

## Physics 20 - Formula Sheet

### Kinematics

$$d = \left( \frac{v_o + v_f}{2} \right) t \quad a = \frac{\Delta v}{\Delta t} \quad d = v_o t + \frac{1}{2} a t^2 \quad v_f = v_o + a t \quad v_f^2 = v_o^2 + 2 a d$$

### Dynamics

$$F_{NET} = m a \quad F_g = m g \text{ (approx)} \quad F_g = \frac{G m_1 m_2}{r^2} \text{ (general)} \quad F_f = \mu F_N \quad F_s = k x$$

### Energy

$$E_{\text{before}} = E_{\text{after}} \quad E_k = \frac{1}{2} m v^2 \quad E_p = m g h \quad E_h = m c \Delta T \quad W = F_{\text{avg}} d = \Delta E \quad P = \frac{W}{t}$$

$$\% \text{ efficiency} = \frac{\text{energy output}}{\text{energy input}} \times 100\% = \frac{\text{Power output}}{\text{Power input}} \times 100\%$$

### Circular Motion

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} \quad E_p = \frac{-G m_1 m_2}{r}$$

### Waves

$$T = \frac{1}{f} \quad v = f \lambda \quad \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1} = \frac{\sin \theta_i}{\sin \theta_r} \quad v_{\text{max}} = A \sqrt{\frac{k}{m}} \quad T = 2\pi \sqrt{\frac{m}{k}} \quad T = 2\pi \sqrt{\frac{\ell}{g}}$$

### Data Analysis

$$\% \text{ error} = \frac{| \text{true} - \text{experimental} |}{\text{true}} \times 100\%$$

### Constants & Conversions

$$g = 9.8 \text{ m/s}^2 \quad c = 3.00 \times 10^8 \text{ m/s} \quad v_{\text{sound}} = 343 \text{ m/s} \quad G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

$$c(\text{H}_2\text{O}) = 4200 \text{ J/kgK} \quad 1 \text{ in} = 2.54 \text{ cm} \quad 1 \text{ mile} = 1609 \text{ m}$$

$$r_{\text{earth}} = 6.38 \times 10^6 \text{ m} \quad m_{\text{earth}} = 5.98 \times 10^{24} \text{ kg} \quad r_{\text{moon}} = 1.74 \times 10^6 \text{ m} \quad m_{\text{moon}} = 7.35 \times 10^{22} \text{ kg}$$