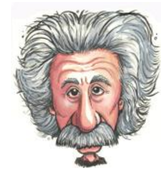
NEED TO KNOW PHYSICS!!!



Kinematics

- **Scalar quantities only have a magnitude (size)** – ie. speed, distance, energy
- **Vector quantities have a magnitude (size) and <u>direction</u>** – ie. force, velocity, momentum, displacement
- Resultant is the sum of vectors (Head-to-Tail Method). Equilibrant: same size, but opposite direction
- **Projectile Motion** – the horizontal acceleration is ZERO and the vertical acceleration is 9.81 m/s/s
    - **Horizontal Projectiles –** initial VERTICAL velocity is ZERO
    - **Projectiles at an Angle**
    - – break velocities into x and y components ($A_x = A\cos\Theta$, $A_y = A\sin\Theta$)
    - – at its maximum height, vertical velocity equals ZERO
    - – the time to reach its maximum height is HALF of its total flight time
    - – d = vt is the ONLY equation you can use for HORIZONTAL motion
    - – Greatest range (horizontal distance) if fired at 45 degrees

- **Graphing Motion**
    - **Distance vs. Time Graphs**
    - – slope of the line equals velocity
    - – curved line indicates accelerated motion
    - – straight line indicates constant velocity (a = 0)
    - **Velocity vs. Time Graphs**
    - - slope of the line equals acceleration
    - - area underneath the line equals the distance covered

Forces and Friction

- Newton's 1st Law: Inertia = mass of an object
- Newton's 2nd Law: $F_{net} = ma$ (most important equation in mechanical physics)
- Newton's 3rd Law: for every action (force), there is an equal and opposite reaction (force)
- **Universal Law of Gravity**: as you move farther away from an object, F_g decreases; as you increase the mass of two objects, F_g increases
- **Force of Gravity = Gravitational Force = WEIGHT = F_g = mg**
- Normal force (F_N) is force from surface pushing perpendicular to the surface ($F_N = F_g$ IF on a flat surface that is NOT accelerating vertically)
- **Elevator problems: Normal force = scale reading**
    - if accelerating up: you appear heavier on a scale (increase in F_N)
    - if accelerating down: you appear lighter on a scale (decrease in F_N)
- Static friction is GREATER than kinetic friction
- In order to START motion, calculate STATIC friction; in order to keep it moving at a constant speed, calculate KINETIC friction
- If an object is on an INCLINE plane: $F_f = F_{gx} = F_g\sin\Theta$ and $F_N = F_{gy} = F_g\cos\Theta$

Circular Motion

- **NEED TO KNOW EQUATION: Circular speed =** $v = 2\pi r / T$
- Circular speed is **TANGENT** to the circle; Centripetal Acceleration and Force are directed **TOWARD the CENTER**

Momentum and Impulse

- When an object experiences a net force for a period of time, its momentum changes ($J=Ft=\Delta p$)
- **NEED TO KNOW EQUATION:** Conservation of Momentum: mv + mv = mv + mv, if they stick together: mv + mv = (m+m)v
- In the case of an explosion: total momentum before = 0 (therefore, the momentum of each object after are EQUAL and OPPOSITE; mv = mv)

Energy, Work, and Power

- Work = Fd = ΔE (if no motion, no work, no change in energy)
- The force that is PARALLEL to displacement is the amount of force being done
- Power is the **RATE** of doing work/using energy (P = W/t)
- **Potential Energy = Stored Energy** (Gravitational PE is based on HEIGHT, Elastic PE is based on how far a spring is stretched)
- **Kinetic Energy** = Energy from Motion
- **NEED TO KNOW EQUATION**: Conservation of Energy: KE + PE = KE + PE
- Work can either add or take away energy
- Internal Energy = HEAT GENERATED BY FRICTION

Electrostatics, Electricity, and Magnetism

- ONLY NEGATIVE CHARGES MOVE (objects become positively charged by losing electrons; become negatively charged by gaining electrons)
- Charge of an electron = charge of a proton = elementary particle = 1.6×10^{-19} C
- You CAN NOT HAVE FRACTION OF ELEMENTARY CHARGES (ie. – 1.65 e)
- Conservation of charge: Total charge is divided evenly between objects that come in contact with each other
- Electric Field: Positive charges – electric field goes AWAY/OUT; Negative charges – electric field goes TOWARD/INWARD
- **<u>MAKE TABLES FOR CIRCUIT PROBLEMS</u>**
- **Series Circuit – ONE Path for current**
  - Current remains constant. Increasing # of resistors; decreases total current
- **Parallel Circuit – MULTIPLE paths for current**
  - Voltage remains constant. Increasing # of resistors; decreases total resistance and increases total current
- Magnetic Field: Field lines go AWAY from NORTH POLE and TOWARD the SOUTH POLE. Field lines never overlap

Waves and Sound

- Transverse waves (ie. light/EM waves) = motion perpendicular to energy; Longitudinal waves (ie. sound) = motion parallel to energy
- Period is the time for one cycle; Frequency is the number of cycles in one second
- Constructive Interference: increase in amplitude (size of wave) (waves 0^o in phase)
- Destructive Interference: decrease in amplitude (size of wave) (waves 180^o out of phase)
- Standing wave – created by two waves with same amplitude, wavelength, frequency, traveling the same medium, but it OPPOSITE directions.
- Nodes (destructive interference) and antinodes (constructive interference) in a standing wave
- Doppler Effect – change is apparent frequency due to motion (If receding, *f* decreases and wavelength increases. If approaching, *f* increase and wavelength decreases)
- Resonance – forced vibration (think of Opera singer shattering glass)
- Diffraction – bending/spreading of a wave around a barrier

Light

- ALL electromagnetic waves (gamma rays, x-rays, radio…) move at the speed of light (3×10^{8} m/s)
- Law of reflection: Angle of incidence = Angle of reflection
- **<u>MEASURE FROM THE NORMAL!!!!!!!!!!!!!!!!</u>**
- Dispersion – Separating white light into each' individual colors (wavelengths) (think rainbows)
- **Refraction**
  - When light (EM) wave enters a GREATER index of refraction: speed and wavelength decrease, it bends TOWARD the normal, frequency remains constant
  - When light (EM) wave enters a SMALLER index of refraction: speed and wavelength increase, it bends AWAY from normal, frequency remains constant

Modern Physics

I am out of space and we just covered this unit. Use your Ref Tabs.