

Work, energy, and power

- ✓ Work: $W = Fd \cos \theta$
- ✓ Kinetic energy: $KE = \frac{1}{2}mv^2$
- ✓ Work-energy theorem: $W_{\text{net}} = \Delta KE$
- ✓ Gravitational potential energy: $PE = mgh$
- ✓ Total mechanical energy: $E = KE + PE$
- ✓ Power: $P = \frac{W}{t} = Fv$

Gravity

- ✓ $F_{\text{grav}} = mg$
- ✓ $F_{\text{grav}} = \frac{GMm}{r^2}$
- ✓ $g = \frac{GM}{r^2}$
- ✓ $g \approx 10 \text{ m/s}^2$ at Earth's surface

Torque

- ✓ $\tau = rF \sin \theta$

Kinematics

- ✓ Constant acceleration: $v = v_0 + at$
- ✓ $d = v_0t + \frac{1}{2}at^2$
- ✓ $v^2 = v_0^2 + 2ad$

Projectile motion

- ✓ Horizontal component:
 - $x = v_{x0}t$
 - $v_x = v_{x0}$
 - $a_x = 0$
- ✓ Vertical component:
 - $y = v_{y0}t - \frac{1}{2}gt^2$
 - $v_y = v_{y0} - gt$
 - $a_y = -g$

Friction

- ✓ Static: $F_s \leq \mu_s F_N$
- ✓ Kinetic: $F_k = \mu_k F_N$

Inclined plane

- ✓ θ is the angle of the incline
- ✓ Parallel to the incline: $F_{g\parallel} = mg \sin \theta$
- ✓ Perpendicular to the incline: $F_{g\perp} = mg \cos \theta$

Circular motion

- ✓ Centripetal acceleration: $a_c = \frac{v^2}{r}$
- ✓ Centripetal force: $F_c = ma_c = \frac{mv^2}{r}$

Thermodynamics

- ✓ First law: $\Delta E = Q - W$
- ✓ Heat capacity: $Q = C\Delta T$
- ✓ Work (gas): $W = P\Delta V$
- ✓ Specific heat: $Q = mc\Delta T$

Fluids

- ✓ Density: $\rho = \frac{m}{V}$
- ✓ Specific gravity: $SG = \frac{\rho}{\rho_{\text{water}}}$
- ✓ Pressure: $P = \frac{F}{A}$
- ✓ Gauge pressure: $P_{\text{gauge}} = P - P_{\text{atm}}$
- ✓ Pascal's law: $\frac{F_1}{A_1} = \frac{F_2}{A_2}$
- ✓ Continuity equation: $A_1v_1 = A_2v_2$
- ✓ Flow rate: $Q = Av$
- ✓ Buoyant force: $F_{\text{buoyant}} = \rho_{\text{fluid}} V_{\text{submerged}} g$