

Physics 202 Cheat Sheet

1 Motion

Constant Acceleration Processes

$$a = \text{constant}$$

$$v = v_0 + at$$

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

$$v^2 = v_0^2 + 2a\Delta x \text{ (Handy Eq.)}$$

Constant Angular Acceleration Processes

$$\alpha = \text{constant}$$

$$\omega = \omega_0 + \alpha t$$

$$\theta = \theta_0 + \omega_0t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$

At a Point

$$s = r\theta$$

$$v = \omega r$$

$$a = \alpha r$$

$$F = ma$$

$$W = F\Delta x$$

$$P = Fv$$

$$KE = \frac{1}{2}mv^2$$

$$p = mv$$

Rolling

$$F_{\text{friction}} = \mu N \text{ (slip)}$$

$$s_{cm} = r\theta \text{ (no slip)}$$

$$v_{cm} = \omega r \text{ (no slip)}$$

$$a_{cm} = \alpha r \text{ (no slip)}$$

Systems of Objects

$$F_{\text{net,external}} = Ma_{cm}$$

$$\tau_{\text{net,external}} = I\alpha_{cm}$$

2 Units

SI: m, kg, s

area: m^2 , volume: m^3

velocity: m/s , acceleration: m/s^2

Common Conversions

1. $3600 \text{ s} = 1 \text{ hour}$
- 1.609 $\text{km} = 1 \text{ mile}$
- 1 $m/s = 2.237 \text{ mi/hr}$
- 745.7 $\text{Watts} = 1 \text{ hp (HorsePower)}$
- 1 $\text{mL} = 1 \text{ cm}^3$

Common Physical Constants

1. $c = 2.998 \times 10^8 \text{ m/s}$ (Speed of Light)
2. $g = 9.81 \text{ m/s}^2 = 32.2 \text{ ft/s}^2$
3. $G = 6.674 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$
4. $\rho_{\text{air}} = 1.2041 \text{ kg/m}^3 = 0.0012041 \text{ g/cm}^3$
5. $\rho_{\text{water}} = 1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$
6. $R = 8.314 \frac{\text{J}}{\text{mol} \cdot \text{K}} = 82.057 \frac{\text{mL} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$
7. $P_0 = 1 \text{ atm} = 101.325 \text{ kPa}$ (atm. press.)
8. $\nu_{\text{human}} = 20 \text{ Hz} \rightarrow 20 \text{ kHz}$
9. $I_{\text{human}} = 0 \rightarrow 120 \text{ dB} = 10^{-12} \rightarrow 1 \text{ W/m}^2$

3 Circular Motion

Centripetal means towards the center of the circle

$$a_{\text{centrip}} = \frac{v^2}{r}, F_{\text{centrip}} = \frac{mv^2}{r}$$

$$T = 2\pi r/v \text{ (T is period of motion)}$$

4 Collisions

$$I \equiv F\Delta t = \Delta p$$

“Elastic” = Energy is Conserved

“Inelastic” = Energy is NOT Conserved

“Perfectly Inelastic” = Two objects move together post-collision

5 Simple Harmonic Motion

$$\omega_{\text{spring}} = \sqrt{\frac{k}{m}}$$

$$\omega_{\text{pendulum}} = \sqrt{\frac{g}{L}}$$

$$x(t) = A\cos(\omega t)$$

$$v(t) = -\omega A\sin(\omega t)$$

$$a(t) = -\omega^2 A\cos(\omega t)$$

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$$E = \frac{1}{2}mv^2 + \frac{1}{2}m\omega^2 x^2 = \text{Constant}$$

6 Temp., Pressure, Density

$$T_C = \frac{5}{9}(T_F - 32)$$

$$T_F = \frac{9}{5}T_C + 32$$

$$T_K = T_C + 273.15$$

$$PV = nRT$$

$$\frac{PV}{nT} = \text{Constant}$$

$$P \equiv F/A$$

$$P = P_0 + \rho gh$$

$$\rho \equiv m/V$$

$$F_{\text{buoy}} = \rho_{\text{fluid}} Vg$$

$$S.G. (\text{Specific Gravity}) = \rho/\rho_{\text{water}}$$

$$P = P_0 + \rho_{\text{fluid}} gh$$

$$\Delta L = \alpha L \Delta T$$

7 Heat Transfer

Conduction, Convection, Radiation

$$\Delta T = IR$$

$$R \equiv \frac{\Delta x}{kA}$$

$$R_{\text{series}} = R_1 + R_2$$

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_f \equiv \frac{\Delta x}{k} = RA$$

8 Sound

$$v_{\text{sound,air}} = 331 \sqrt{1 + \frac{T_C}{273}} \text{ m/s}$$

$$I \equiv P/A \text{ (Intensity)}$$

$$dB = 10 \log \left(\frac{I}{I_0} \right)$$