Contact vs. Field Force U2P1a

- Contact Force – a push/pull that happens at a ____________ ___________ or points (i.e. football player on ___________, rope on ________ (a.k.a. _____________), ____________ on ball, __________ on floor (a.k.a. ___________ force)).
- Field Force – a ______________ that acts on _________ atom of an object, including the atoms on the ___________ (i.e. _____________ force of Earth on student (a.k.a. _________), _____________ force of magnet on a nail).
- Note: With a contact force you can point to a location where two objects are ____________ and say that that spot is where the __________ is happening. Field forces, however, are sometimes called ___________ forces, because you can't see the spot that the push/pull is occurring.

Contact ____________	Contact ___________	Field _____________	Field _____________
__________________	__________________	_________________	__________________

Naming Forces

- Force names always have three parts
  - Agent – The physical thing that ___________ the force.
  - Type – the ________ of force that is being exerted.
    - Push/Pull ____ -- A ___________ force that doesn't have a special type.
    - Gravity ____ or ____ -- Force created by _______ attracting _______.
    - Normal ____ or ____ -- Force a surface exerts to prevent ________________.
    - Friction ____ -- Force of two ____________ rubbing against each other.
    - Tension _____ -- Force of a ______/_______ on an object.
    - Centripetal ____ -- A net force that creates ____________ motion.
  - Object – The physical thing that ___________ the force.
- When labeling forces on diagrams we must include an __________, because forces are ________

Free Body Diagram (for ____)

- _______ _______ ____________ show only the __________ that act _____ an object/system.
  - NOT the forces that the _________ exerts on outside things.
  - NOT the internal forces of the object on ____________.
- FB-diagrams are useful for predicting ___________, because of the equation __________.
  - F in this equation is the _____ of all the ________ acting ____ the object. __________.

Boy Pulling Wagon

FB for the Wagon FB for the Boy FB for Boy and Wagon System

Newton's 1st Law (Law of ___________) U2P1b

- When velocity is ___________ in both ___________ and ____________, then the acceleration is _______ and the net force (a.k.a. ______ of all the _______/_______) add to ________.
- Note: if either ___________ or _______________ of velocity _________, then there is _________ and therefore ________ cannot be zero. So, Newton's 1st ____________ apply.

Newton's 2nd Law (_____________=____=_____=____________)

- The ***vector*** sum of the forces ______ ___ an object causes _______________. In fact, this is the only thing that causes _________/_________ to change. (Forces ***exerted by*** an object don't cause Δv.)
- Note: For a certain amount of force, when mass is big, acceleration will be ________, and when mass is _______, acceleration will be ______. Ergo, it is easier to ______, ______, and ________ a shopping cart if it is __________.

Newton's 3rd Law (_____________-____________)

- When two objects ______/______ on each other the force of A on B ___________ the force of __________, but in the ____________ direction.
- These forces are called an ____________________ pair.
- Note: Action-reaction does not help you predict ______________/____, that's the job of Newton's _____ Law, which is the forces of ___, ___, ___, ___, ___, etc. acting ____ the __________.

Apparent Weight vs. Weight vs. Normal Force

- Your __________________ is the gravitational attraction of the ________ pulling on ______.
- Apparent means, "What we perceive to be true." So, your __________________ is the force that a bathroom scale reads.
- __________________ is the force a floor pushes with to prevent you from breaking through it.
  - Note: Weight is a ________ force. Normal force is a __________ force. Apparent weight is a _________ force.
  - Note: If you fall out of an airplane you perceive yourself to be ______________, even though (unfortunately) gravity is ______________ you with full strength.
  - Ergo, apparent weight ___________ weight.
- The more our bodies/legs have to work, the __________ we feel. It is "_____________" to you that you are ____________ when an elevator starts going _____, and ______________ as it stops. So, the harder the _________ of the elevator pushes on us, the __________ we feel.
  - Ergo, apparent weight ___________ normal force.
- In an elevator, $F_g = F_N$ (and apparent weight), if acceleration is ___ and the net force is ___. So, the elevator is ________ or ______________________.
- In an elevator, $F_g > F_N$ (and apparent weight), if acceleration is ___ and the net force is ___. So, the elevator is going ________ ___________ or going ________ ___________.
- In an elevator, $F_g < F_N$ (and apparent weight), if acceleration is ___ and the net force is ___. So, the elevator is going ________ ___________ or going ________ ___________.
- Notice: ____ always agrees with ____ and ____ always equals ____.

Comparing Laws	Newt's 1st	Newt's 2nd	Newt's 3rd	U2P1c
Short Name				
Purpose				
Force Diagram				
Watch Out For				

More Force Examples

Elevator

Big Man – Little Boy

Friction U2P1d

- ____________ tries to ______________/___________ two objects from sliding/moving past each other. Frictions "goal" is to make all objects have the ________ speed. (ie. road and _______, airplane and ___________, shoes and _________, etc.)
- The frictional force a road exerts on a car is ______________ the frictional force of the _______ on the _______ (a.k.a. Newton's _____ Law).
  - So, why does the car's velocity change more? Acceleration, a, is inversely proportional to ____ (Newton's ____). The car's mass is miniscule compared to __________. So, the car's acceleration is much ____________. Earth's acceleration exists but is too small to measure.
- Friction acts in a direction ___________ and __________ to the sliding motion.
- We will be studying friction between a solid and a solid, ie. ___________________.
  - In contrast, when friction is between a solid and a _________ or ______ it is called drag. The most common and most frequently ignore type of drag is ____ __________. The main reason we don't study drag is its complexity. Drag coefficients are multivariable equations that depend on ____________ _____ and ___________ as well as other things.
- With solid on solid friction, however, the ______________ ___ ___________, μ, depends only on the _______ of rubbing materials (i.e. the objects are ____________ and their ______________).
- The formula kinetic friction when objects that are currently ___________ is _____________. Where F_N usually = ______, as long as the ground is ________ and only ____ acts vertically.
  - This means μ = __________, which makes μ the ratio of the difficulty to ___________ an object vs. the difficulty to _________ an object. Since, __________ is usually easier, μ is usually ___ 1. μ can be ___ 1 if the surfaces are extremely __________, though.
- The formula static friction when objects that are currently ___________ is _____________.
  - The reason for the ____ sign is that static friction only exists to the degree necessary to ___________ motion. So, a F_{fs} for a block experiencing an F_p of 2N is ____. So, a F_{fs} for a block experiencing an F_p of 0 N is ____. If the 0 N push block still had a F_{fs} of 2N acting on it, then the block would _______________ the table all by itself.
- Special note, while we tend to think of friction as the force that makes moving objects _______, like a truck approaching a ________________. Friction _________ makes objects speed up faster, like a truck in front of a ________________.

	Static Friction	**Kinetic Friction**
Motion & Equation		
Microscopic Diagram		
Watch out for		