

## Force and Energy

$$F = ma$$

$$PE = mgh$$

$$F = \text{force}$$

$$m = \text{mass}$$

$$F = w = mg$$

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

$$a = \text{acceleration}$$

$$w = \text{weight}$$

$$F_g = \frac{Gm_1m_2}{d^2}$$

$$W = \Delta KE$$

$$g = \text{acceleration due to gravity}$$

$$G = \text{gravitational constant}$$

$$d = \text{distance}$$

$$k_e = \text{Coulomb's constant}$$

$$F = \frac{k_e q_1 q_2}{d^2}$$

$$q = \text{charge}$$

$$PE = \text{potential energy}$$

$$h = \text{height}$$

$$KE = \text{kinetic energy}$$

$$v = \text{velocity}$$

$$W = \text{work}$$

## Motion

$$s = \frac{\Delta d}{\Delta t}$$

$$s = \text{speed}$$

$$d = \text{distance}$$

$$t = \text{time}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$a = \text{acceleration}$$

$$v = \text{velocity}$$

$$p = mv$$

$$p = \text{momentum}$$

$$m = \text{mass}$$

$$J = F\Delta t = m\Delta v$$

$$J = \text{impulse}$$

$$F = \text{force}$$

**Kepler's Laws**

$$e = \frac{f}{d}$$

$e$  = eccentricity

$f$  = distance between foci of an ellipse

$d$  = major axis length of an ellipse

$$T^2 \propto R^3$$

$T$  = orbital period

$R$  = semi-major axis of an orbit

**Waves and Light**

$$E = hf$$

$E$  = energy

$h$  = Planck's constant

$f$  = frequency

$$v = f\lambda$$

$v$  = wave speed

$\lambda$  = wavelength

**Experimental Design**

$$\text{Percent Error} = \frac{|\text{accepted value} - \text{experimental value}|}{\text{accepted value}} \cdot 100$$

$$\text{Percent Yield} = \left( \frac{\text{actual yield}}{\text{theoretical yield}} \right) \cdot 100$$

## Constants

**Acceleration Due to Gravity:**  $g = 9.8 \frac{\text{m}}{\text{s}^2}$

**Avogadro's Number:**  $N_A = 6.02 \times 10^{23} \frac{\text{particles}}{\text{mol}}$

**Charge of an Electron:**  $e = 1.60 \times 10^{-19} \text{ C}$

**Coulomb's Constant:**  $k_e = 9.00 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$

**Gravitational Constant:**  $G = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$

**Mass of Earth:**  $M_E = 5.97 \times 10^{24} \text{ kg}$

**Planck's Constant:**  $h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$

**Radius of Earth:**  $R_E = 6.37 \times 10^6 \text{ m}$

**Speed of Light in a Vacuum:**  $c = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$

**Volume of a Gas at 0°C and 100 kPa:**  $V_m = 22.4 \frac{\text{L}}{\text{mol}}$

## Conversions

**Calorie to Joule:**  $1 \text{ cal} = 4.184 \text{ J}$

**Pressure:**  $1 \text{ atm} = 760 \text{ Torr} = 101.3 \text{ kPa}$

## Units

**Energy:**  $1 \text{ J} = 1 \text{ N} \cdot \text{m}$

**Frequency:**  $1 \text{ Hz} = 1 \frac{\text{cycle}}{\text{s}}$

**Force:**  $1 \text{ N} = 1 \frac{\text{kg} \cdot \text{m}}{\text{s}^2}$