

Work, energy, and power

$$\text{Work} = W = Fd \cos \theta$$

$$\text{Kinetic energy} = KE = \frac{1}{2} mv^2$$

$$\text{Work-energy theorem} = W_{\text{net}} = \Delta KE$$

$$\text{Gravitational potential energy} = PE_{\text{grav}} = mgh$$

$$\text{Total mechanical energy} = E = KE + PE$$

$$\text{Power} = P = \frac{W}{t} Fv$$

Gravity

$$F_{\text{grav}} = mg$$

$$g = \frac{GM}{r^2}$$

$$F_{\text{grav}} = \frac{G(Mm)}{r^2}$$

$$g (\text{Earth}) \approx 10 \text{ m/s}^2$$

Torque

$$\tau = rF \sin \theta$$

Kinematics

$$\text{Constant acceleration} = v = v_0 + at$$

$$d = v_0 t + \frac{1}{2} at^2$$

Projectile motion

Horizontal component

$$x = v_{x0} t \quad vx = v_{x0} \quad a_x = 0$$

Vertical component

$$y = v_{y0} t - \frac{1}{2} gt^2 \quad vy = v_{y0} - gt \quad ay = -g$$

Friction

$$F_{\text{static}} \leq \mu_s FN$$

$$F_{\text{kinetic}} = \mu_k FN$$

Inclined plane

$$\theta = \text{angle of incline}$$

$$F_{\text{g perpendicular}} = mg \cos \theta$$

$$F_{\text{g parallel}} = mg \sin \theta$$

Circular motion

$$\text{Centripetal acceleration} = v_0 + at$$

$$\text{Centripetal force} = F_c = ma_c = \frac{mv^2}{r}$$

Thermodynamics

$$\text{First law} = \Delta E = Q - W$$

$$\text{Heat capacity} = Q = C \Delta T$$

$$\text{Work} = W = P \Delta V$$

$$\text{Specific heat capacity} = Q = mc \Delta T$$

Fluids

$$\text{Density} = \rho = \frac{\text{mass}}{\text{volume}} = \frac{m}{v}$$

$$\text{Specific gravity} = SG = \frac{\rho}{\rho_{\text{water}}}$$

$$\text{Pascal's law} = P = \frac{F}{A}$$

$$\text{Gauge pressure} = P_{\text{gauge}} = P - P_{\text{atm}}$$

$$\text{Pascal's law} = \frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\text{Continuity equation} = A_1 v_1 = A_2 v_2$$

$$\text{Flow rate} = Q = Av$$

$$\text{Buoyant force} = F_{\text{buoyant}} = F_{\text{fluid}} \times V_{\text{submerged}} \times g$$