Unit 4: Newton’s Laws  
**Forces**

There are four fundamental forces that make up all of the forces in the universe:  
1)  
2)  
3)  
4)

Force:

The units of force are:

**Force of Gravity**

Force of Gravity:

Mass (kg):

Weight (N):

Mass is \_\_\_\_\_\_\_\_\_\_\_\_ throughout the universe but weight \_\_\_\_\_\_\_\_\_\_\_\_ depending on where you are.

The formula for force of gravity is:

Where:

m =

g =

=

**Determine your weight on Earth, the moon and Jupiter   
(in Newtons)**

Your Mass: \_\_\_\_\_\_\_\_\_\_\_ kg (1 kg = 2.2 lbs)

Weight on Earth:  
 Fg = mg  
 =

Weight on the Moon:

Weight on Jupiter:

**g varies depending on…**

For Example:

* On Earth at sea level, g =
* On the moon, g =
* On Jupiter, g =
* On the sun, g =

Activity:   
**Jumping on the Moon**

Purpose: To determine how high you could jump on the surfaces of the Moon and the Sun.

Procedure:

1. Have your lab partner measure your best vertical on Earth.
2. Determine the initial velocity of your jump. We will assume that your initial jump velocity will be the same on the Moon and the Sun.
3. Find your **vertical** and **hang time** on the moon using an acceleration = -1.60 m/s2.
4. Find your **vertical** and **hang time** on the Sun using an acceleration = -274 m/s2.

**Sun**

dmax: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Moon**

dmax: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Earth**

Vertical: \_\_\_\_\_\_\_\_\_\_\_\_

vo = \_\_\_\_\_\_\_\_\_\_\_\_\_

A Quick Aside on G-Forces

“G-forces” are actually a measurement of ***acceleration*** experienced by an object. It is related to the supporting reaction force that an object experiences due to acceleration. While at rest on Earth you are experiencing 1 *g*.

1 *g* = 9.80 m/s2

For Example:  
A car accelerates at 4.9 m/s2, how many g’s is that?

During lift-off a shuttle will accelerate at 28 m/s2. How many g’s are experienced by the astronaut?

A normal human can withstand 4.0 g’s, while a fighter pilot can withstand up to 9.0 g’s. What acceleration would cause each to pass out?