



# Massachusetts Comprehensive Assessment System

## Introductory Physics Formula Sheet

### Formulas

$$\text{Average Speed} = \frac{\Delta d}{\Delta t}$$

$$\text{Average Acceleration} = \frac{\Delta v}{\Delta t}$$

$$\text{Average Velocity} = \frac{v_i + v_f}{2} *$$

$$v_f = v_i + a\Delta t$$

$$\Delta d = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$v_f^2 = v_i^2 + 2a\Delta d$$

$$F = ma$$

$$F = G \frac{m_1 m_2}{d^2}$$

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

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

$$PE = mg\Delta h$$

$$W = F\Delta d$$

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

$$p = mv$$

$$V = IR$$

$$P = IV$$

$$Q = mc\Delta T$$

$$v = f\lambda$$

$$\lambda = \frac{c}{f}$$

$$T = \frac{1}{f}$$

### Variables

a = acceleration

c = specific heat

d = distance

$\Delta d$  = change in distance

f = frequency

F = force

$\Delta h$  = change in height

I = current

KE = kinetic energy

$\lambda$  = wavelength

m = mass

p = momentum

P = power

PE = gravitational potential energy

q = charge of particle

Q = heat

R = resistance

$\Delta t$  = change in time

$\Delta T$  = change in temperature

T = period

v = velocity

$v_i$  = initial velocity

$v_f$  = final velocity

$\Delta v$  = change in velocity

V = voltage

W = work

### Definitions

$$G = \text{Universal gravitational constant} = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$$

$$k = \text{Coulomb constant} = 8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$$

$$c = \text{speed of electromagnetic waves} = 3.00 \times 10^8 \text{ m/s}$$

$$g \approx 10 \text{ m/s}^2 \quad 1 \text{ N} = \frac{1 \text{ kg} \cdot \text{m}}{\text{s}^2} \quad 1 \text{ J} = 1 \text{ N} \cdot \text{m} \quad 1 \text{ W (watt)} = \frac{1 \text{ J}}{\text{s}}$$

**\* => For constant a only !**