

Science Reference Sheet

Motion and Forces

$$v_{avg} = \frac{\Delta x}{\Delta t}$$

$$v = v_0 + at$$

$$x = v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2ax$$

$$\Sigma F = F_{net} = ma$$

$$a_c = \frac{v^2}{r}$$

$$F_g = G \frac{m_1 m_2}{R^2}$$

$$F_g = mg$$

$$\text{Mechanical Advantage (MA)} = \frac{\text{load force}}{\text{effort force}}$$

a = acceleration

a_c = centripetal acceleration

F = force

F_g = gravitational force or weight

g = gravitational acceleration

G = universal gravitational constant

m = mass

r = radius

v = speed

v_{avg} = average speed

v_0 = initial speed

t = time

x = distance

R = distance between m_1 and m_2

Waves

$$v = f\lambda$$

$$n = \frac{c}{v}$$

c = the speed of light

f = frequency

n = index of refraction

v = wave speed

λ = wavelength

Conservation of Momentum and Energy

$$W = Fd \cos \theta \quad KE = \frac{1}{2} mv^2$$

$$PE = mgh$$

$$P = \frac{W}{t}$$

$$p = mv$$

$$\Delta p = m\Delta v = Ft$$

$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

d = distance

F = force

KE = kinetic energy

m = mass

p = momentum

P = power

PE = potential energy

W = work

t = time

v = speed

θ = angle

Electric and Magnetic Phenomena

$$E = \frac{F}{q}$$

$$V = IR$$

$$P = IV$$

$$P = I^2 R$$

E = electric field

F = force

I = current

P = power

q = charge

R = resistance

V = potential difference or voltage

Heat and Thermodynamics

$$Q = mc\Delta T$$

$$Q = mL$$

$$W = P\Delta V$$

$$Q = \Delta U + W$$

c = specific heat capacity

L = latent heat

m = mass

P = pressure

Q = heat

T = temperature

U = internal energy

V = volume

W = work

Physical Constants

Gravitational acceleration on Earth:

$$g = 9.8 \text{ m/s}^2$$

Universal gravitational constant:

$$G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$$

Proton mass:

$$m = 1.67 \times 10^{-27} \text{ kg}$$

Electron mass:

$$m = 9.11 \times 10^{-31} \text{ kg}$$

Elementary charge:

$$e = 1.6 \times 10^{-19} \text{ C}$$

Speed of light:

$$c = 3.0 \times 10^8 \text{ m/s}$$