Friction

Friction → the forces that opposes motion.

*note – it always opposes motion. Friction is never responsible for moving something. It is never the 'applied force'.

Kinds of Friction – we will work with the 1st 2 types (kinetic and static) only.

- **Kinetic friction** (μk) - friction that opposes motion when one surface moves across another
- **(limiting) static friction** (μs)- friction that opposes initial movement (object is @ rest)

There is also…

- drag − which is friction through a fluid like air or water
- rolling friction − which is the friction that opposes an object like a wheel from rolling

Friction – Friend or Foe?

It depends really. Sometimes we WANT friction. When we do, we call it 'traction'. We want traction in our tires. A sprinter wants traction and so wears spikes. Football/soccer players wear cleats for grip. But sometimes we DON'T WANT friction. Then we called it 'resistance' or 'drag'. Speed cyclists wear aerodynamically shaped helmets and crouch down to reduce drag. Curlers sweep the ice in front of the rock to remove grit and melt ice to reduce friction. So it really depends on whether you want or don't want to slide! Downhill skiers in a race want both – waxed skis reduce friction (for speed) but the edges are sharpened to give grip (friction) in order to turn!

What is friction?

We will be focusing on sliding friction. Every surface, no matter how smooth, has microscope bumps and pits. These bumps and pits catch on each other and slow movement down. Of course, the smoother the surface, the less they will catch. So, the amount of friction observed is a characteristic of the TWO surfaces sliding over one another.

Coefficient of Friction (μ = 'mu ')

- ➔ Coefficient of static friction μ_s – this increases to match applied force until a maximum value at which point the object begins to move.
- ➔ Coefficient of kinetic friction μ_k - is a constant value.

Look at the graph in your text. It nicely shows that static friction is usually greater than kinetic friction. This means it's harder to START something moving than to keep it moving. Have you ever moved something really heavy like a stove? It's difficult to get it going, but not so bad once it's moving.

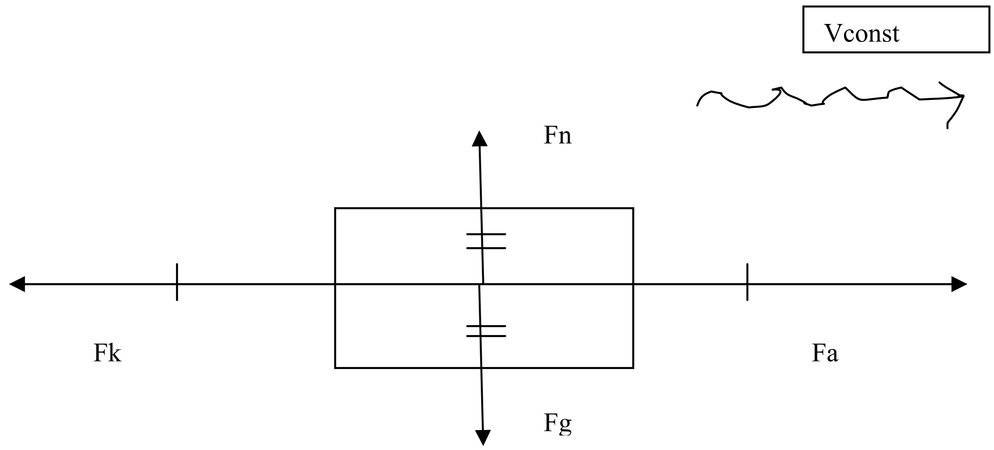
μ = is a greek letter that represents the ratio of friction to normal force.

<u>Generally</u> : $\mu = F_f / F_n$ * no units – it's a ratio

<u>Specifically</u> µk = Fk/Fn and µsmax = Fs/Fn

Experimentally, you can calculate µ for 2 surfaces. (ie: sandpaper on desk). Once calculated, now you can <u>predict</u> how much friction there will be.

In-class Inquiry – Calculate μ_k - We will use µk = Fk/Fn
- We can't measure Fk and Fn directly, so we're a bit sneaky about it.



Pull your block along the desk at constant speed. When you do this, you can't measure Fk, but you CAN measure Fa which EQUALS Fk.
You can't measure Fn, but you can hang the block up and measure Fg which EQUALS Fn.
Sneaky, eh?

Graph Fk (y axis) versus Fn (x – axis). You should see a predictable pattern.