Feel free to rip this equation sheet from the rest of the test. If you don't, **please write your name** and lab weekday/time here.

$\sin\theta$ = opposite/hyp $\cos\theta$ = adjacent/hyp $\tan\theta$ = opposite/adj $a^2 + b^2 = c^2$

for $ax^2 + bx + c = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Kinematics

$$\Delta\vec{x} = \vec{x}_f - \vec{x}_i \qquad \vec{v}_{\text{ave}} = \frac{\Delta\vec{x}}{\Delta t} \qquad \vec{a}_{\text{ave}} = \frac{\Delta\vec{v}}{\Delta t}$$

$$\Delta\vec{x} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2 \qquad \vec{v} = \vec{v}_0 + \vec{a}t \qquad v^2 = v_0^2 + 2a\Delta x$$

Forces

net $\mathbf{F} = m\mathbf{a}$ $W = m g$ $f_k = \mu_k F_N$ $f_S \le \mu_S F_N$

Constants and Unit Conversions

$g = 9.8\ \text{m/s}^2$ 1 in = 2.54 cm   1 kg = 2.24 lb

$1\ \text{m}^3 = 1000$ L

1 m = 3.28 ft

Prefixes:

1 m = 100 cm = 1000 mm = 1,000,000 μm = 1,000,000,000 nm   1 kg = 1000 g

Work = (component of force in the direction of displacement)(displacement) = $F_{||}\,\Delta x$

$W_{total} = \Delta KE$ $W_{NC} = \Delta KE + \Delta PE$

Energy: $KE = \frac{1}{2} m v^2$ $GPE = mgy$

$\rho = M/V$ $P = F/A$ stress=elastic modulus x strain $F/A = Y\,\Delta L/L_0$ (Young's modulus)

$F/A = S\Delta x/h$ (shear modulus) $\Delta P = -B\,\Delta V/V$ (bulk modulus)

$P = P_0 + \rho gh$ $B = \rho Vg$ $A_1v_1 = A_2v_2$ $P_1 + \frac{1}{2}\rho v_1^2 + \rho gy_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho gy_2$

$T_C = T - 273.15$ $T_F = 9/5\ T_C + 32$

$\Delta L = \alpha\, L_0\, \Delta T$ $\Delta A = \gamma\, A_0\, \Delta T$ $\Delta V = \beta\, V_0\, \Delta T$

$Q = mc\Delta T$ $Q = \pm\, mL$

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$F_s = -kx$ $a = -(k/m)\,x$ $v = \pm\sqrt{\frac{k}{m}(A^2 - x^2)}$

Elastic PE = $\frac{1}{2} kx^2$ $Tspring = 2\pi\sqrt{\frac{m}{k}} = 1/f$ $\omega = 2\pi f = \sqrt{\frac{k}{m}}$

$x = A\cos(2\pi ft) = A\cos(\omega t)$ $v = -A\,\omega\sin(2\pi ft) = -A\,\omega\sin(\omega t)$ $v_{max} = A\,\omega$

$a = -A\,\omega^2\cos(2\pi ft) = -A\,\omega^2\cos(\omega t)$ $a_{max} = A\,\omega^2$ (calculator in rad mode for sines/cosines)

$Tpendulum = 2\pi\sqrt{\frac{L}{g}}$ $v = \lambda f$ $v = \sqrt{\frac{F}{\mu}}$ Speed of light = $3\text{x}10^8$ m/s

Constants for H_2O: Area of a circle = πr^2

Linear expansion for water: $\alpha = 6.9 \times 10^{-5}\ °C^{-1}$

Specific heat of water (ice): 4186 J/kg°C (2090 J/kg°C)

Latent heat of fusion (vaporization) for water: 333,000 J/kg (2,260,000 J/kg)

Density of water: 1000 kg/m^3