

Force and Energy

$$F = ma$$

$$PE = mgh$$

F = force

m = mass

a = acceleration

w = weight

g = acceleration due to gravity

G = gravitational constant

d = distance

k_e = Coulomb's constant

q = charge

PE = potential energy

h = height

KE = kinetic energy

v = velocity

W = work

$$F = w = mg$$

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

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

$$W = Fd$$

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

Motion

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

s = speed

d = distance

t = time

a = acceleration

v = velocity

p = momentum

m = mass

J = impulse

F = force

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

$$p = mv$$

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

Kepler's Laws

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

e = eccentricity

f = distance between foci of an ellipse

d = major axis length of an ellipse

T = orbital period

R = semi-major axis of an orbit

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

Waves and Light

$$E = hf$$

E = energy

h = Planck's constant

f = frequency

v = wave speed

λ = wavelength

$$v = f\lambda$$

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