Physical Science
Chapter 1 & 2
Motion & Force

I. Need to Know Formulas for this unit:
   Speed = distance / time \[ S = \frac{D}{T} \]
   Distance = Speed \times Time \[ D = ST \]
   Acceleration = Final Velocity – Initial Velocity \[ A = \frac{V_f - V_i}{T} \]
   Force = Mass \times Acceleration \[ F = MA \]
   Weight = Mass \times Acceleration of gravity
   Momentum = Mass \times Velocity

II. Motion
A. Motion occurs when the distance between the object and a reference point is changing
B. Reference point – place or point used to determine if an object is in motion
C. SI
   1. International System of Units: The metric system
   2. Length – measured in meters
   3. Mass – grams
   4. Volume – liters
      a) 1ml = 1cm³
   5. Weight – Newtons
   6. Density – mass / volume
D. Speed – the distance an object travels in one unit of time
   1. a magnitude only: it only tells us “how much”
   2. 75 miles per hour, 18 meters per second
E. Velocity – when the speed and the direction is known then the velocity can be described
   1. Specifies a magnitude AND a direction
   2. 75 miles per hour in a northern direction, 18 meters per second east
F. Graphing motion
   1. x axis – the horizontal units
   2. y axis – the vertical axis
   3. slope of the line = \[ \frac{\text{rise}}{\text{run}} \]
   (the vertical change)
      (the horizontal change)
G. Acceleration – the change in speed or the change in direction of an object

III. Forces
A. Force is measured in the units of Newtons (N): \[ 1N = 1kg \times 1\, m/s^2 \]
B. Force – a force is simply a push or a pull on an object
   1. Like velocity and acceleration Force shows a magnitude AND direction
   2. Arrows called “Vectors”
   3. Balanced force – opposite and equal forces acting on the same object result in NO motion of the object
   4. Unbalanced forces – two or more forces of unequal strength acting upon on object results in the motion of the object.
   5. Newton’s 1st Law of Motion: The Law of Inertia - an object at rest will remain at rest, and an object in motion will remain in motion and at a constant velocity until acted on by another force.
      a) The greater the mass of an object the greater the inertia
C. **Force = mass x acceleration**
   1. **Newton’s Second Law of Motion** – The net force on an object is equal to the product of its acceleration and its mass:
   2. mass = Force / acceleration
   3. acceleration = force / mass

D. **Friction & Gravity**
   1. **Friction**: the force of friction is the force that one surface exerts on another one when they are rubbed together.
      a) The strength of the force of friction depends on
         (1) The type of surfaces
         (2) How hard they push against each other
   2. **Gravity**: the force that pulls objects towards each other
      a) **Earth’s Gravity pulls objects at 32 ft / s / s**
      b) Earth’s Gravity pulls objects down at **9.8 m/s²**
         (1) Velocity after one second: 9.8 m/s
         (2) Velocity after two seconds: 19.6 m/s
         (3) Velocity after three seconds: 29.4 m/s
         (4) Velocity after four seconds: 39.2 m/s
   3. **Weight** – Force of gravity acting on an object
      a) **Weight = Mass x Acceleration of gravity**
   4. **Newton’s Third Law of Motion**: For every action there is an equal and opposite reaction.
      a) AKA: if one object exerts a force on another object, then the second object exerts a force of equal magnitude in the opposite direction of the first object.
   5. **Momentum = Mass x Velocity**
      a) Conservation of Momentum: The total of any group of objects remains the same unless outside forces act on the objects