*Common Forces*

# Weight (Force of Gravity)

What is the difference between weight and mass?

You have a specific mass regardless of where you are located (M = DV). Your weight is defined as the force of gravity on the mass. Think of standing on a bathroom scale. The Earth is pulling you down, so you squeeze the scale forcing it to take a reading. The larger your weight, the larger the “squeeze.” Earth will pull your mass with a certain amount of force. This is why your weight is different on the moon compared to earth or any other planet. Weight is measured in Newtons, not kilograms.

In physical terms, we call weight the “Force of Gravity” on an object. It is defined as follows:

*Fg*  *mg*

where: **Fg** is the force of gravity (measured in Newtons, N)

**m** is the mass of the object (measured in kg)

**g** is acceleration due to gravity (measured in m/s2)

Unit analysis:

The symbol **g** is called “acceleration due to gravity.” On Earth, it is equal to 9.81m/s2. For any other planet, this value will be give subtext, for example, the moon will be gmoon or Venus will be gvenus.

\*NOTE: The force of gravity always acts STRAIGHT DOWN. It will always point to the centre of the planet.

Eg. What is the weight of a 45.2kg dog?

Eg. A truck has a weight of 4905N. What is its mass?

Eg. How does Fg change as an object’s mass increases? What falls faster, a bowling ball or an apple?

# Normal Force

The normal force is a contact force. Whenever an object exerts a force on a flat surface such as a wall, floor, or ground, that surface will exert a force back on the object in a direction perpendicular to that surface. We call this force the normal force. For example, an object that sits on a flat surface is shown below:

Here, gravity is forcing this block down, but the ground is equalizing that force by creating a normal force (FN) to balance the gravitational force (Fg).

Since the two forces are the same magnitude, but

opposite in direction, they will cancel each other out, thus there is no net force and the object stays at rest.

Whenever a force is applied by an object to a surface (and that surface does not move), the object is at rest because the normal force exerted by the surface equalizes the applied force.

Eg. A 654kg horse is standing on the ground.

1. Draw all the forces acting on the horse.
2. What is the value of the normal force on the horse?

Eg. A 68.5kg block is sitting on a frictionless ramp that is on a 20o angle.

1. Draw all forces acting on the block.
2. Calculate the value of the normal force\*\*