PHYSICS CONTENT FACTS

The following is a list of facts related to the course of Physics. A deep foundation of factual knowledge is important; however, students need to understand facts and ideas in the context of the conceptual framework. This list is not intended to provide a comprehensive review for State and National Assessments. Its purpose is to provide a highlight of the factual material covered in Physics. This list is not all inclusive, be sure to check Nevada State Standards and your district syllabi.

MECHANICS

- Scalars are quantities which are fully described by a magnitude only
- Speed, Distance, Time, Mass, Charge, and Energy (joules) are examples of scalar quantities
- Vectors are quantities which are fully described by a magnitude and a direction
- Velocity, Displacement, Momentum, Force, and Acceleration are examples of vector quantities
- The resultant is a vector representing the sum of two or more vectors
    - At 0°, two vectors have a resultant equal to the sum of their magnitudes
    - At 180°, two vectors have a resultant equal to the difference of their magnitudes
    - From the difference to the sum, the total range of possible resultant magnitudes is determined
- The magnitude of two vectors, at right angles, can be calculated using the Pythagorean theorem ($a^2 = b^2 + c^2$)
- For two vectors at right angles, the direction of a resultant can be found using the tangent function $\tan\theta = \frac{Opposite}{Adjacent}$
- The equilibrant is a vector that is equal in magnitude, but opposite in direction to the resultant vector
- Displacement is a change in position in a certain direction (not the total distance traveled)
- The velocity of an object is its speed in a given direction
- The average velocity of an object during some time interval is equal to the displacement of the object divided by the time interval $v_{avg} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$
- The slope of a **position-time** graph is <u>velocity</u>
- The average acceleration of an object during a certain time interval is equal to the change in the object's velocity divided by the time interval $a_{avg} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$
- The slope of the **velocity-time** graph is <u>acceleration</u>
- Objects in free-fall experience constant acceleration directed toward the center of Earth
- Free-fall acceleration is the same for all objects at the earth's surface, regardless of mass ($a=g=$ ¯$9.8 m/s^2$)
- Projectiles follow parabolic trajectories

- Ignoring air resistance, a launch angle of 45° produces the greatest range for a projectile
- At the top of a projectile's path, the vertical velocity is zero, and the acceleration is -9.8 m/s^2
- Projectiles have constant horizontal velocity (ignoring air resistance)
- Projectiles have constant downward free-fall acceleration (vertical velocity)
- Mass is the quantity of inertia – the greater the mass of an object, the greater its inertia (resistance to change)
- Net forces cause accelerations (constant velocity means the net force is zero and acceleration is zero)
- The acceleration of an object is directly proportional to the net external force acting on the object and inversely proportional to the object's mass. $a = \frac{\Sigma F}{m}$ or more commonly expressed $\Sigma F = ma$
- Forces ALWAYS exist in pairs
- Mass is not weight!
- Weight of an object is the force on the object due to gravity and is equal to the mass of the object times the acceleration due to gravity $w = mg$
- Weight (the gravitational attraction of the Earth) decreases rapidly as you move away from the earth by distance (**r**) squared $F = G\frac{m_1 m_2}{r^2}$
- Centripetal force and centripetal acceleration vectors are directed toward the center of the circle (or curve), while the velocity vector is tangent to the circle $F_c = \frac{mv^2}{r}$ $a_c = \frac{v^2}{r}$
- Friction is the resistive force that opposes the relative motion of two surfaces in contact
- The force of friction is proportional to the normal force, and depends on the surfaces in contact $F_{friction} = \mu F_{normal}$