Achievable

AP PHYSICS 1 DUMP SHEET

Oscillations and fluids

Simple harmonic motion

- Restoring force: $F = -kx$
- Acceleration: $a = -\dfrac{k}{m}x$
- Position: $x = A\cos(\omega t)$
- Maximum speed: $v_{\max} = \omega A$
- Maximum acceleration: $a_{\max} = \omega^2 A$
- Angular frequency: $\omega = \sqrt{\dfrac{k}{m}}$
- Period of a mass on a spring: $T = 2\pi\sqrt{\dfrac{m}{k}}$
- Frequency: $f = \dfrac{1}{T}$
- Simple pendulum: $T = 2\pi\sqrt{\dfrac{L}{g}}$
- Spring energy:
  - Total: $E = \frac{1}{2}kA^2$
  - At equilibrium: $K_{\max} = \frac{1}{2}kA^2$
  - At a turning point: $U_{s,\max} = \frac{1}{2}kA^2$

Fluids

- Density: $\rho = \dfrac{m}{V}$
- Pressure: $P = \dfrac{F}{A}$
- Gauge pressure: $P_g = \rho g h$
- Absolute pressure: $P = P_0 + \rho g h$
- Bernoulli's equation:
  - $P + \frac{1}{2}\rho v^2 + \rho g y = \text{constant}$
  - Between two points: $P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$
- Buoyant force: $F_B = \rho_{\text{fluid}} V_{\text{disp}}\, g$
- Floating condition: $F_B = F_g$
- Continuity equation: $A_1 v_1 = A_2 v_2$
- Volume flow rate: $Q = Av$

Constants and useful values

- Gravitational acceleration: $g \approx 9.8\ \text{m/s}^2$
- Newton: $1\ \text{N} = 1\ \text{kg}\cdot\text{m/s}^2$
- Joule: $1\ \text{J} = 1\ \text{N}\cdot\text{m}$
- Watt: $1\ \text{W} = 1\ \text{J/s}$
- Pascal: $1\ \text{Pa} = 1\ \text{N/m}^2$