ElCoM
ELECTRICAL COMPUTER MECHATRONICS

تقدم لجنة ElCoM الاكاديمية

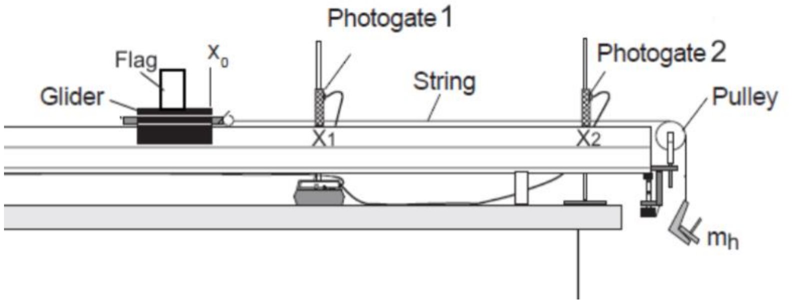
ريبورتات لمختبر :

الفيزياء العامة العملية

Force and Motion: Newton's Second Law

Name: Mohammed H Abadi　　Partner:.................................　　Instructor: Iyaad

ID#: 2034513　　ID#: ....　　Section: 14



In figure **M**: mass of glider
m_a: added mass on glider
m_h: hanging mass
The theoretical equation of motion for this system is:

$$m_h g = (M + m_a + m_h)a$$

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

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

Fill in **table (1)** with data from **your experiment**. Make a graph for **m_a** versus **1/a.** Then answer the following questions.

Glider's mass = 0.1 kg			
Air pressure #	Added mass m_a (kg)	Acceleration **a** (m/s^2)	**1/a** $(m/s^2)^{-1}$
4	0	3.17	0.31545741
5	0.020	2.91	0.34364261
6	0.050	2.45	0.40816326
7	0.100	1.92	0.52083

a) What is your conclusion about the way in which the acceleration depends on the magnitude of the added mass ? When I increase magnitude of adding mass , the acceleration is decreased.

b) Find the slope of your **(m_a-1/a)** graph.

Slope $= \frac{\Delta y}{\Delta x} = \frac{0.1-0}{0.52-0.315} = 0.4878$ ($kg.m/s^2$)

What does the slope represent? Driving force ($m_h g$)

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

From equation (1) (موجودة على الرسالة الأولى) , if $m_a = 0$, then :

$$M = \frac{-(M_a)(a)}{g} + 0.148 - \frac{0.148(a)}{g}$$

$$= 0 + 0.148 - \frac{0.148(3.17)}{9.8} = \mathbf{0.10012653}$$

Percent error $= \frac{|0.1-0.10012653|}{0.1} \times 100\% = 0.12653\%$

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

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

Air pressure	m_a (g)	m_h (g)	$m_h g$ (dyne)	**a** (cm/s^2)
7	100	50	49000	192
6	50	100	98000	398.2
5	20	130	127400	501.6
4	0	150	147000	587.3

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

When I increase the magnitude of hanging mass, the acceleration increase (directly) .

b) Find the **slope** of your $\boldsymbol{m_h g}$ versus $\boldsymbol{a}$ graph. What does the slope represent?

Slope = $\frac{\Delta y}{\Delta x} = \frac{1.47\times10^5-0}{587.3-0}$ = 250.2 (dyne.s^2/cm) , and represent ($m_h+m_g+m_a$).

c) Do you expect that the $\boldsymbol{m_h g}$ versus $\boldsymbol{a}$ curve should pass through the origin? **Explain** your answer.

Yes, because when $m_h = 0$, $a = 0$, from equation (2) , then the point should be (0,0).

$$m_h g = (m_h + m_a + m_g)\,a$$

$$\frac{1}{a}(m_h g) = (m_h + m_g) + m_a$$

$$y = x\,m + y$$

$$m_a = \frac{1}{a}(m_h g) - (m_h + m_g)$$

m_a → y; $\frac{1}{a}$ → x; $(m_h g)$ → slope; $(m_h + m_g)$ → y-intercept

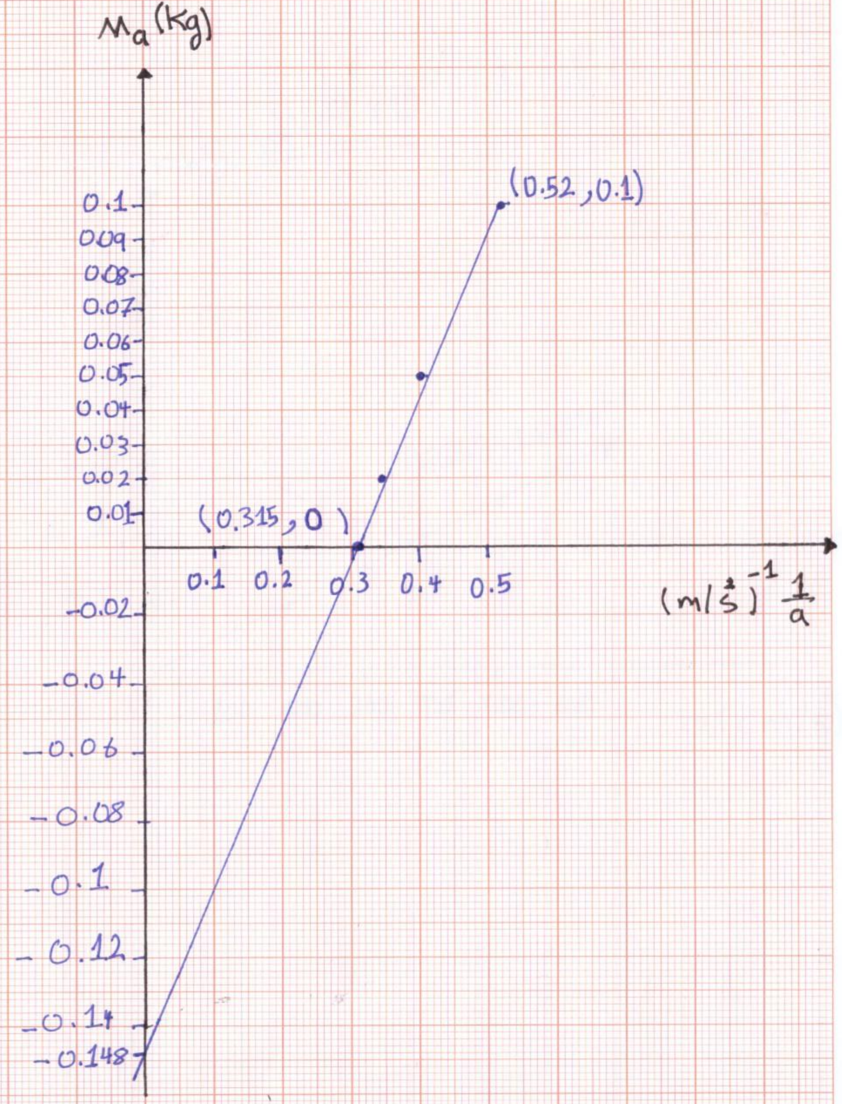
Equation [1]

$$m_g = -m_a + \frac{m_h(g)}{a} - m_h$$

↳ but: $-m_h - m_g$ = y-intercept

$$-(m_h + m_g) = -0.148$$

$$m_h = -m_g + 0.148$$



Equation (2)

$$m_h g = (m_h + m_g + m_a)\, a$$

$m_h g$ → Y, $(m_h + m_g + m_a)$ → Slope, a → X