



PHYSICS LAB

(20147)

Experiment No. 5

Newton's Second Law

Acceleration Due to Gravity

Exp.no.5 Newton's Second Law

Acceleration Due to Gravity

Newton's second law takes the form

$$\sum \mathbf{F} = m \mathbf{a}$$

Where $\sum \mathbf{F}$ is the resultant force acting on an object and cause its motion.

m is the mass of the object.

a is the acceleration of the object.

We shall use this law to determine the acceleration of gravity by studying the freely motion of an object on a frictionless incline surface.

Motion of an object on an incline surface

According to Newton's second law, the force caused the motion of the object is

$$m g \sin \theta$$

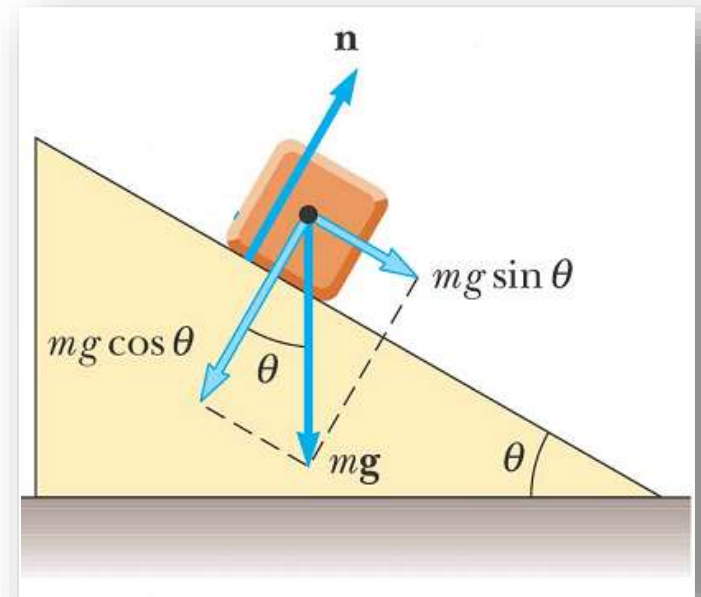
We can write

$$m g \sin \theta = m a$$

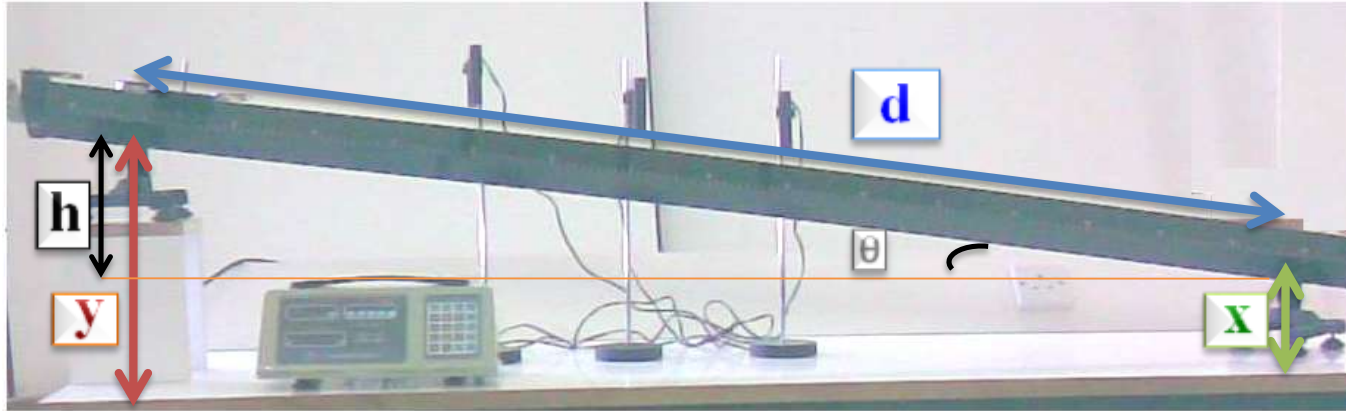
or
$$g \sin \theta = a$$

From which we determine the acceleration due to gravity as

$$g = \frac{a}{\sin \theta}$$



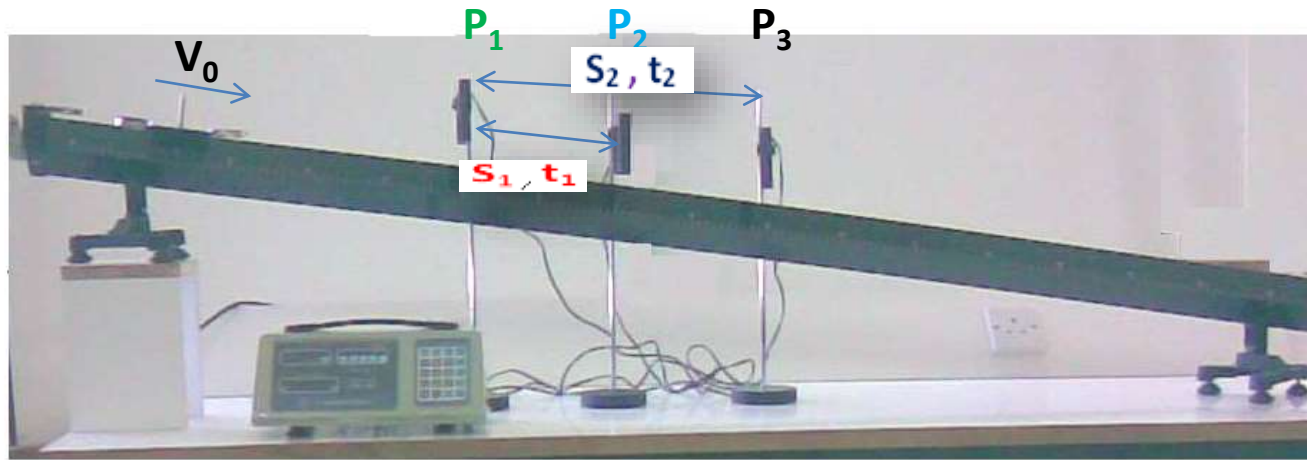
To find $\sin \theta$ experimentally



we have $\sin \theta = \frac{h}{d}$, but $h = y - x$

Therefore $\sin \theta = \frac{y - x}{d}$

To determine a experimentally



According to the laws of motions

$$S_1 = V_0 t_1 + \frac{1}{2} a t_1^2 \dots\dots\dots (1)$$

$$S_2 = V_0 t_2 + \frac{1}{2} a t_2^2 \dots\dots\dots (2)$$

Solving eqs. 1 and 2, we get

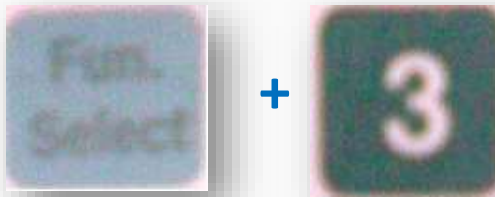
$$a = \frac{2(S_2 t_1 - S_1 t_2)}{t_1 t_2 (t_2 - t_1)}$$

$$g = \frac{ad}{h}$$

How to operate the electronic timer for the first time

1. Turn the power switch on.

2. Press



3. Press many times.



4. Connect the photo cells in the right order.



1.



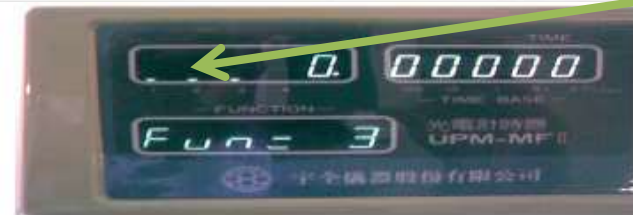
2.



3.



4.



How to take readings by the electronic timer

1. Press



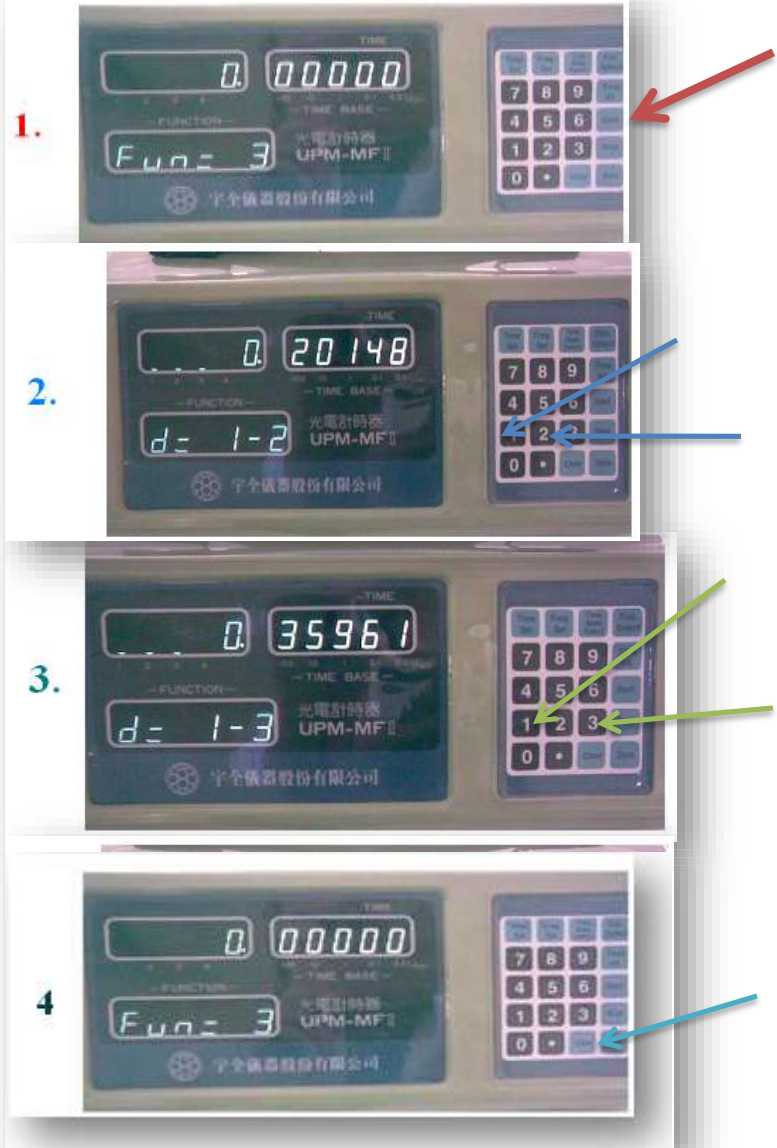
2. To find t_1 , press



3. To find t_2 , press



4. To start new reading, press



Results:

A) Complete the following table :

$d = \dots\dots\dots \text{cm}$, $y = \dots\dots\dots \text{cm}$, $x = \dots\dots\dots \text{cm}$, $h = \dots\dots\dots \text{cm}$

No.	P ₁	P ₂	P ₃	S ₁ cm	S ₂ cm	t ₁ Sec.	t ₂ Sec.	a cm/s ²	g cm/s ²
1	70	90	110						
2	80	95	125						
3	90	100	130						
Average g								=	

B. Calculate the acceleration **a** of the trolley using the relation

$$a = \frac{2(S_2 t_1 - S_1 t_2)}{t_1 t_2 (t_2 - t_1)}$$

and the acceleration due to gravity **g** using the relation $g = \frac{ad}{h}$ in each case, write your results in the above table.

Case 1:

Case 2.
