Achievable

MCAT DUMP SHEET

Mechanics and thermodynamics

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: $P = \dfrac{W}{t} = Fv$

Gravity

- $F_{\text{grav}} = mg$
- $F_{\text{grav}} = \dfrac{GMm}{r^2}$
- $g = \dfrac{GM}{r^2}$
- $g \approx 10\ \text{m/s}^2$ 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: $a_c = \dfrac{v^2}{r}$
- Centripetal force: $F_c = ma_c = \dfrac{mv^2}{r}$

Thermodynamics

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

Fluids

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