

# Physics Review

## 1<sup>st</sup> Semester

**Acceleration** – Only a net force can cause an acceleration. If an acceleration is observed, then a net force is being applied to the accelerated object. Constant acceleration means the net force is constant. A changing acceleration means the net force is also changing.

**Angular Measure** . . . . .  $s = r\theta$ ;  $v = r\omega$ ;  $a = r\alpha$

**Angular Motion Equations** ( $\alpha = \text{constant}$ )

**Centripetal Force and Centripetal Acceleration** . . . . .  $F_c = mv^2/r = mr\omega^2$

**Conservation of Energy**

**Conservation of Momentum** . . . . .  $\Sigma m_i v_i = \Sigma m_f v_f$  or  $m_1 v_1 = m_2 v_2$

**Derivatives and integrals**

**Energy** – Kinetic and Potential – Conservation of Energy

**Equations of Motion** – Constant Acceleration equations ( $a = \text{constant}$ )

**Equilibrium**

**Vector equation**  $\Sigma F = 0$

**Force Diagrams**

**Forces**

**Newton's Second Law**  $F = ma$

**Gravity, Newton's Law of Universal Gravitation**

$$F = G \frac{m_1 m_2}{r^2}$$

**Spring Force** – **Hooke's Law**

$$F = -kx$$

**Buoyancy & Fluids** **Pascal's Principle** – Pressure is transmitted undiminished throughout an enclosed fluid.

**Archimedes's Principle**

**B** = weight of displaced fluid

**Normal Force** –  $F_N$  – Always perpendicular to a surface

**Friction force**  $f = \mu F_N$

**Free-body Diagrams** – Another name for Force Diagrams – Show all Forces

**Free Fall** . . . . .  $g = \text{constant acceleration near the surface of the Earth}$

**Friction** . . . . .  $F_s = \mu F_N$

**Gravity** – Newton's Law of Universal Gravitation

**Ideal Gas Law**

**Inclined Plane**

**Mass, work, energy, heat, temperature, density, etc** are scalars

**Momentum**

**Newton's Laws of Motion** and the Motion Equations (constant acceleration)

**Ohm's Law**

**Projectile Motion** – 2D

**Temperature** (C, K, F)

**Torque**

$$\tau = r \times F = F \times (\text{moment arm})$$

**Vectors and Scalars** – **Vector Components**

**Velocity** – Constant velocity means no acceleration therefore no net force  
Changing velocity means acceleration and a net force is being Applied.

**Work and Energy** . . . . . Work Energy Theorem; work = change in KE

$$W = F \cdot d \quad KE = \frac{1}{2}mv^2 \quad \Delta U_g = mgh = m[G \cdot M_E / (R_E^2)]h$$

# Physics Review

## 2<sup>nd</sup> Semester

**Angular Momentum** – Angular Momentum is conserved  
**Banked and Unbanked Tracks** – Review force diagrams  
**Calculus** – Derivative (slope of tangent line), Integral (area under the curve)  
**Capacitors** – Capacitance, Stored Energy, RC Circuits & Exponential Functions  
**Carnot Efficiency**  
**Circuit Analysis** – Kirchhoff's Laws, Current (Node) Rule, Voltage (Loop) Rule  
**Electric Fields**  
**Equivalent Capacitance**  
**Equivalent Resistance**  
**Inductance and Transformers**  
**Linear Equivalent Mass**  
**Logarithmic Scales**. . . . . Richter Scale and Decibels  
**Magnetic Fields** – **Biot-Savart** (**B** field at a point caused by a current in a wire)  
    **Lenz's Law** (Induced **B** field direction opposes changes)  
    **Flux** (in webers) and **Flux density** (in teslas)  
**Mirrors and Lenses**  
**Moment of Inertia** – parallel axis theorem  
**Pendulum Motion**  
“**Plumbing**” – Bernoulli's Equation, Constant flow rate equation  
**Pulley's with Mass**  
**Radioactive Decay - Exponential Decay**  
**Right Hand Rules**  
**Rotational Kinetic Energy** –  $K_r = \frac{1}{2}I\omega^2$   
**Simple Harmonic Motion** – Springs, Pendulum, based on components of the trigonometric functions.  
**Snell's Law** – Refraction, Reflection, Index of Refraction       $n_1\theta_1 = n_2\theta_2$   
**Special Relativity**  
**Speed of Light** –  $c = \lambda f = 3 \times 10^8$  m/s in a vacuum  
**Thermodynamics** –

Work, **W**, is + when done on the system, and – when done by the system.  
Heat, **Q**, is + when added to the system, and – when lost from the system.

1<sup>st</sup> Law;  $\Delta U = + Q_{NET} + W_{NET}$  or Heat and Work are interchangeable  
    *“The Energy of the Universe is a constant.”*

2<sup>nd</sup> Law;  $\Delta U = + Q_{IN} + W_{ON} - Q_{OUT} - W_{BY}$  AND  $Q_{OUT}$  is never zero.  
    *“Heat cannot be converted completely into work.”*  
    *“During any process, the Entropy change in a closed system must be greater than zero”*

*Maximum Efficiency =  $1 - Q_{OUT}/Q_{IN} = 1 - T_C/T_H$  (T in Kelvins)*  
3<sup>rd</sup> Law; The Absolute Entropy of a pure substance may be zero only at the absolute zero of temperature, 0 K. At all other temperatures the entropy has a finite positive value. Any disorder that remains at 0 K will indicate a finite positive entropy even at this lowest possible temperature.

For a constant Temperature Process:  $\Delta S = (+Q_{IN} - Q_{OUT}) / T$