Physics 11 – Physics Formulas & Constants

Kinematics

$$v_{avg} = \frac{\Delta d}{\Delta t} \quad \rightarrow \quad \Delta \vec{d} = \vec{v}\Delta t \qquad \vec{a} = \frac{\Delta v}{\Delta t} = \frac{\overrightarrow{v_f} - \overrightarrow{v_i}}{\Delta t}$$

The Big Three: $\boldsymbol{\vec{v}_f = \vec{v}_i + \vec{a}t}$ $\boldsymbol{{v_f}^2 = {v_i}^2 + 2ad}$ $\boldsymbol{d = v_i t + \frac{1}{2}at^2}$

Dynamics

$$\boldsymbol{\vec{F}_{net} = m\vec{a}} \qquad \boldsymbol{F_E = k\Delta L} \qquad \boldsymbol{F_f = \mu F_N}$$

$$\boldsymbol{F_g = mg} \qquad \boldsymbol{F_g = \frac{Gm_1m_2}{r^2}} \qquad g = \frac{GM}{r^2}$$

Work and Energy

$$W = F\Delta d \qquad W = \Delta E \qquad Power = \frac{W}{\Delta t} \text{ or } P = \frac{\Delta E}{\Delta t} \qquad Eff = \frac{W_O}{W_I}$$

$$E_k = \frac{1}{2}mv^2 \qquad E_{gp} = mgh \qquad E_{Elastic} = \frac{1}{2}kx^2$$

$Thermal\ Energy$: $Q = mc\Delta T$ $Q = mL_v$ $Q = mL_f$

$Conservation\ of\ Energy\ (not\ including\ work)$: $Total\ E_{initial} = Total\ E_{final}$

Waves

$$v = f\lambda \qquad n = \frac{c}{v} \qquad f_o = f_s\left(\frac{v_w \pm v_o}{v_w \mp v_s}\right) \qquad v_{sound} = 331 + 0.6T \qquad \frac{v_1}{\lambda_1} = \frac{v_2}{\lambda_2}$$

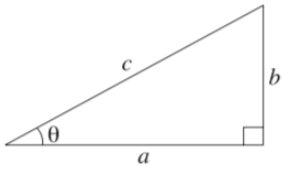
Circuits

$$I = \frac{Q}{t} \qquad V = \frac{E}{Q} \qquad Ohm's\ Law:\ V = IR \qquad Power = IV \qquad V_{terminal} = \mathcal{E} \pm Ir$$

Constants	$c = 3.0 \times 10^8 m/s$	$g = -9.8\, m/s^2$	$R_E = 6.37 \times 10^6\, m$ $M_E = 5.98 \times 10^{24} kg$	$G = 6.67 \times 10^{-11} Nm^2/kg^2$

Quadratic Formula: $If\ ax^2 + bx + c = 0$, then $\boldsymbol{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$

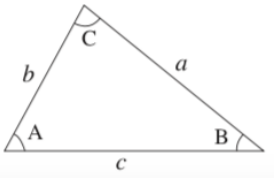
For Right-angled Triangles:



$\boldsymbol{a^2 + b^2 = c^2}$ $\quad Area = \frac{1}{2}ab$

$\boldsymbol{\sin(\theta) = \frac{O}{H}}$ $\boldsymbol{\cos(\theta) = \frac{A}{H}}$ $\boldsymbol{\tan(\theta) = \frac{O}{A}}$

For All Triangles:



Sine Law: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Cosine Law: $c^2 = a^2 + b^2 - 2ab\cos(\angle C)$

Specific heat

Substances	J/kg °C
Solid	
Aluminum	900
Asbestos	800
Carbon, *graphite*	710
Carbon, *diamond*	520
Concrete, *granite*	840
Copper	387
Glass	840
Gold	129
Ice	2090
Iron, steel	425
Lead	128
Silver	235
Wood	1700
Liquid	
Benzene	1740
Ethanol	2450
Glycerine	2410
Mercury (L)	139
Water 15°C	4186
Gas	
Air	1015
Ammonia	2190
Carbon dioxide	833
Nitrogen	1040
Oxygen	913
Steam 100°C	2020
Mixed	
Human body	3500

Latent Heat

Substances	Melting Point (°C)	L_f (kJ/kg) $\times 10^3$	Boiling Point (°C)	L_v (kJ/kg) $\times 10^3$
Hydrogen	-259.3	58.6	-252.9	452
Nitrogen	-210.0	25.5	-195.8	201
Oxygen	-218.8	13.8	-183.0	213
Ethanol	-114	104	78.3	854
Ammonia	-77.7	332	-33.4	1370
Mercury	-38.9	11.8	357	272
Water	0.00	334	100.0	2256
Sulphur	119	38.1	444.6	326
Lead	327	24.5	1750	871
Antimony	631	165	1440	561
Aluminum	660	380	2450	11400
Silver	961	88.3	2193	2336
Gold	1063	64.5	2660	1578
Copper	1083	134	2595	5069
Uranium	1133	84	3900	1900
Tungsten	3410	184	5900	4810