TP 02: 2^{nd} law of Newton

II

1.TP N02

Conduct of the experiment: ……/……../…….
Corrector teacher : …….
Report made by :

Name	First name	group	Subgroup	Prep_note	Final note
				/5	/20
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College year :2023/2024

1.Purpose of the experiment

"The goal is to demonstrate Newton's second law with a simple experiment." « $\vec{F}=m\vec{a}$ »[1] **.** thus to determine the value “g” of the acceleration of gravity.

2. Preparation work

In Figure -1- a weight “m2” is shown immersed in the Gravitational field, acquiring a movement. It drives, via an inextensible wire, a self-supporting mobile of mass “m1” which slides on a rail without friction.We neglect the mass of the pulley as well as the friction of the wire passing through its throat.

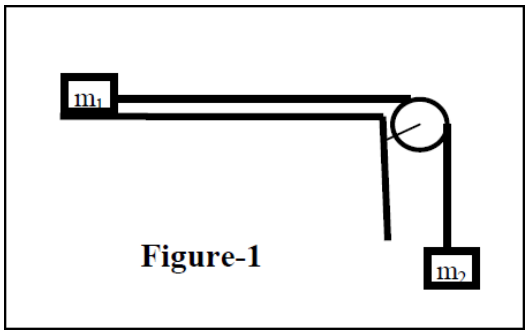

Figure-1

1- Take inventory of the external forces applied to the self-supporting mobile of mass “m1” and to the weight “m2» in figure -1-

2- Apply Newton's second law to the self-supporting mobile (m1) and the weight (m2)

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3- By projecting these onto different axes. Write the force equations for each mass

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3- Derive the literal expression for the acceleration (a) of the system as a function of m1, m2 and g.

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5-What is the type of movement?

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6-Give the temporary equation of this movement

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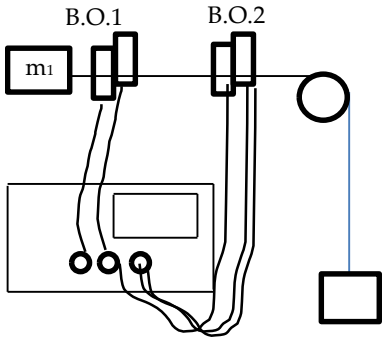
3. Practice

3.1 Study of distance variations as a function of time



Set up the experimental setup for Figure 2:

- m1: trolley with overload.
- m2: weights.
- B.O.1: Optical barrier.
- B.O.2: Optical barrier.
- Weigh the mass of trolley m1 and then add a 100g mass.
- Place a 55g mass on the mass port such that m2 = 60g.
- Place the small rod on the trolley and measure its width.
- Initially position the optical barrier at a specific location.
- Start the air blower.
- Set the stopwatch to zero and release the motion.
- Take two measurements.
- Choose a new step distance of 10 cm and repeat the previous steps.

Table 1

$S = S_f - S_0 (cm)$	30	40	50	60	70
t_1					
t_2					
t_{moy}					
t_{moy}^2					
γ					
g					
Δg					

Questions

1. Fill in Table 1.
2. Plot the curve $S = f(t^2)$ (figure below). Then deduce the value of g_{exp}

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3. Deduce from the table the value of g for the city of M'sila and express it as $g_{exp} = \overline{g} \pm \Delta g$

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4. What short or long distances do you use to obtain the best value of g_{exp}

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3.2 Relationship between acceleration and force

We study the relationship between the acceleration of the system and the accelerating force (F), while keeping the total mass m1 + m2 of the system constant. We take the acceleration due to gravity g_{exp} from the first part.

- To vary F, we remove mass from one side and add it to the other.
- Fix the optical barriers at long distances.
- Record in Table 2 the respective values of the passage times« δ_t » for the rod of width $\delta x = 5mm$ .Repeat the operation a second time.
- Return the trolley to the initial position and set the stopwatch so that it indicates the time t it takes to pass through each optical barrier. Repeat the operation a second time.

Questions

1. Fill in Table 2.
2. What do you observe about the ratio F/γ ?

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3. Plot the variation of « F » with « γ » (figure below).
4. What does the slope represent? Compare it to the ratio« F/γ »?

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Table 2

m_2(g)	5	10	20	30	40
m_1					
$[m_1+m_2]$(g)	305	305	305	305	305
$F = m_2\bar{g}(N)$					
$t_1(s)$					
$t_2(s)$					
$\delta t_1(s)$					
$\delta t_2(s)$					
$v_1 = \delta x/\delta t_1\,(m/s)$					
$v_1 = \delta x/\delta t_2\,(m/s)$					
$\gamma = v_2 - v_1/t_2 - t_1$					
F/γ					

Conclusion

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