Newton's Second Law

You may work with one or two partners during this activity. Submit one set of answers for your team.

Part 1 Types of Forces

1. Complete the following table. You may use your text book or the Internet.

Type of force	Direction in which the force is applied	How is this force produced?
a. applied	depends on the problem	by someone or something pushing or pulling
b. normal	perpendicular to the direction of motion	by the surface on which an object is resting or moving
c. static friction	opposite the direction of motion, before the object being pushed or pulled starts to move	by the interface between the object and a surface
d. kinetic friction	opposite the direction of motion, after the object being pushed or pulled starts to move	by the interface between the object and a surface
e. air resistance	opposite the direction of motion	by the interface between a falling object and the atmosphere
f. gravitational	downward toward the center of the planet, star, moon, etc.	by a body substantially larger than the object on which it is acting
g. tension	along the length of the string, rope, cable, wire, chain, etc.	by a string, rope, cable, wire, chain, etc.
h. elastic	opposite the direction of compression or stretch	by a compressed or stretched spring, rubber band, etc.
i. centripetal	toward the center of a circle	by moving an object around in a circle

Part 2 Steps for Constructing Free Body Diagrams

Free body diagrams are used to show the magnitude and direction of forces acting on an object or objects under a specific situation.

2. According to your text book, there are 5 steps required to draw a free body diagram. List the 5 steps:
   a. sketch the forces

   b. isolate the object of interest

   c. choose a convenient coordinate system

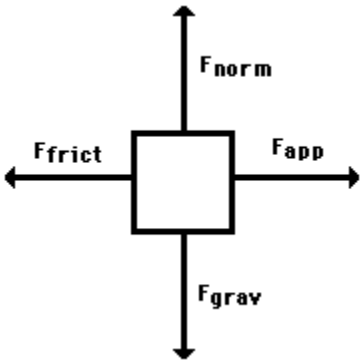
   d. resolve the forces into components

   e. apply Newton's Second Law to each coordinate direction

Part 3 Drawing Free Body Diagrams

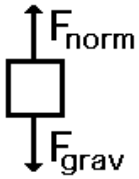
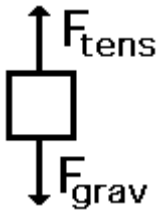
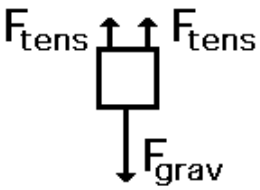
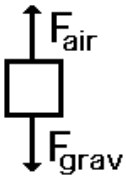
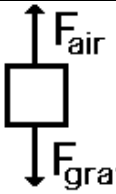
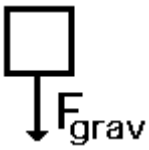
For example, a crate in motion, being pushed across a floor to the right, has the following free body diagram:

- F_{grav} is the force exerted by gravity on the crate, can also be written as F_g or W for weight;
- F_{norm} is the normal force exerted on the crate by the floor, can also be written as F_N or N (which can be confused with newtons);
- F_{app} is the force applied by the person pushing the crate across the floor, can also be written as F_A or simply F;
- F_{frict} is the frictional force, can also be written as f_k since the crate is moving (written as f_s if the crate is not moving)



(Images from: http://www.physicsclassroom.com/Class/newtlaws/U2L2c.cfm#1)

3. Draw the free body diagram for each of the following situations. The possible forces for the six items below are: F_{norm} for the normal force, F_{grav} for the force produced by the acceleration of gravity, F_{air} for the force produced by air resistance, F_{tens} for the force produced by tension

a. Your stationary physics book on the desk. There are 2 forces.		b. Your backpack, which you have flung over one shoulder using only one strap. There are 2 forces.	
c. You, sitting still on a rope swing. A rope is looped over a large branch and tied to the two sides of the swing. There are 3 forces, 2 of which are the same.		d. A skydiver with constant, terminal velocity. There are 2 forces.	
e. A leaf falling gently from a tree. Remember that it is subject to air resistance. There are 2 forces.		f. A football, after having been kicked by the punter, assuming no air resistance. There is 1 force.	

(Images from: http://www.physicsclassroom.com/Class/newtlaws/U2L2c.cfm#1)