PHYSICS I REFERENCE TABLE

Name_____

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MATHEMATICS

Algebra

Slope equation:

$$m \equiv \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometry

$$\mathrm{Sin}\theta = \frac{\mathrm{Opp}}{\mathrm{Hyp}}$$

$$\mathrm{Cos}\theta = \frac{\mathrm{Adj}}{\mathrm{Hyp}}$$

$$\mathrm{Tan}\theta = \frac{\mathrm{Opp}}{\mathrm{Adj}}$$

Geometry

Circles: Area = πr^2
Perimeter = $2\pi r$

Triangles: Area = $\frac{1}{2}bh$
Perimeter = $a + b + c$

Rectangles: Area = ab
Perimeter = $2a + 2b$

Cylinder: Volume = $\pi r^2 l$

Vectors

$$\vec{E} = -\vec{R}$$

$$R_x = |\vec{R}|\cos\theta$$

$$R_y = |\vec{R}|\sin\theta$$

$$|R| = \sqrt{(\Sigma R_x)^2 + (\Sigma R_y)^2}$$

Percent Difference or Error

Comparing your number to a known result:

$$\%\ \text{error} = \frac{|\text{your \# - known \#}|}{\text{known \#}} * 100\%$$

Comparing two numbers of equal validity:

$$\%\ \text{diff} = \frac{|\text{first \# - second \#}|}{\text{first\#}} * 100\%$$

General Unit Conversions

Time:

24 hours = 1 day
365 days = 1 year
10 years = 1 decade
100 years = 1 century
2 weeks = 1 fortnight

Length:

1 inch = 2.54 centimeters
12 inches = 1 foot
3 feet = 1 yard
8 furlongs = 1 mile
5280 feet = 1 mile
100 cm = 1 meter
1609 meters = 1 mile
1 AU = 1.5×10^{11} meters
1 light year = 9.461×10^{15} meters

Mass:

1000 grams = 1 kilogram
1 atomic mass unit = 1.7×10^{-27} kilograms
1 kilogram = 0.0685 slugs

Other Quantities:

1 acre = 4047 meters^2
1 gallon = 3.788 liters
1 liter = 1000 cm^3
1 radian = 57.3°

1 kWh = 3,600,000 J
1 mAh = 3.6 C

Metric Conversions

Power	Prefix	abbreviation
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exo	E

Solar System Values:

Mass of Earth:	6×10^{24} kg
Radius of Earth:	6.4×10^{6} m
Distance to Moon:	3.8×10^{8} m
Mass of Moon:	7.4×10^{22} kg
Distance to Sun:	1.5×10^{11} m
Mass of Sun:	2×10^{30} kg

Sub-Atomic Values:

mass of electron = 9.1×10^{-31} kg
charge of electron = -1.6×10^{-19} C

mass of proton = 1.6×10^{-27} kg
charge of proton = $+1.6 \times 10^{-19}$ C

mass of neutron = 1.7×10^{-27} kg
charge of neutron = 0 C

PHYSICS

Value of g near various bodies			
Body	**field strength (N/kg)**	**acceleration (m/s^2)**	**accel. in g's**
Earth	9.8	9.8	1
Moon	1.7	1.7	0.17
Mars	3.7	3.7	0.38
Jupiter	27	27	2.7
Pluto	0.49	0.49	0.05
Sun	270	270	28

KINEMATICS

$$\bar{v} \equiv \frac{\Delta s}{\Delta t}$$

$$s_f = s_i + v\Delta t$$

$$\bar{v} = \frac{v_i + v_f}{2}$$

$$\Delta v = v_f - v_i$$

$$a \equiv \frac{\Delta v}{\Delta t}$$

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

$$\Delta s = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

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

$$a_{\parallel} = |g| \sin(\theta)$$

$$\text{range} = \frac{v^2}{g} \sin(2\theta)$$

STATICS & DYNAMICS

$$\Sigma F = 0$$

$$\Sigma F = ma$$

$$F_A = -F_B$$

$$F_g = mg$$

$$\vec{g} \equiv \frac{F_g}{m}$$

$$F_{\perp} = mg\cos(\theta)$$

$$F_{\parallel} = mg\sin(\theta)$$

$$F_f = \mu F_{\perp}$$

$$\left|\bar{v}\right| = \frac{2\pi r}{T}$$

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

$$|F_G| = \frac{G m_A m_B}{r^2}$$

$$\frac{r^3}{T^2} = \frac{G m_c}{4\check{s}^2}$$

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

Named Units

Force is measured in Newtons (N)
Energy is measured in Joules (J)
Power is measured in Watts (W)

MOMENTUM & ENERGY

Energy Unit Conversions

1 Joule = 0.24 Calories
1 Calorie = 1000 calories
1 Joule = 10^7 Ergs
1 Joule = 0.0095 BTU's

$$\vec{p} \equiv m\vec{v}$$

$$\Sigma\vec{p}_i = \Sigma\vec{p}_f$$

$$m_A v_A + m_B v_B = m_A v_A' + m_B v_B'$$

$$\Delta\vec{p} = m\Delta\vec{v}$$

$$\Delta\vec{p} = \vec{F}\Delta t$$

$$\Sigma E_i = \Sigma E_f$$

$$w \equiv \Delta E$$

$$w = \vec{F} \cdot \Delta\vec{s}$$

$$w = F\Delta s\cos(\theta)$$

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

$$P = \left|\vec{F}\right| \bar{v}$$

$$KE = \frac{1}{2} m v^2$$

$$PE_g = mg\Delta h$$

$$F_s = k\Delta x$$

$$PE_s = \frac{1}{2} k \Delta x^2$$

WAVE PHENOMENA

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

$$v = f\lambda$$

$$E \propto A^2$$

$$\theta_I = \theta_R$$

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

$$n_i \sin\theta_f = n_i \sin\theta_f$$

Index of refraction for yellow light			
vacuum	1.00	glycerol	1.47
air (*rounded)	1.00*	vegetable oil	1.47
water	1.33	turpentine	1.47
acetone	1.36	lucite	1.50
isopropol alcohol	1.36	glass	1.63
corn oil	1.47	diamond	2.42

Useful Constants:

Speed of light in vacuum:
3×10^8 m/s

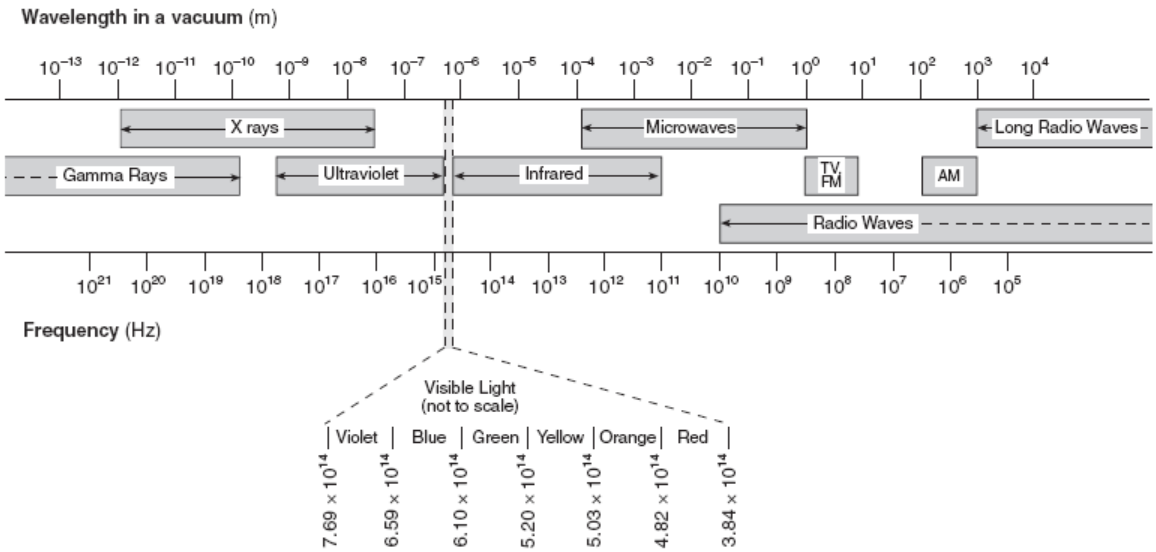
Speed of sound in air:
330 m/s

Speed of sound in water:
1400 m/s

Named Units

Frequency is measured in Hertz (Hz)

ELECTROMAGNETIC SPECTRUM



ELECTROSTATICS

$$|F_E| = \frac{k|q_A||q_B|}{r^2}$$

$$\vec{E} \equiv \frac{\vec{F}_E}{q}$$

$$\vec{E} = \frac{kq}{r^2}$$

$$w = qE\Delta s$$

$$\Delta V \equiv \frac{w}{q}$$

$$|E| = \frac{\Delta V}{\Delta s}$$

$$\vec{F}_E = \vec{E}q$$

Useful Constants:

$k = 9 \times 10^9\ Nm^2/C^2$

$k' = 1 \times 10^{-7}\ Tm^2/CV$

Electrical breakdown of air at STP:
3,000,000 V/m

$1C = 6.25 \times 10^{18}\ e$

$1e = 1.6 \times 10^{-19}\ C$

mass of electron = 9.1×10^{-31} kg

mass of proton = 1.6×10^{-27} kg

ELECTRODYNAMICS

$$I = \frac{\Delta q}{\Delta t}$$

$$C \equiv \frac{\Delta q}{\Delta V}$$

$$C = \frac{A}{4\pi kd}$$

$$PE_c = \frac{C(\Delta V)^2}{2}$$

$$R \propto \frac{L}{A}$$

$$\Delta V = IR$$

$$P = I\Delta V = I^2R = \frac{\Delta V^2}{R}$$

$$w = P\Delta t$$

$$|B| = \frac{k'qv}{r^2}$$

$$|B| \equiv \frac{F}{qv}$$

$$\vec{F}_B = qv \times B$$

$$\vec{F}_B = I\ell \times B$$

Named Units

Potential Difference is measured in Volts (V)
Current is measured in Amperes (A)
Capacitance is measured in Farads (F)
Resistance is measured in Ohms (Ω)
Power is measured in Watts (W)
Magnetic field is measured in Teslas (T)

Series & Parallel Capacitors:

$$\sum C_p = C_1 + C_2 + C_n$$

$$\sum \frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_n}$$

Series & Parallel Cells:

$$\sum \Delta V_s = \Delta V_1 + \Delta V_2 + \Delta V_n$$

$$\sum Q_p = Q_1 + Q_2 + Q_n$$

Series Resistors:

$$\sum R_s = R_1 + R_2 + R_n$$

$$\sum \Delta V_s = \Delta V_1 + \Delta V_2 + \Delta V_n$$

$$\sum I_s = I_1 = I_2 = I_n$$

Parallel Resistors:

$$\sum \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_n}$$

$$\sum \Delta V_p = \Delta V_1 = \Delta V_2 = \Delta V_n$$

$$\sum I_p = I_1 + I_2 + I_n$$