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**Introduction to Newton’s Law s ![C:\Users\Chris\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\EUJ0T5FN\MC900413302[1].wmf]()
Newton’s First Law.**

* Arguably the greatest scientific genius ever.
* Came up with to explain the observations and analyses of Galileo and Johannes Kepler.
* Discovered that was composed of many colors all mixed together.
* Invented new mathematical techniques such as and theorem in his study of physics.
* Published his Laws in 1687 in the book Mathematical Principles of Natural Philosophy.

**5.1 What is Force?**

 ![j0368408[1]]()

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**5**.**2 Newton’s First Law**

**The First Law is Counterintuitive**



**Implications of Newton’s 1st Law**

* If there is zero net force on a body, it cannot accelerate, and therefore must move at constant velocity, which means

1.

2.

3.

**What is Zero Net Force? (Draw the picture below)**

Even though there are forces on the book, they are balanced. Therefore, there is no net force on the book. ΣF = 0

**Diagrams**

* Draw a force diagram and a free body diagram for a book sitting on a table.

Force Diagram Free Body Diagram

**Sample Problem**

1. A monkey hangs by its tail from a tree branch. Draw a force diagram representing all forces on the monkey
2. Now the monkey hangs by both hands from two vines. Each of the monkey’s arms are at a 45o from the vertical. Draw a force diagram representing all forces on the monkey.

**5.3 - Newton’s Second Law**

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**Units of force**

*

**Working 2nd Law Problems**

1.

2.

3.

4.

5.

**Sample Problem**

In a grocery store, you push a 14.5-kg cart with a force of 12.0 N. If the cart starts at rest, how far does it move in 3.00 seconds?

A catcher stops a 92 mph pitch in his glove, bringing it to rest in 0.15 m. If the force exerted by the catcher is 803 N, what is the mass of the ball?

A 747 jetliner lands and begins to slow to a stop as it moves along the runway. If its mass is 3.50 x 105 kg, its speed is 27.0 m/s, and the net braking force is 4.30 x 105 N

a) what is its speed 7.50 s later?

b) How far has it traveled in this time?

5.4 - Newton’s Third Law

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* .



Sample Problem

You rest an empty glass on a table.

 a) How many forces act upon the glass?

 b) Identify these forces with a free body diagram.

 c) Are these forces equal and opposite?

 d) Are these forces an action-reaction pair?

Sample Problem

A force of magnitude 7.50 N pushes three boxes with masses m1 = 1.30 kg, m2 = 3.20 kg, and m3 = 4.90 kg as shown. Find the contact force between (a) boxes 1 and 2 and (b) between boxes 2 and 3.

1. m1 = 1.3 kg, m2 = 3.2 kg, m3 = 4.9 kg, SF = 7.5 N Find total ‘a’ for all boxes. mT = 9.4 kg, using ΣF = ma
2. Looking at box 3 only, there are 2 forces acting on it. Box 2 on 3 and the applied force.



**5.5 - Newton’s 2nd Law in 2-D**

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**5.6 – Mass & Weight**

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Sample Problem

A man weighs 150 pounds on earth at sea level. Calculate his a) mass in kg b) weight in Newtons.

Apparent weight

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Elevator rides

Going Up?

Going Down?

Sample Problem

An 85-kg person is standing on a bathroom scale in an elevator. What is the person’s apparent weight

1. when the elevator accelerates upward at 2.0 m/s2?
2. when the elevator is moving at constant velocity between floors?

Sample Problem

A 5-kg salmon is hanging from a fish scale in an elevator. What is the salmon’s apparent weight when the elevator is

1. at rest?
2. moving upward and slowing at 3.2 m/s2? a = -3.2 m/s2

**5.7 Normal Force**

Normal force on flat surface

Drawing

Normal force on ramp – **HUGE!!!!!!! UNDERSTAND CONCEPT.**

Drawing

Normal force not associated with weight

More on the Normal Force

Draw a free body diagram for the skier.



Sample problem

1. Find the normal force exerted on a 2.5-kg book resting on a surface inclined at 28o above the horizontal.
2. If the angle of the incline is reduced, do you expect the normal force to increase, decrease, or stay the same?