Practical Work N°3: Verification of Newton's law

I- Objective of the experiment:

- Verification of Newton's law.

-Determine the acceleration due to gravity.

-Create strong friction.

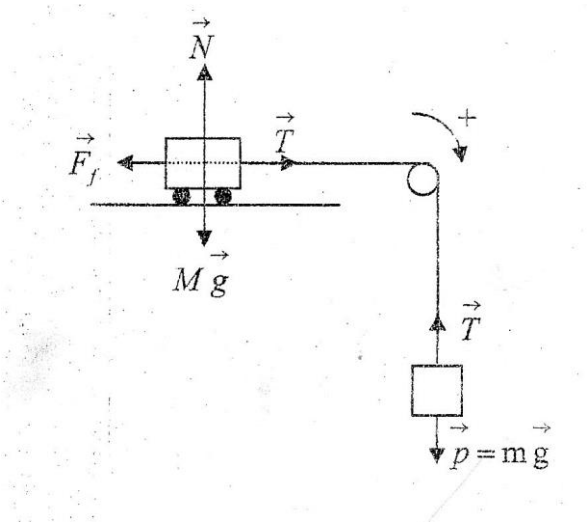
II-Theoretical principle:

Let us consider a cart with a mass M moving on a horizontal rail, and the latter is pulled by an inextensible string passing over a pulley groove, with a mass m tied at its end.

Applying Newton's second law while neglecting the mass of the pulley, we get the following

For the mass M:

$$\sum \vec{F_i} = m\vec{\gamma}$$
$$\Leftrightarrow T - F_f = M\gamma$$
$$\Leftrightarrow T = M\gamma + F_f \ldots\ldots\ldots\ldots\ldots\ldots (1)$$



For the mass m:

$$\sum \vec{F_i} = m\vec{\gamma}$$
$$\Leftrightarrow mg - T = m\gamma \ldots\ldots\ldots\ldots\ldots (2)$$

Substituting (1) into (2), we find

$$mg - M\gamma - F_f = m\gamma \Leftrightarrow (m+M)\gamma = mg - F_f$$
$$\Leftrightarrow \gamma = \frac{mg - F_f}{M+m} \ldots\ldots (3) \Leftrightarrow F_f = mg - (M+m)\gamma \ldots\ldots\ldots (4)$$

Since the acceleration of the cart's movement, γ, is non-zero and the cart moves without initial speed, and $\gamma = \frac{d^2H}{dt^2}$ and $v = \frac{dH}{dt}$

Distance traveled so that we have: $H = \frac{1}{2}\gamma t^2 \Rightarrow H = \frac{1}{2}\left[\frac{(mg - F_f)}{(M+m)}\right]t^2$

-III Experience:

Experimental setup for measuring time and distance traveled

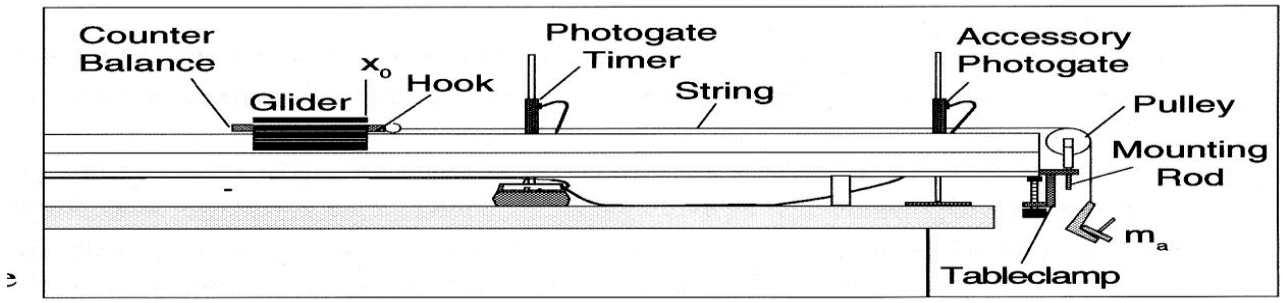


Figure 1

Achieve the experimental setup shown in Figure 1.

-We install the cart, put the timer in time-two gates-start, then release the cart and read the time of the distance traveled, change the distance and put the results in the corresponding table. The recorded time corresponds to the distance traveled by the vehicle between the two light barriers.

Cart mass M=200 g and m=20g.

H(cm)	t_1(s)	t_2(s)	t_3(s)	t_m(s)	t^2(s)	γ(cm/s^2)	$\gamma\Delta$
20							
40							
60							
80							

1- Fill in the table and explain the method of filling the table with an example….