PHYS 201 SFQ on String Vibrations Name:________________

Speed of transverse waves on a stretched string is given by,

$$V = \sqrt{\frac{T}{\mu}}.$$

1. Describe each term in the above equation.

T = tension in the string

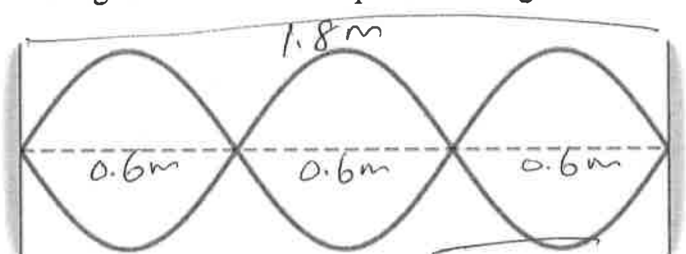
μ = mass per length of the string.

2. Show that the above equation is valid unit wise (ie dimensionally ~~correct~~).

$$= \sqrt{\frac{N}{kg/m}} = \sqrt{\frac{N}{kg/m}} = \sqrt{\frac{kg \cdot m/s^2}{kg/m}} = \sqrt{m^2/s^2} = m/s$$

Since $V \rightarrow m/s$, valid unitwise.

3. A string has a linear density of 8.5×10^{-3} kg/m and is under a tension of 280 N. The string is 1.8 m long, is fixed at both ends, and is vibrating in the standing wave pattern shown in the drawing. Determine the (a) speed, (b) wavelength, and (c) frequency of the traveling waves that make up the standing wave.



$$V = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{280}{8.5 \times 10^{-3}}} = 181.5 \text{ m/s}$$

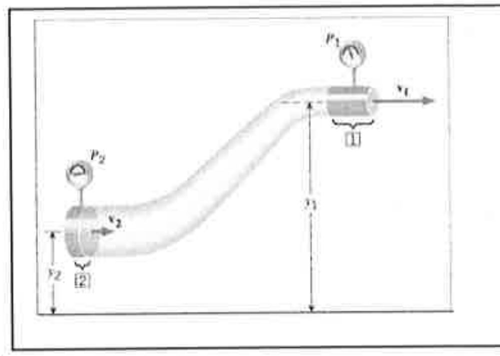
$$\lambda = 2 \times 0.6 = 1.2 \text{ m}$$

$$f = \frac{V}{\lambda} = \frac{181.5}{1.2} = 151 \text{ Hz}$$

PHYS 201 Bernoulli's Principle Name:________________________

1. Define pressure.

Force per Area.



2. Describe each of the terms in the Bernoulli's equation below.

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2.$$

$P =$ pressure $\rho =$ density

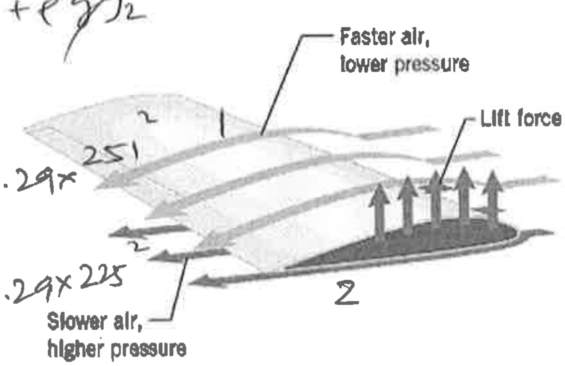
$v =$ velocity $y =$ height

$g =$ acceleration due to gravity

3. What is the unit for the term $\rho g y$ in the Bernoulli's equation?

$N/m^2 \simeq \frac{kg}{m^3} \times \frac{m}{s^2} \times m = \frac{kg}{ms^2}$

4. An airplane wing is designed so that the speed of the air across the top of the wing is 251 m/s when the speed of the air below the wing is 225 m/s. The density of the air is 1.29 kg/m³. What is the lifting force on a wing of area 24.0 m²?



$P_2 + \frac{1}{2}\rho v_2^2 + \cancel{\rho g y_2} = P_1 + \frac{1}{2}\rho v_1^2 + \cancel{\rho g y_2}$

$y_1 \simeq y_2$

$P_2 + \frac{1}{2} \times 1.29 \times 225^2 = P_1 + \frac{1}{2} \times 1.29 \times 251^2$

$P_2 - P_1 = \frac{1}{2} \times 1.29 \times 251^2 - \frac{1}{2} \times 1.29 \times 225^2$

$\Delta P = 7982\ N/m^2$

$F = \Delta P \times A = 7982 \times 24 = \underline{191580\ N}$

PHYS 201 SFQ on Rot Dynamics Name:______________________________

1.	2.	3.	4.	5.	Newton's 2nd Law
$\theta = \bar{\omega}\, t$	$\theta = \frac{1}{2}(\omega_0 + \omega)t$	$\omega = \omega_0 + at$	$\theta = \omega_0 t + \frac{1}{2}at^2$	$\omega^2 = \omega_0^2 + 2\alpha x$	$\sum \vec{\tau} = I\vec{\alpha}$

Force of friction: $F_{fr} = \mu\ F_N$. torque = τ = LA· F $I = \sum m_i r_i^2$

A stationary bicycle is raised off the ground, and its front wheel (m = 1.3 kg) is rotating at an angular velocity of 13.1 rad/s (see the drawing). The front brake is then applied for 3.0 s, and the wheel slows down to 3.7 rad/s. Assume that all the mass of the wheel is concentrated in the rim, the radius of which is 0.33 m. The coefficient of kinetic friction between each brake pad and the rim is μ_k = 0.85. What is the magnitude of the normal force that *each* brake pad applies to the rim?

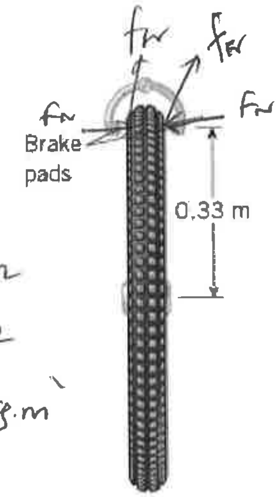
$\omega_0 = 13.1$ rad/s

$\omega = 3.7$ rad/s

$t = 3.0$ s

$\omega = \omega_0 + \alpha t \rightarrow 3.7 = 13.1 + \alpha \times 3$

$\alpha = -3.133$ rad/s^2



$\tau = I\alpha$, $I = mr^2 = 1.3 \times 0.33^2$

$= 0.142$ kg.m^2

$\tau = 0.142 \times (-3.133)$

$\tau = -0.4435$ N.m

$\tau = LA \cdot 2f_{fr}$

$-0.4435 = 0.33 \times 2f_{fr} \rightarrow f_{fr} = -.6719$ N

$= -0.672$ N

$f_{fr} = \mu f_N$

$\frac{-0.672}{\cancel{1.3}} = 0.85 \cdot f_N$

$|f_N| = 0.79$ N $\leftarrow$ on each side

$f_N = -0.79$N

PHYS 201 SFQ on Pascal's Principle Name: key

1. Define Pressure, identify it as a scalar or vector, and state its SI unit.

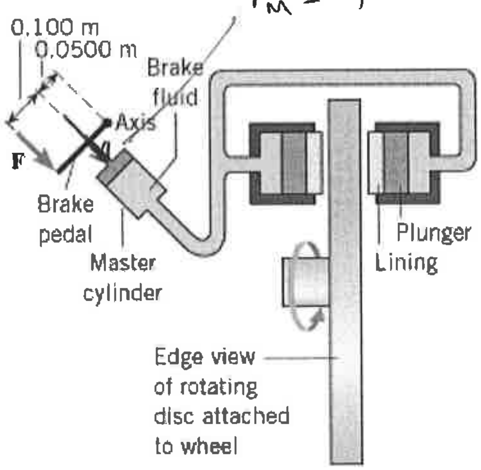
Pressure = Force/area, scalar, N/m^2

2. State Pascal's principle.

Any change in the pressure applied to a completely enclosed, incompressible fluid is transmitted undiminished to all parts of the fluid and the enclosing walls.

3. The drawing shows a hydraulic system used with disc brakes. The force **F** is applied perpendicularly to the brake pedal. The pedal rotates about the axis shown in the drawing and causes a force to be applied perpendicularly to the input piston (radius= 9.50×10^{-3} m) in the master cylinder. The resulting pressure is transmitted by the brake fluid to the output plungers (radii = 1.90×10^{-2} m), which are covered with the brake linings. The linings are pressed against both sides of a disc attached to the rotating wheel. Suppose that the magnitude of **F** is 9.00 N. Assume that the input piston and the output plungers are at the same vertical level, and find the force applied to each side of the rotating disc.

F_M = force applied to the master cylinder



$F \times 0.15 = F_M \times 0.05$

$9 \times 0.15 = F_M \times 0.05$

$F_M = 27\,N$

$P = \frac{F_M}{A} = \frac{27}{\pi(9.5\times10^{-3})^2} = 9.5\times10^{4}\ N/m^2$

$F_{Plunger} = P \cdot A = 9.5\times10^{4} \times \pi \times (1.9\times10^{-2})^2$

$F_{Plunger} = 108\,N$