrow C_2=0.094\ cal/g.°C$$

4. Calculate ΔC_2 and express your final result as : $C_2 \pm \Delta C_2$. $\Delta M = 0.01\ g$
$\Delta T = 0.1°C$

« derived quantity »

$$C_2=\frac{(C_1M_1+C_wM_w)(T_f-T_1)}{M_2(T_2-T_f)}\quad\left(\frac{xy}{M_2z}\right)$$

1. $x=C_1M_1+C_wM_w=0.22\times 63.15+1\times 33.81=47.7\ Cal/°C$

$$\Delta x=\sqrt{(C_1\Delta M_1)^2+(C_w\Delta M_w)^2}=(0.22\times 0.01)^2+(1\times 0.01)^2=0.01\ Cal/°C$$

2. $y=T_f-T_1=26-21=5°C$

$$\Delta y=\sqrt{(\Delta T_f)^2+(\Delta T_1)^2}=0.14°C$$

3. $z=T_2-T_f=95-26=69°C$

$$\Delta z=\sqrt{(\Delta T_2)^2+(\Delta T_f)^2}=0.14°C$$

$C_2 \pm \Delta C_2 = 0.094 \pm 0.0026$ Cal/g.°C

4. $$\Delta C_2=\sqrt{\left(\frac{\Delta x}{x}\right)^2+\left(\frac{\Delta y}{y}\right)^2+\left(\frac{\Delta z}{z}\right)^2+\left(\frac{\Delta M_2}{M_2}\right)^2}\times C_2$$

$$=\sqrt{\left(\frac{0.01}{47.7}\right)^2+\left(\frac{0.14}{5}\right)^2+\left(\frac{0.14}{69}\right)^2+\left(\frac{0.01}{36.66}\right)^2}\times 0.094$$

5. What is the heat capacity of the metal sample?

$$C=C_2M_2=0.094\times 36.66=3.45\ Cal/°C$$

6. How much heat is required to raise the temperature of 120g of Aluminum from 25 °C to 140 °F .

$\Delta Q = cM * (T_f - T_i) \leftarrow \Delta T$

$= 0.094 * 120 (60 - 25)$

$= 394.8$ Cal.

$* \; T_f = 1.8 T_c + 32$

$140 = 1.8 T_c + 32$

$\Rightarrow T_c = 60°C$