# PHYSICS 11 - EQUATION SHEET

## KINEMATICS

$$\vec{v}_{avg} = \frac{\Delta \vec{d}}{\Delta t} \qquad \vec{a} = \frac{\Delta \vec{v}}{\Delta t} \qquad \vec{d} = \frac{1}{2}(\vec{v}_f + \vec{v}_o)t \qquad \vec{v}_f = \vec{v}_o + \vec{a}t \qquad \vec{v}_f^2 = \vec{v}_o^2 + 2\vec{a}\vec{d} \qquad \vec{d} = \vec{v}_o t + \frac{1}{2}\vec{a}t^2$$

## FORCES

$$\vec{F}_e = kx \qquad \vec{F}_f = \mu \vec{F}_n \qquad \vec{F}_g = mg \qquad \vec{F}_g = \frac{Gm_1 m_2}{r^2} \qquad \vec{F}_{net} = m\vec{a}$$

## MOMENTUM

$$\vec{p} = m\vec{v} \qquad \Delta \vec{p} = m\Delta \vec{v} = \vec{F}\Delta t$$

## ENERGY, WORK AND POWER

$$E_p = mg\Delta h \qquad E_k = \frac{1}{2}m\vec{v}^2 \qquad E_h = mc\Delta T \qquad E = mc^2 \qquad E_e = \frac{1}{2}kx^2$$

$$Eff = \frac{useful\ out \times 100\%}{total\ input} \qquad W = \vec{F}d \qquad P = \frac{w}{t} \qquad W = \Delta E$$

## WAVES

$$T = \frac{1}{f} \qquad f = \frac{1}{T} \qquad \vec{v} = \lambda f \qquad \vec{v} = \frac{\lambda}{T}$$

## LIGHT

$$n_i sin\theta_i = n_r sin\theta_r \qquad n = \frac{c}{v} \qquad \frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o} \qquad m = -\frac{d_i}{d_o} = \frac{h_i}{h_o}$$

## RELATIVITY

$$t = \frac{t_o}{\sqrt{1-\frac{\vec{v}^2}{c^2}}} \qquad L = L_o\sqrt{1-\frac{\vec{v}^2}{c^2}} \qquad m = \frac{m_o}{\sqrt{1-\frac{\vec{v}^2}{c^2}}} \qquad u = \frac{u' + \vec{v}}{1 + u'\frac{\vec{v}}{c^2}}$$

## NUCLEAR

$$E = mc^2 \qquad \%\ remaining = 100\left(\frac{1}{2}\right)^n \qquad N = N_o\left(\frac{1}{2}\right)^n$$

## CONSTANTS

$$g = 9.81\frac{m}{s^2} \qquad G = 6.67 \times 10^{-11}\frac{Nm^2}{kg^2} \qquad c_{H_2O} = 4200\frac{J}{kg} \times K$$

$$1kWh = 3.6 \times 10^6\ J \qquad c = 3.00 \times 10^8\frac{m}{s} \qquad 1\ eV = 1.60 \times 10^{-19}\ J$$

$$m_e = 5.98 \times 10^{24}\ kg \qquad r_e = 6.38 \times 10^6\ m \qquad 1\ amu = 1.66 \times 10^{-27}\ kg \qquad 1\ amu = 934\ MeV$$

## INDICES OF REFRACTION:

| Medium | n | | Medium | n |
|---|---|---|---|---|
| Vacuum | 1.0000 | | Crown glass | 1.52 |
| Air | 1.0003 | | Quartz | 1.54 |
| Water | 1.33 | | Flint glass | 1.61 |
| Ethanol | 1.36 | | Diamond | 2.42 |