Name

Date

ISTANBUL INTERNATIONAL COMMUNITY SCHOOL
IICS SINCE 1911

Forces II

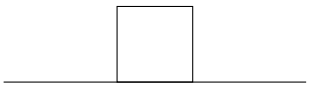
1. A 5 kg box lies at rest on a bench. If the bench were lifted, slowly, how would the normal force and static friction force change as the angle of inclination increased? For each:

   A. Draw free body diagrams for the situations below

   B. Algebraically, write in $F_{net,x}$ and $F_{net,y}$.

   C. Give a numerical value for F_N and F_s for each.

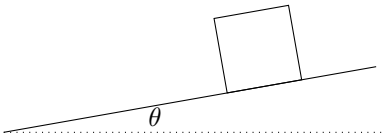
$\theta = 0°$



$F_{net,x} =$ $F_N =$

$F_{net,y} =$ $F_s =$

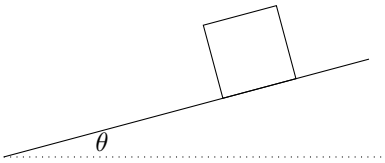
$\theta = 10°$



$F_{net,x} =$ $F_N =$

$F_{net,y} =$ $F_s =$

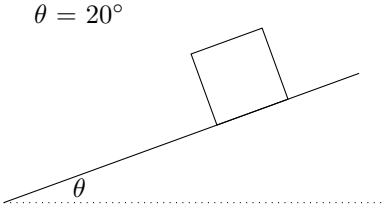
$\theta = 15°$



$F_{net,x} =$ $F_N =$

$F_{net,y} =$ $F_s =$

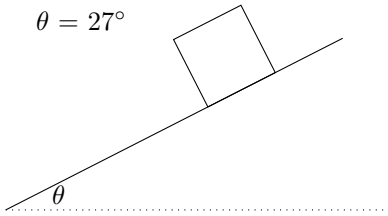
$\theta = 20°$



$F_{net,x} =$ $F_N =$

$F_{net,y} =$ $F_s =$

Let's assume that the friction between the object and the bench cannot hold the object stationary above 27°. Because F_s ceases to exist, and turns into F_k, we call this $F_{s,max}$. Complete the pieces below.



$F_{net,x} =$ $F_N =$

$F_{net,y} =$ $F_{s,max} =$

This relationship between angle, normal force, and static friction defines what we call the coefficient of static friction, μ_s. The formula for coefficient of static friction is:

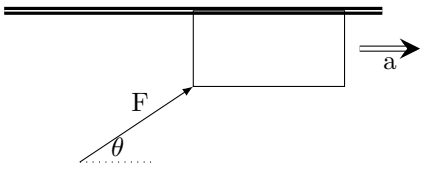
$$\mu_s = \frac{F_{s,max}}{F_N}$$

Note that F_s is different than $F_{s,max}$, and F_N is not always equal to F_g.

When an object is stationary, we use the static friction formula. When an object is in motion, the friction is considered kinetic friction, μ_k. The formula for coefficient of kinetic friction is:

$$\mu_k = \frac{F_k}{F_N}$$

2. A 4.00 kg block is pushed along a ceiling with a constant applied force of F=85 N that acts at an angle of $\theta = 55°$with the horizontal, as shown below. The block accelerates to the right at 6.00 $m{\cdot}s^{-2}$. Determine the coefficient of kinetic friction between the block and the ceiling. (*remember your first steps*)



3. A block with a mass of 14 kg is held in equilibrium on an incline of angle θ= 30°by the horizontal force, F, as shown in the figure below. (Disregard friction)