# Chapter Seven: Gravitation
## Section 2: Using the Law of Universal Gravitation

If an object above the Earth were shot with a great horizontal velocity high enough in the air, the object would match the curvature of the Earth and remain in orbit.

- Of course, the object would have to be launched from 150 km above the Earth (Mount Everest is 8.85 km high)

A satellite in orbit that is always the same height move above the Earth in uniform circular motion

Speed of a Satellite orbiting Earth

$$v = \sqrt{(Gm_E/r)}$$

Period of a Satellite orbiting Earth

$$T = 2\pi\sqrt{(r^3/Gm_E)}$$

Acceleration due to gravity:

$$a = g(r_E/r)^2$$

Weightlessness or zero-g

- Astronauts experience this either when they are falling freely back towards Earth or when they are in orbit and there are no contact forces acting on them

Gravitational Field

- Gravity acts on everything whether it be on you jumping or force between planets

- **Gravitational field:** the field that surrounds any object with a mass

$$g = GM/r^2$$

G = universal gravitational constant
M = object's mass
r = distance from the object's center

  - the direction is towards the mass's center
  - the unit is N/kg which is equivalent to $m/s^2$
  - represented as vectors pointing towards the center of the object producing the field

**Inertial mass:** a measure of an object's resistance to any type of force

$$m_{inertial} = F_{net}/a$$

**gravitational mass:** the size of the gravitational force between two objects

$$m_{grav} = r^2F_{grav}/Gm$$

r = distance of the objects
$F_{grav}$ = gravitational force
m = mass of the other object

According to Einstein, mass cause's space to be curved and other bodies are accelerated because of the way they follow this curved space.

- In this same way, the Earth and Sun are attracted to one another because of the way space is distorted by the two objects