

## Some Formulas

### Selected Math Formulas

Circumference of a circle:  $C = 2\pi R$

Area of a circle:  $A = \pi R^2$

Volume of a sphere:  $V = \frac{4}{3}\pi R^3$

Surface area of sphere:  $A = 4\pi R^2$

### International System of Units

Unit of		is the	
length	meter (1 m)		
time	second (1 s)		
mass	kilogram (1 kg)		
If prefix	multiply by	if prefix	divide by
giga- (G)	1 billion	centi- (c)	100
mega- (M)	1 million	milli- (m)	1000
kilo- (k)	1000	micro- ( $\mu$ )	1million
		nano- (n)	1 billion

### Motion

Speed:  $v = \frac{d}{t}$ ;  $[v]=\text{m/s}$

Velocity:  $\vec{v}$  = speed and direction

Acceleration:  $\vec{a} = \frac{\Delta\vec{v}}{t}$ ;  $[a]=\text{m/s}^2$

Uniform acceleration:  $a = \text{constant}$ :

$$v = v_0 + at$$

$$d = v_0t + \frac{1}{2}at^2$$

Free fall:

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

horizontal acceleration  $a = 0$

### Forces

Newton's second law:  $\vec{F} = m\vec{a}$ ;  $[F]=\text{kg m/s}^2=\text{N}$  (newton)

Newton's third law: action = reaction

Weight: force of gravity  $w = mg$

Centripetal acceleration:  $a_c = v^2/r$

Centripetal force:  $F_c = ma_c$

$$\text{Newton's law of universal gravitation: } F = G \frac{m_1 m_2}{r^2}$$

Gravitational constant:  $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

### Work and Energy

Work:  $W = Fd$ ;  $[W]=\text{Nm}=\text{J}$  (joule)

Power:  $P = W/t$ ;  $[P]=\text{J/s}=\text{W}$  (watt)

Kinetic energy:  $KE = \frac{1}{2}mv^2$ ;  $[KE]=\text{J}$

Gravitational potential energy:  $PE = mgh$ ;  $[PE]=\text{J}$

Conservation of energy:  $E = KE + PE = \text{constant}$ .

### Linear Momentum

Impuls and Momentum:  $F\Delta t = \Delta p$ ,  $p = mv$

Conservation of momentum: If  $F_{\text{external}} = 0$  then

$$p_{\text{total}} = \text{constant}; m_1\vec{v}_{1i} + m_2\vec{v}_{2i} = m_1\vec{v}_{1f} + m_2\vec{v}_{2f}$$