BASIC EQUATIONS

MOTION:

equation	symbols - variables	units
average speed $= \dfrac{\text{distance}}{\text{time}}$ $\overline{v}_s = \dfrac{d}{t}$	$\overline{v}_s$ = average speed d = distance t = time	$\frac{m}{s}$ m s
When initial position and velocity = 0 $x = \frac{1}{2}at^2$ $v = at$ $v^2 = 2ax$	x = position or distance a = acceleration t = time v = velocity	m $\frac{m}{s^2}$ s $\frac{m}{s}$
When initial velocity = v_o $x = v_o t + \frac{1}{2}at^2$ $v = v_o + at$ $v^2 = v_0^2 + 2ax$	x = position or distance v_o = initial velocity a = acceleration t = time v = velocity	m $\frac{m}{s}$ $\frac{m}{s^2}$ s $\frac{m}{s}$
Free Fall - upward motion with distance measured upward $y = \frac{1}{2}gt^2$ $v = v_o - gt$	$g = 9.8\frac{m}{s^2}$ $a = -g$ = acceleration t = time y = position at time t v_o = initial velocity v = velocity at time t	 $\frac{m}{s^2}$ s m $\frac{m}{s}$ $\frac{m}{s}$

equation	symbols - variables	units
Free Fall - downward motion with distance measured downward $d = \frac{1}{2}gt^2$ $v = v_o + gt$	$g = 9.8 \frac{m}{s^2}$ $a = g =$ acceleration $t =$ time $d =$ distance fallen at time t $v_o =$ initial velocity $v =$ velocity at time t	$\frac{m}{s^2}$ s m $\frac{m}{s}$ $\frac{m}{s}$

FORCE AND MOMENTUM:

equation	symbols - variables	units
$F = sum\ of\ \ forces$	$F =$ total or net force	$N = \frac{kg \cdot m}{s^2}$
$F = ma$	$F =$ total or net force $m =$ mass $a =$ acceleration	N kg $\frac{m}{s^2}$
$W = mg$	$W =$ weight $m =$ mass $g = 9.8 \frac{m}{s^2}$	N kg
Circular Motion $F_C = \frac{mv^2}{r}$	$F_C =$ centripetal force $m =$ mass $v =$ velocity $r =$ radius	N kg $\frac{m}{s}$ m
Gravity $F_G = G\frac{m_1 m_2}{d^2}$	$F_G =$ gravitational force $m_1 =$ mass 1 $m_2 =$ mass 2 $d =$ distance $G = 6.67 \times 10^{-11} \frac{Nm^2}{kg^2}$	N kg kg d

equation	symbols - variables	units
Momentum $p = mv$	$p =$ momentum $m =$ mass $v =$ velocity	$\frac{kg \cdot m}{s}$ kg $\frac{m}{s}$
Impulse $\bar{F}t = \Delta p$	$\bar{F} =$ average force $t =$ time $\Delta p =$ change in momentum	N s $\frac{kg \cdot m}{s}$

WORK AND ENERGY

equation	symbols - variables	units
Force in direction of motion: $W = Fd$ Force in opposite direction of motion: $W = -Fd$	$W =$ work $F =$ magnitude of force $d =$ distance	J N m
$KE = \frac{1}{2}mv^2$	$KE =$ kinetic energy $m =$ mass $v =$ speed	J kg $\frac{m}{s}$
$W_{NET} = \Delta KE$	$W_{NET} =$ net or total work $\Delta KE =$ change in kinetic energy	J J
$PE = mgh$	$PE =$ potential energy $m =$ mass $g =$ free fall acceleration $h =$ height	J kg $9.8 \frac{m}{s^2}$ m
$E = KE + PE$	$E =$ total energy $KE =$ kinetic energy $PE =$ potential energy	J J J
conservation of mechanical energy: $E_A = E_B$	$E_A =$ total energy at point A $E_B =$ total energy at point B	J J

equation	symbols - variables	units
Work-Energy: $\Delta E = E_B - E_A = W_{NC}$	$\Delta E =$ change in mechanical energy $E_A =$ total energy at point A $E_B =$ total energy at point B $W_{NC} =$ work done by non-conservative force	J J J J
$P_{AVG} = \frac{W}{t}$	$P_{AVG} =$ average power $W =$ work done $t =$ elapsed time	w J s

ELECTRICITY:

equation	symbols - variables	units
$q = ne$	$q =$ charge $n =$ number of particles $e =$ fundamental charge	C $-$ C
$F = \left\| k\frac{q_1 q_2}{d^2} \right\|$	$F =$ magnitude of force $k =$ electrostatic constant $q_1 =$ charge 1 $q_2 =$ charge 2 $d =$ distance between charges	N $\frac{Nm^2}{C^2}$ C C m
$E = \frac{F}{q}$	$E =$ magnitude of electric field $F =$ magnitude of force $q =$ charge	$\frac{N}{C}$ N C
$V = \frac{PE}{q}$	$V =$ electric potential $PE =$ potential energy $q =$ charge	V J C
$I = \frac{q}{t}$	$I =$ electric current $q =$ charge $t =$ time	A C s
$V = IR$	$V =$ voltage drop $I =$ current $R =$ resistance	V A Ω

equation	symbols - variables	units
$P_{loss} = I^2 R$	$P_{loss} =$ power loss $I =$ current $R =$ resistance	w A Ω
$P_{supply} = IV$	$P_{supply} =$ power supplied $I =$ current $V =$ supply voltage	w A V
transformer: $\frac{V_S}{N_S} = \frac{V_P}{N_P}$	$V_P =$ primary coil voltage $N_P =$ turns of wire in primary coil $V_S =$ secondary coil voltage $N_S =$ turns of wire in secondary coil	V $-$ V $-$
$I_S V_S = I_P V_P$	$I_S =$ secondary coil current $V_S =$ secondary coil voltage $I_P =$ primary coil current $V_P =$ primary coil current	A V A V

CONVERSION FACTORS:

$$1 mile = 1609 m$$
$$1 hour = 3600 s$$
$$1 m = 3.28 ft$$
$$1 lb = 4.448 N$$
$$1 hp = 746 w = 550 \frac{ft \cdot lbs}{s}$$

CONSTANTS:

$$g = 9.8 \frac{m}{s^2}$$
$$G = 6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$$
$$e = 1.6 \times 10^{-19} C$$
$$k = 9.0 \times 10^9 \frac{Nm^2}{C^2}$$

The Metric System:
- fundamental physical quantities
- base units
- metric prefixes
- SI system of units
- The Scientific Method

Conversions

Average Speed:

Motion in one dimension:
- position
- velocity
- acceleration
- equations of motion and their use
- conditions for free fall
- free fall

Force and Momentum:
- Newton's Three Laws of Motion
- Finding the total force
- Using Newton's laws
- Weight
- Normal force
- Friction:
  - Static
  - Kinetic
- Momentum and Conservation
- Impulse
- Circular Motion
- Gravitation

Work
Kinetic Energy
Potential Energy
Total Mechanical Energy
Work-Energy
Conservation of Mechanical Energy
Power

charge
force between charges
the electric field
conducting and non-conducting materials
electric potential
electric potential energy
electric current
resistance
Ohm's law
power loss and supply
magnetism
magnetic domains
electromagnetism
AC generator
transformers