وزاره التعليم العالي والبحث العلمي
كليه المستقبل الجامعه
قسم الفيزياء الطبيه
مختبر الميكانيك2

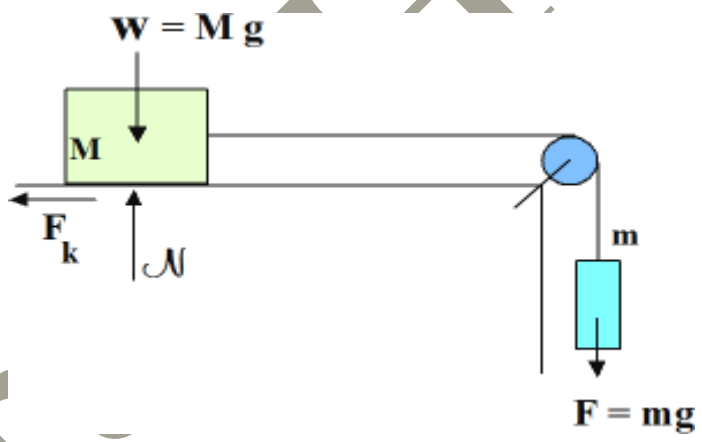
The Coefficient of Friction

The Aim:

To study the relationship between force of limiting friction and normal reaction and to find the coefficient of friction between a block and a horizontal surface.

The theory:

Friction is the force that resists the relative motion of one surface in contact with another .The direction of the friction force is parallel to the surface and in the opposite direction of the motion. The magnitude of the friction force **F** is directly proportional to the normal force N (**F**∝ N) .There are two types of friction: static and kinetic. Usually, the kinetic frictional force is less than the maximum value of the static frictional force. The maximum value of static frictional force is given by $f_{s,max} = \mu_s N$ and the kinetic frictional force is given by $f_k = \mu_k N$, where μ_s is the coefficient of static friction, μ_k is the coefficient of kinetic friction and N is the normal force.



Kinetic frictional force, F_k minus the Tension on the string equals zero. That is, $F_k - T = 0$

$F_k = T$

From the formula of kinetic friction $F_k \propto N$, $F_k = \mu_k N$ Since $F_k = T$, then

$T = \mu_k N$

Since the Tension on the string equals the attached weights, mg, then, $mg = \mu_k N$

..... (1)

Resolving vertical forces:

Normal force N acting on the block minus weight of the block mg equals zero. That is

N – Mg = 0 N =

Mg

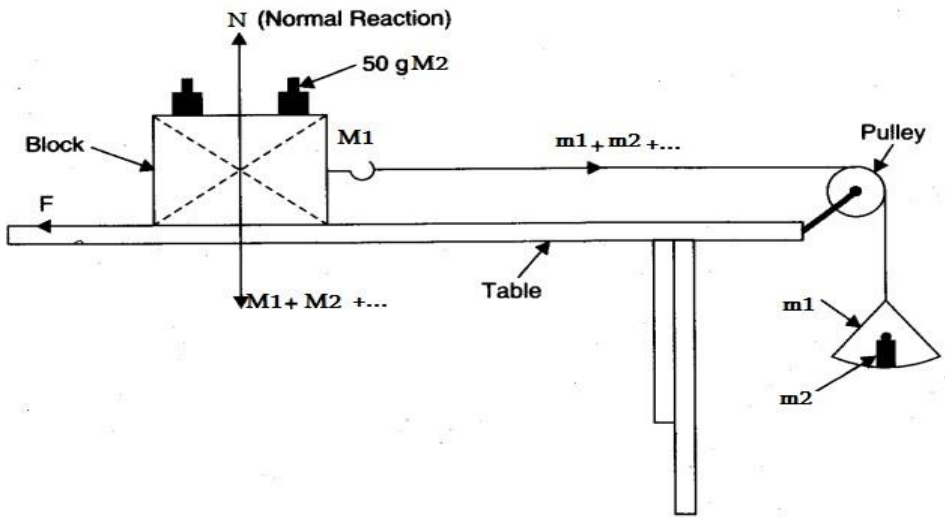
Substituting mg for N in equation 1, we have, mg = μ_k Mg

Therefore μ_k = mg / Mg = m / M= slope

This means that the coefficient of kinetic friction between the two surfaces is the ratio of the attached weights and the weight of the block.

Apparatus:

Wooden block , weights, horizontal plane (table top), pulley, thread , pan.



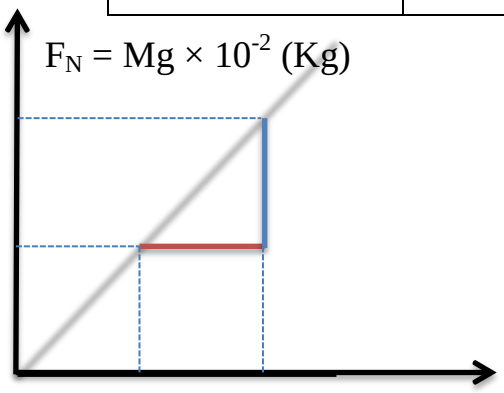
Method:

1- Weigh the wooden block and put it on the table top.
2- Tie one end of a thread with the hook of the wooden block and pass it over thepulley. (The thread must be horizontal)
3- Find the weight of the pan.
4- Tie other free end of the thread with the pan and let the pan hang vertical. (Thepan will pull the wooden block horizontally by a force equal to its weight).
5- Since the pan itself does not pull the block, put some weights in the pan (fromweight box).
6- Tap the table top to make the block just slide.
7- Increase weights in pan little by little, till the block just starts sliding on tappingthe table top.

8- Note the total weights put in the pan then record them in observation table (sum of weight of pan and weights in pan gives the force of sliding friction.)

$M*10^{-3}$(Kg)	$F(N)*10^{-2}$	$M*10^{-3}$(Kg)	$F(k)*10^{-2}$

$F_N = Mg \times 10^{-2}$ (Kg)



μ_k =Slope = $\frac{\Delta FN}{\Delta Fk}$

$Fk = mg \times 10^{-2}$ (Kg)