Name: _____ Period:_____ Date: _____

NEWTON'S 2ND LAW OF MOTION

Newton's 2nd Law of Motion: _____Acceleration_____depends on an object's ___mass___ and all the _____forces_____ (net force) acting upon the object.

Acceleration = $\frac{\text{Net force}}{\text{Mass}}$ OR Force = mass × acceleration

The mass of an object is a measure of how much __matter__ it contains. We often measure mass in __kilograms (kg)__ and __grams___. Any object with mass has __inertia___.

You are pulling your brother/sister in a wagon, and he or she loves it when you accelerate quickly. Then your neighbor comes over and climbs into the wagon as well. Now you find you cannot accelerate nearly as quickly as you did when it was just your brother/sister. How is the wagon's acceleration related to the wagon's mass?

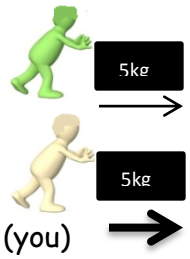
When the mass of the wagon increases, the acceleration decreases. More force is required to accelerate the wagon.

If you push a 5 kg box across the room and your friend pushes a 10 kg box across the room and you both use equal force, who will get to the other side of the room first? Why?

You will get to the other side first because your box has less mass and, therefore, will allow for greater acceleration.

(you)

You push a 5 kg box across the room and your friend pushes a 5 kg box across the room. You use more force than your friend (since you ate your Wheaties for breakfast). Who will get to the other side of the room first? Why?



You will get to the other side first. Even though the boxes are the same mass, you use <u>greater</u> force than your friend. Therefore, you will have a greater acceleration.

A heavier object requires a bigger force (push or pull) to change its speed or its direction than a lighter object. For example, it is much easier to push start a small car than a big truck.

The second part of this law also tells us that if you push or pull a stationary object in a particular direction it will travel in that direction. If you push or pull a moving object it will change its direction towards the direction of the push or pull.

Summary of Newton's 2nd Law of Motion:

Acceleration is produced when a force acts on an object's mass. The greater the mass (of the object being accelerated), the greater the amount of force needed (to accelerate the object).

Practice using the formulas:

An object with a mass of 15kg is accelerating at 10m/s^2. How much force was applied to this object to get it to accelerate to 10m/s^2.

F_{net} = m * a
= 15kg * 10 m/s^2
= 150 kg*m/s^2 or 150 N

N = Newtons (the unit used when measuring FORCE)

kg*m/s^2 = Newtons g*m/s2 does not equal N

1 kg = 1000 g 1 g = .001 kg

An object that is 2kg was pushed with 10N of force. What was the object's acceleration?

$A = \frac{F_{net}}{m} = \frac{10\ N}{2kg} = 5\ m/s^2$

What would be the object's acceleration if the mass of the object doubled, but the force stayed the same?

$A = \frac{F_{net}}{m} = \frac{10\ N}{4kg} = 2.5\ m/s^2$

If mass doubles AND you have <u>not</u> changed the amount of force applied, then acceleration is cut in half.