# Forces: Chapter 3 of Text
# Chapter 4 and 5 of MHR

## ***Definition of Dynamics***

***Dynamics*** is the study of why an object moves.

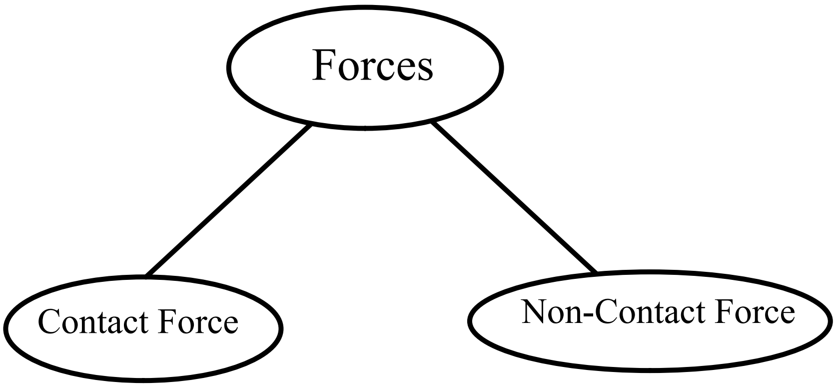
In order to understand why objects move, we must first study forces.

## ***Forces***

A ***force*** is defined as a push or a pull.

Forces are vector quantities - they have magnitude and direction.

In the last unit, the sum of all the forces acting on an object was referred to as the resultant force. **N*et force***, $\vec{F}_{net}$, is another term used for the vector sum of forces.




**Contact Force**

- a force exerted by an object in direct contact with another object

Examples

friction
tension
normal force
applied force

**Non-Contact Force**

- a force that acts over a distance

Examples

force of gravity
magnetic force
electric force

# *Types of Forces*

An object can experience many different forces simultaneously. Some of the more common forces are listed below.

$\vec{F}_g$ : gravitational force (force of *gravity*)

- this is an attractive force that acts over a distance between masses

**NOTE**: Weight is the force of gravity acting on an object.

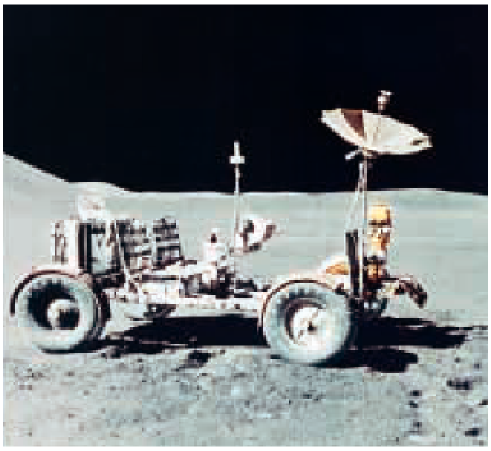
$$\vec{F}_g = m\vec{g}$$

Fg -> Force of gravity or weight (N)
m -> mass (kg)
g -> acceleration due to gravity ($m/s^2$)

## PRACTICE PROBLEMS

Chapter 4

1. Find the weight of a 2.3 kg bowling ball on Earth.
2. You have a weight of 652.58 N[down] while standing on a spring scale on Earth near the equator.
   (a) Calculate your mass.
   (b) Determine your weight on Earth near the North Pole.
   (c) Determine your weight on the International Space Station. Why would this value be impossible to verify experimentally?
3. The lunar roving vehicle (LRV) pictured here has a mass of 209 kg regardless of where it is, but its weight is much less on the surface of the Moon than on Earth. Calculate the LRV's weight on Earth and on the Moon.
4. A 1.00 kg mass is used to determine the acceleration due to gravity of a distant, city-sized asteroid. Calculate the acceleration due to gravity if the mass has a weight of $3.25 \times 10^{-2}$ N[down] on the surface of the asteroid.



| Location | Acceleration due to gravity (m/s²) | Altitude (m) | Distance from Earth's centre (km) |
|---|---|---|---|
| North Pole | 9.8322 | 0 (sea level) | 6357 |
| equator | 9.7805 | 0 (sea level) | 6378 |
| Mt. Everest (peak) | 9.7647 | 8850 | 6387 |
| Mariana Ocean Trench* (bottom) | 9.8331 | 11 034 (below sea level) | 6367 |
| International Space Station* | 9.0795 | 250 000 | 6628 |

*These values are calculated.

| Location | Acceleration due to gravity (m/s²) |
|---|---|
| Earth | 9.81 |
| Moon | 1.64 |
| Mars | 3.72 |
| Jupiter | 25.9 |