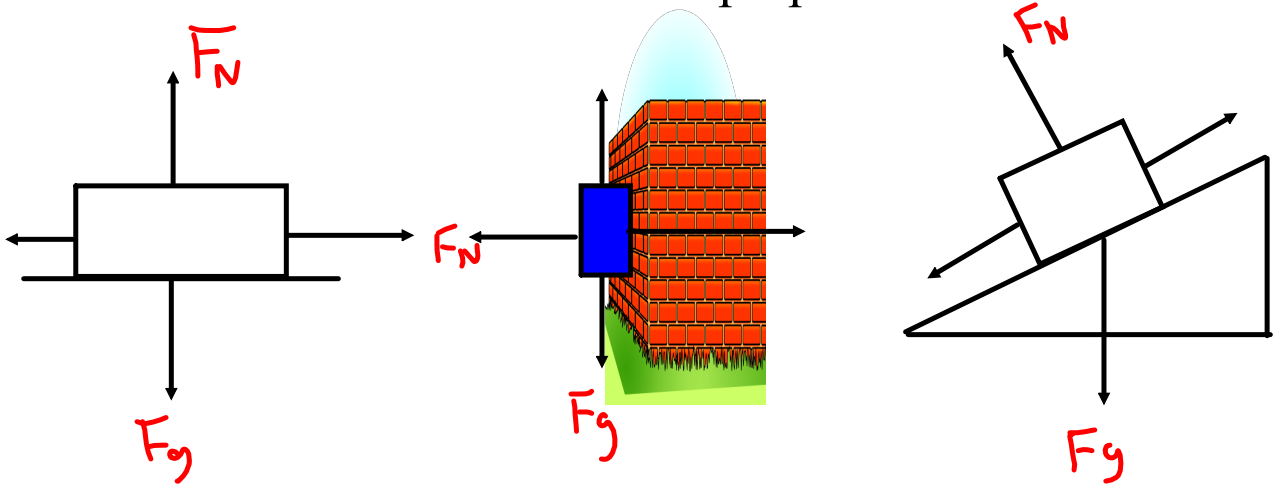
Common Forces

F_a : an ***applied*** force
- a push or pull you exert on an object

F_N : the ***normal*** force
- a force that acts perpendicular to the surface on which an object rests

NOTE: "normal" means perpendicular

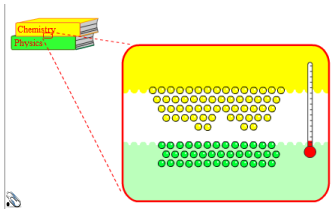


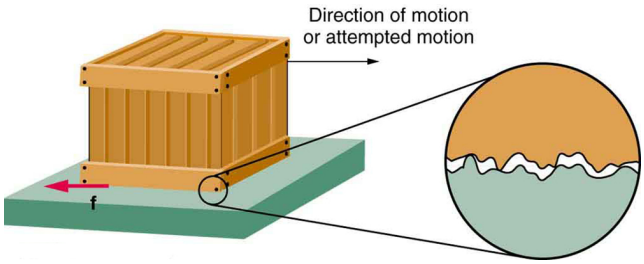
F_T : ***tension***
- the force that acts along a rope, wire, string, etc.

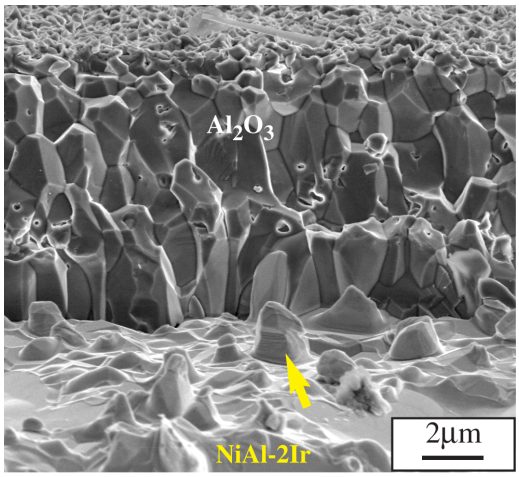
F_e : *elastic*
- the force that an elastic pulls with (dependant on distance stretched or compressed).

The Force of Friction

1. What is friction?
2. What causes it?







It is very important to have a detailed understanding of friction as all motion is affected by some type of friction (surface, fluid, air, etc).

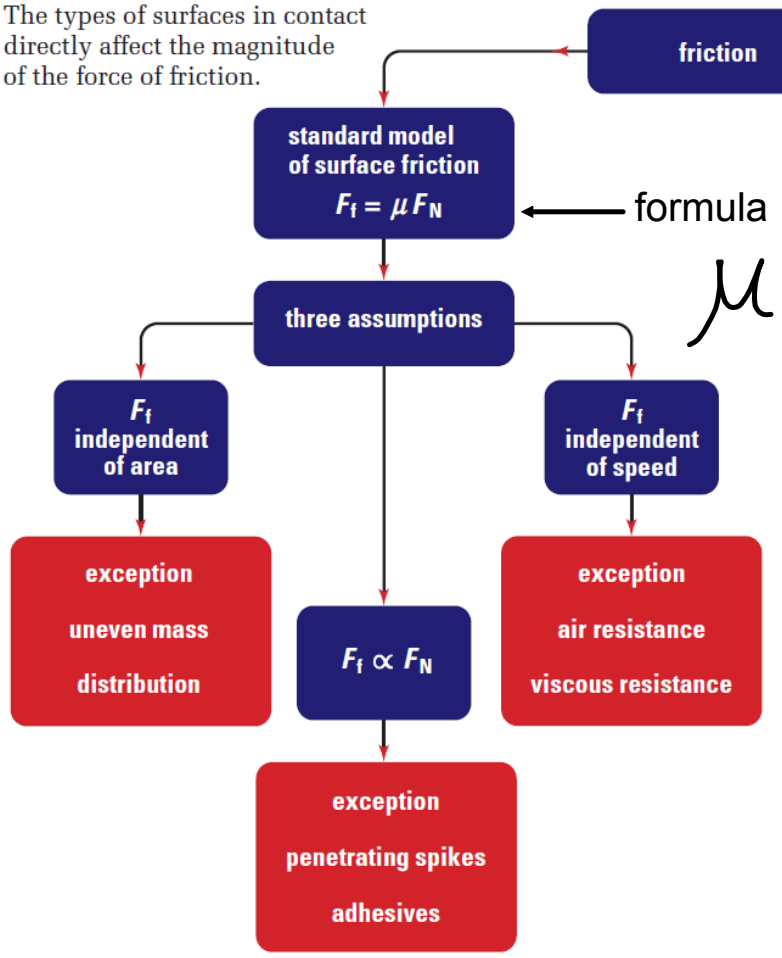
Reading: Friction

MHR: Pg. 137 - 145 Follow Up Questions:

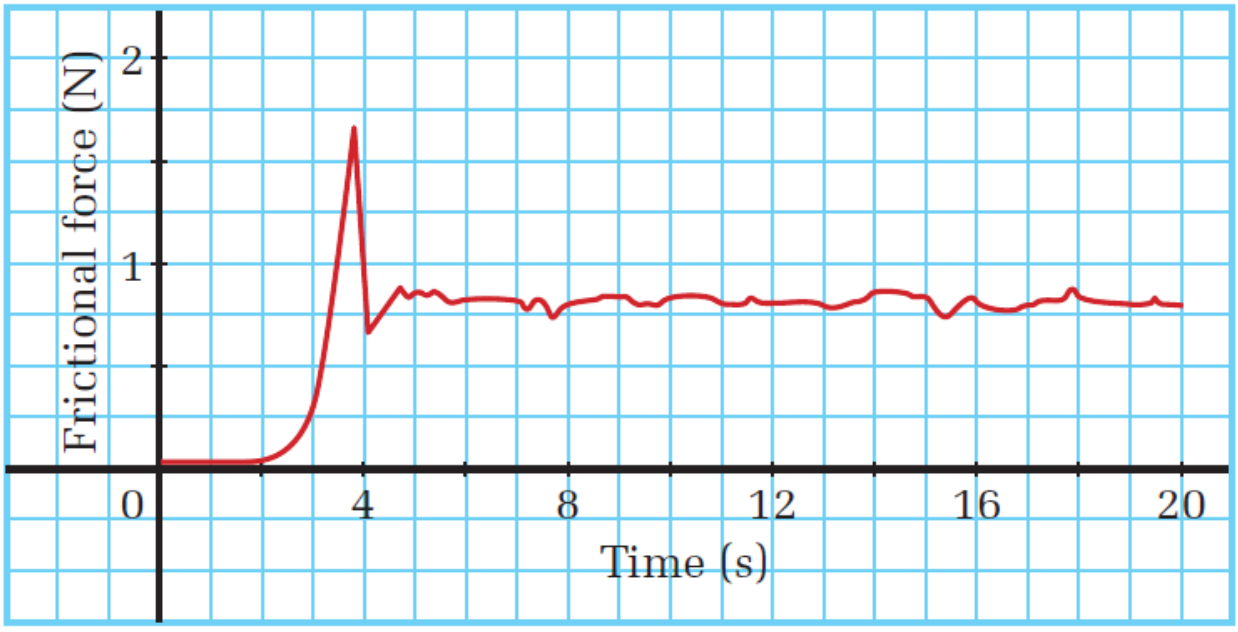
1. In detail and with physics terminology, what is friction the result of?
2. Does the force of friction have a dependance on surface area? Provide an explanation.
3. Summarize 3 situations where we will not apply the basic theory of surface friction.
4. Suppose I have two smooth (to the touch) pieces of iron, how come they do not fuse when I bring them together?

Concept Organizer

The types of surfaces in contact directly affect the magnitude of the force of friction.

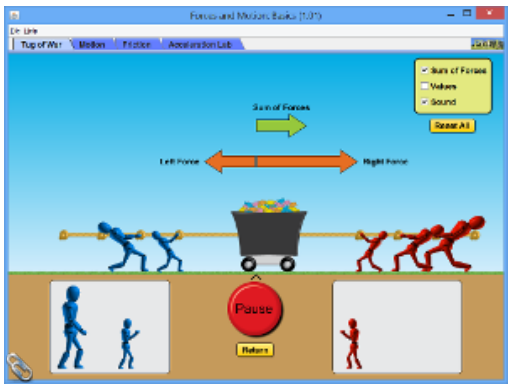


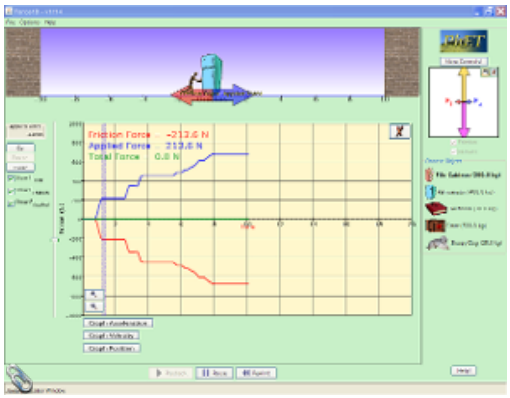
In the above formula F_N is equal to the weight supported by the reference surface.



Friction Demos:

1. Pulling a block of wood varying the mass.
    1. Vary the weight.
    2. Surface area.
2. Pushing objects (PhET).
    1. Visualize the vectors.
    2. Graphical Analysis.





5-10 min Writing Review: Friction

Suppose you slowly push and increase the applied force on a heavy crate. Describe the two forces of friction and how they affect the crate's motion from the first push until the crate is moving at a constant velocity. Use as much detail as possible.

Solving Problems with Common Forces

Understanding the concepts discussed thus far is the key to solving mathematical problems involving forces. Along with the strategies we previously used there are a couple more we can use for forces:

- Free Body Diagram.
- Sketch/label a diagram showing forces.

Free-Body Diagrams

"***Physics is all about simplification***."

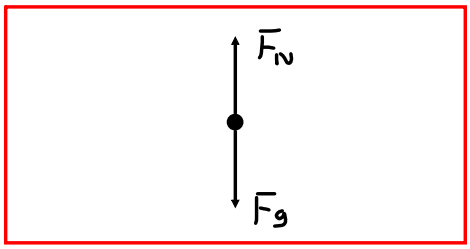
A ***free-body diagram*** (FBD) is a picture that shows ALL the forces acting on an object.

For the sake of simplicity, an object is usually represented by a dot and only the forces acting on the object are included on the diagram. The forces are represented by arrows.

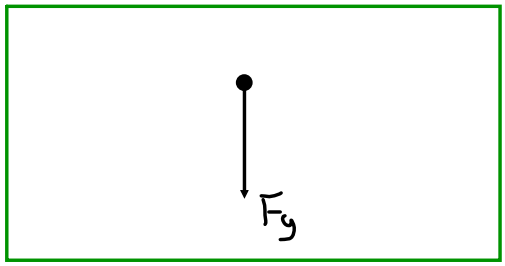
When drawing FBDs, put the tail of the force vectors on the object, with the arrow pointing away from the object. NEVER draw a force vector pointing toward an object.

Examples:

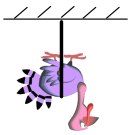
An ***apple*** rests on a desk.

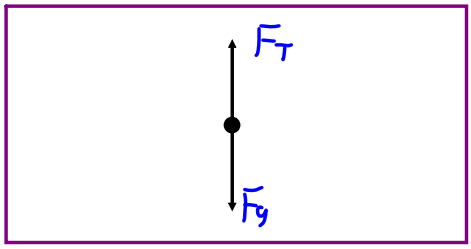


A ***flower pot*** falls in the absence of air resistance.



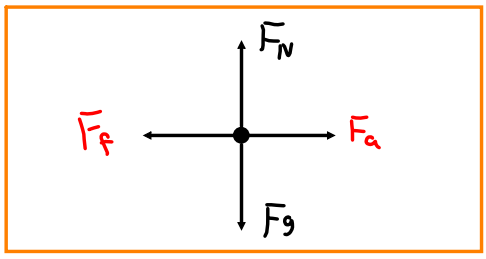
A ***turkey*** is hung from the ceiling of a classroom.



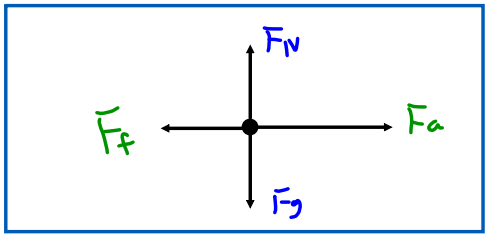


A snail pushes a ***pumpkin*** across the floor at constant ~~speed~~ velocity.

$F_{Net} = 0\ N$



A *car* speeds up while traveling on a dirt road.



A Note about Motion and Forces

When the net force on an object is zero, it is in a state of ***equilibrium***. This means that the object is either at ***rest*** or moving at a ***constant velocity***. ***It cannot be accelerating***.

What determines an object's motion?
Why, the value of the net force of course!

Equilibrium : $\vec{F}_{net} = 0N$

- object at rest
- object moving at constant velocity

If the net force does not equal zero, the object will accelerate at a constant rate!

NOTE

The object will accelerate in the direction of the net force.

Attachments

forces-and-motion-basics_all.jar

forces-1d_all.jar

friction_en.jar