**Topics & Approximate time of study**

*Graphing Motion (2wks)*

-Position vs. time Graphs

*-displacement calculations*

*-time calculations*

*-average velocity calculations*

*-instantaneous velocity (initial and final) calculations*

*-acceleration recognition (+/-) (speeding up or slowing down based on direction)*

-Velocity vs. time Graphs

*-displacement calculations*

*-average velocity calculations*

*-instantaneous velocity (initial and final) calculations*

*-acceleration calculations (+/-)*

*Vectors (1.5wks)*

-Graphical Addition of Vectors

*-head to tail*

*-resultant vector*

*-magnitude and direction*

-Component Addition Method

*-x/y components (trig)*

*-adding components*

*-resultant vector by trig and Pythagorean Thrm*

*1D and 2D Kinematics (3wks)*

-1D kinematics

*d=vit+½at2 d=vft-½at2 vf2= vi2+2ad d=½(vf+vi)t a=(vf+vi)/t*

-2D kinematics (projectiles)

*-‘cliffdiver’ problems*

*-range, vfinal, flight time, & height*

*-‘cannon’ problems*

*-initial vx & vy, range, vfinal , flight time,max height*

*-projectiles landing at different heights from launch position*

*Forces (3wks)*

-Universal Gravitation

*-force of attraction b/w bodies with mass (N3L)*

*-based on masses and distances between COMs*

-Balanced forces (objects at constant velocities)

*-free body diagrams (FBDs) at equilibrium*

*-Fg, F­N, Ff, F­applied, tension*

-Unbalanced forces (objects which are accelerating)

*-FBDs where we have a net force (N2L)*

*-Fg, F­N, Ff, F­applied, tension, Fnet*

-Fundamental Forces

*-Strong Nuclear/Electromagnetism/Weak Nuclear/Gravitational*

*-Grand Unification Theories (GUTs)*

*Roller Coaster Physics (2.5wks)*

-Centripetal Force

*-center-seeking net force that is required in order to go in a circle/curve*

-Energy Conservation

*-E is conserved and cannot be created or destroyed, just changed to another form*

*-Gravitational Potential Energy*

*-Kinetic Energy*

*-Work & Power*

-Momentum and Impulse

*-momentum (p) is conserved*

*-p can be transferred to other objects through collisions*

*-p can be increased for an object when a net force acts for a period of time (Impulse)*

*Electromagnetism (2wks)*

-Electrostatics

*-Coulomb’s Law*

*-Charge Density*

-Circuits

*-voltage, current, & resistance calculations in series, parallel, & mixed circuits*

*-work and power in circuits*

-Electromagnetism

*-magnetic domains and polarity*

*-magnetic field lines*

*-Right Handed Rules for coils and wires*

*-electromagnets and their effects dues to energy conservation*

*Sound and Waves (1.5wks)*

-Wave Speed Formula and Simple Harmonic Motion (SHM)

*-frequency, wavelength, period, speed calculations*

*-transverse and longitudinal waves*

*-amplitude as energy*

*-SHM (pendula) as wave phenomena*

-Superposition

*-constructive and destructive interference*

*-shockwaves, standing waves (harmonics), beats, resonance*

*Optics (Portfolio) (1.5wks)*

-Speed of light

*-one true constant in the universe*

-Color

*-emag spectrum*

*-additive and subtractive color mixing*

-Reflection

*-law of reflection of light*

-Refraction

*-Snell’s Law, angle of incidence, angle of reflection, total internal reflection*

-Ray Diagrams

*-concave and convex mirrors*

*-concave and convex lenses*

*-focal point, object distance and height, image distance and height*

*-real/imaginary images*

*-Lens/mirror Equation*

*Modern (1wk)*

-Relativity

*-General – space-time is warped by mass*

*-Special – speed of light being constant means time and distances must be variable*

-Quantum Mechanics

*-the ‘world’ of the very small*

*-non-Newtonian*