Ruiz – Houston's Physics Equation Sheet

Chapter 9 ~ Heat

Temperature Conversions

$K = {}^0C + 273.15$ $\quad {}^0F = \frac{9}{5}({}^0C) + 32$

${}^0C = K - 273.15$ $\quad {}^0C = \frac{5}{9}({}^0F - 32)$

Conservation of Energy

$$\Delta PE + \Delta KE + \Delta U = 0$$

$$(PE_f - PE_i) + (KE_f - KE_i) + (U_f - U_i) = 0$$

Heat & Calorimetry

$$Q = mc\Delta T$$

$$Q_{gained} = -Q_{loss}$$

$$m_w c_w \Delta T_w = -m_x c_x \Delta T_x$$

Heat during a Phase Change

$Q = mL_F$ $\quad Q = mL_v$

Chapter 10 ~ Thermodynamics

Work done by a Gas

$$W = PAd = P\Delta V$$

First Law of Thermodynamics

$$\Delta U = Q - W$$

Cyclic Process

$\Delta U_{net} = 0$ $\quad Q_{net} = W_{net}$

Efficiency of a Heat Engine

$$eff = \frac{W_{net}}{Q_h} = \frac{Q_h - Q_c}{Q_h} = 1 - \frac{Q_c}{Q_h}$$

Chapter 11 ~ Vibrations & Waves

Hooke's Law

$$F_{elastic} = -kx$$

Period of a Simple Pendulum

$$T = 2\pi\sqrt{\frac{L}{g}}$$

Period of a Mass-Spring System

$$T = 2\pi\sqrt{\frac{m}{k}}$$

Wave Equation

$v = f\lambda$ $\quad c = f\lambda$

$c = 3.00 \bullet 10^8\ {}^m/_s$

Chapter 12 ~ Sound

Intensity of a Spherical Wave

$$Intensity = I = \frac{P}{4\pi r^2}$$

Harmonic Series – String

$$f_n = n\frac{v}{2L} \quad n = 1,2,3,\ldots$$

Harmonic Series – Open Pipe

$$f_n = n\frac{v}{2L} \quad n = 1,2,3,\ldots$$

Harmonic Series – Closed Pipe

$$f_n = n\frac{v}{4L} \quad n = 1,3,5,\ldots$$

Chapter 13 ~ Light & Reflection

Wave Speed Equation

$c = f\lambda$ $\quad c = 3.00 \bullet 10^8\ {}^m/_s$

Law of Reflection

$$\theta_i = \theta_r$$

Mirror Equation

$$\frac{1}{p} + \frac{1}{q} = \frac{2}{r} = \frac{1}{f}$$

Magnification Equation

$$M = \frac{h'}{h} = -\frac{q}{p}$$

Variables

p = Object $\quad$ h' = Image height

q = image $\quad$ h = Object height

Chapter 14 ~ Refraction

Index of Refraction

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

Snell's Law

$$n_i(\sin\theta_i) = n_r(\sin\theta_r)$$

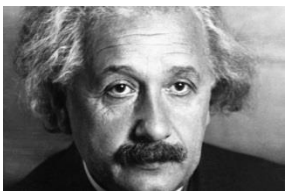
Critical Angle

$$\sin\theta_c = \frac{n_r}{n_i}(\sin 90^0) = \frac{n_r}{n_i}$$

for $n_i > n_r$

Lens & Magnification Equation

$$\frac{1}{p} + \frac{1}{q} = \frac{2}{r} = \frac{1}{f} \qquad M = \frac{h'}{h} = -\frac{q}{p}$$

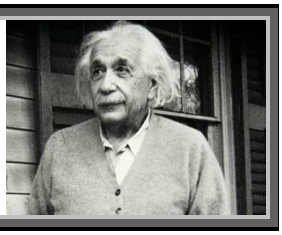


The world is a dangerous place, not because of those who do evil but because of those who look on and do nothing.

~ Albert Einstein ~

The measure of intelligence is the ability to change.

~ Albert Einstein ~



Chapter 16 ~ Electric Forces & Fields

Coulomb's Law

$$F_{electric} = k_c\frac{q_1 q_2}{r^2}$$

Electric Field Strength

$$E = k_c\frac{q}{r^2} = \frac{F_{electric}}{q}$$

$$k_c = 8.99 \bullet 10^9\ {}^{N \bullet m^2}/_{C^2}$$

Chapter 17 ~ Electric Energy & Current

Electric Potential Energy

$$PE_{electric} = -qEd$$

Potential Difference

$$\Delta V = \frac{\Delta PE_{electric}}{q} = -E\Delta d = k_c\frac{q}{r}$$

Capacitance

$$C = \frac{Q}{\Delta V} \qquad C_{vacuum} = \varepsilon_0\frac{A}{d}$$

Ohm's Law

$$\Delta V = IR$$

Electrical PE – in Capacitor

$$PE_{electric} = \tfrac{1}{2}Q\Delta V = \tfrac{1}{2}C(\Delta V)^2 = \frac{Q^2}{2C}$$

Electrical Current

$$I = \frac{\Delta Q}{\Delta t} \qquad I = \frac{\Delta V}{R_{eq}}$$

Electrical Power

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

Chapter 18 ~ Circuits & Circuit Elements

Series

$$emf = \Delta V = V_1 + V_2 + V_3 + \ldots$$

$$I_{Total} = I_1 = I_2 = I_3 = \ldots$$

$$R_{eq} = R_1 + R_2 + R_3 + \ldots$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots$$

Parallel

$$emf = \Delta V = \Delta V_1 = \Delta V_2 = \Delta V_3 = \ldots$$

$$I_{Total} = I_1 + I_2 + I_3 + \ldots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

$$C_{eq} = C_1 + C_2 + C_3 + \ldots$$

Chapter 19 ~ Magnetism

Magnetic Flux

$$\Phi_M = AB\cos\theta$$

Magnetic Force

$$F_{magnetic} = qvB = BI\ell$$

Chapter 21 ~ Atomic Physics

Energy of Quantum

$$E = hf$$

Photoelectric Kinetic Energy

$$KE_{max} = hf - hf_t$$

de Broglie λ & Frequency

$$\lambda = \frac{h}{p} = \frac{h}{mv} \qquad f = \frac{E}{h}$$

Constant

Planck's Constant $= 6.63 \bullet 10^{-34}$ J•s

Chapter 22 ~ Subatomic Physics

Rest Energy

$$E_{rest} = \Delta mc^2$$

Nuclear Binding Energy

$$E_{binding} = \Delta mc^2$$

$$c^2 = 931.49\ {}^{MeV}/_u$$

Activity (Decay Rate)

$$Activity = -\frac{\Delta N}{\Delta t} = \lambda N$$

Activity (Decay Rate)

$$T_{1/2} = \frac{0.693}{\lambda} \qquad A = A_0\left(\frac{1}{2}\right)^t$$

$t = \#\ half\ lives$

Mass Defect

$$\Delta m = Z(atomic\ \ mass\ \ of\ \ H) + Nm_n - atomic\ \ mass$$

$$\Delta m = Z(1.007825u) + N(1.008665u) - atomic\ \ mass$$

A person who never made a mistake never tried anything new. ~ Albert Einstein ~