College of Sciences كلية العلوم

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Equations and Constants

$$s=\left(\frac{v+u}{2}\right)t,\quad v=u+at\ ,\quad s=ut+\frac{1}{2}at^2,\ v^2=u^2+2as,\ h=\frac{1}{2}gt^2,$$

Weight = mg, $\sum F=ma$ **,** f **= μN ,** f **= μmg (horizontal plane),** f **= μmgcosθ (inclined plane by θ)**

Work = Force x Distance, **Kinetic Energy:** $K.E=\frac{1}{2}mv^2$**,** **Potential Energy:** $P.E=mgh$

$E_f=E_i$ **and** $E=mgh+\frac{1}{2}mv^2$ **,** **Power:** $P=\frac{Energy}{time}$**,** **P = F.v**

Density: $\rho=\frac{mass}{volume}$**,** Hooke's law: **F = k.x,** $Y=\frac{F/A}{\Delta L/L_0}$**,** $B=\frac{F/A}{\Delta V/V_0}$**,** $G=\frac{F}{A\varphi}$

$\text{Pressure} = \frac{Force}{Area}$, **Pressure in a liquid:** $P = \rho g h$, $P = P_0 + h\rho g$,

Hydraulic Amplifiers: $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

Flow rate: Q = Volume/time, Q = Velocity x Area, $v_1 A_1 = v_2 A_2$

Bernoulli's theory: $P_1 + mgh_1 + \frac{1}{2}\rho v_1^2 = P_2 + mgh_2 + \frac{1}{2}\rho v_2^2$

$\Delta Q = mc\Delta T$, $m_1 c_1 (T_1 - T_f) = m_2 c_2 (T_f - T_2)$, $Q = mL_f$, $Q = mL_v$

$L = L_0(1 + \alpha\Delta T)$, $\alpha = \frac{\Delta L / L_0}{\Delta T}$, $V = V_0(1 + \gamma\Delta T)$, $\gamma = \frac{\Delta V / V_0}{\Delta T}$

Conduction: $\frac{\Delta Q}{\Delta t} = kAt\frac{(T_2 - T_1)}{L}$, **Convection:** $\frac{\Delta Q}{\Delta t} = hA(T_2 - T_1)$,

Stefan's Law: $\frac{\Delta Q}{\Delta t} = \sigma e A T^4$, **Radiation for two surfaces:** $\frac{\Delta Q}{\Delta t} = \sigma e A(T^4 - T_o^4)$

<u>Constants:</u>

1 cal = 4.186 J, c_w = 4186 J/kg.K, L_f = 3.35x10^5 J/kg for ice, g = 9.8 m/s^2, ρ_W =1000 kg/m^3, 1 tonne = 1000 kg, 1 km/h = (1/3.6) m/s, 1 m = 100 cm = 1000 mm, 1 m^2 = 10^4 cm^2 = 10^6 mm^2, 1 m^3 = 10^6 cm^3 = 10^9 mm^3, 1 m^3 = 1000 liters, 1 hPa = 100 Pa, 1 mb = 100 Pa, P_0 = 1.01x^5 Pa, σ = 5.67x10^{-8} W/m^2/K^4 ,

Area of a circle = πr^2, Surface area of a sphere = $4\pi r^2$, Volume of a sphere = $(4/3)\pi r^3$