PHYS 3306 Intermediate Physics **Practice Problems for Test 1**

1. A point source emits 30.0 W of sound isotropically. A small microphone intercepts the sound in an area of 0.750 cm^2, 200 m from the source. Calculate

(a) the sound intensity at the microphone

(b) the power intercepted by the microphone

2. The fresh water behind a dam has total depth of 15 m. At a depth of 6.0 m below the water's surface a horizontal pipe of diameter 4.0 cm passes entirely through the dam and a plug secures the opening.

(a) Find the magnitude of the frictional force between the plug and the pipe wall.

(b) After the plug is removed, what volume of water exits the pipe in 3.0 h, assuming all other data remain the same?

3. A liquid of density 900 kg/m^3 flows through a horizontal pipe that has a cross-sectional area 1.9×10^{-2} m^2 in region *A* and a cross-sectional area 9.5×10^{-2} m^2 in region *B*. The pressure difference between the two regions is 7.20×10^3 Pa. What is the mass flow rate?

4. Two sine waves are generated on a string of length 3.0 m, tension 1.5 N, and linear density 15 g/m. This produces a 4-node standing wave of amplitude 1.0 cm. Let the equation for one of the waves be $y(x, t) = 0.25\text{cm} \sin(kx - \omega t)$. For the other wave, what are

(a) the amplitude

(b) the wavelength

(c) the frequency

(d) the direction of travel of this wave

5. The equation of a transverse wave traveling along a very long string is

$$y = 6.0 \sin (0.02 \pi x + 4.0 \pi t)$$

where *x* and *y* are in cm and *t* is in s. Determine

(a) the amplitude

(b) the wavelength

(c) the frequency

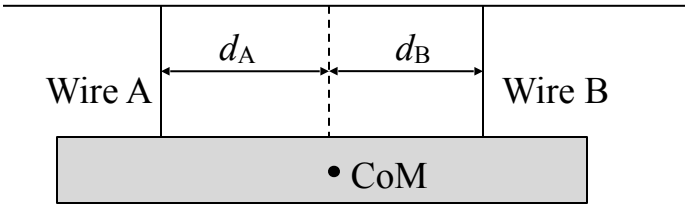
(d) the speed

(e) the direction of propagation of the wave

(f) the maximum transverse speed of a particle in the string

(g) the transverse displacement at $x = 3.5$ cm and $t = 0.26$ s.

6. A 103-kg uniform log hangs by two steel wires, A and B, from a horizontal ceiling. Both wires have a radius of 1.20 mm. Initially, before the log was attached, the wire A was 2.50 m long and 2.00 mm shorter than wire B. After attaching, the log is horizontal.

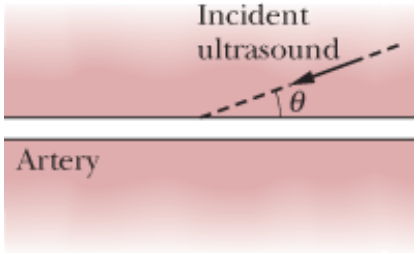


(a) What is the magnitude of the force on the log from wire A?

(b) What is the magnitude of the force on the log from wire B?

(c) What is the ratio d_A/d_B

7. An ultrasound image is created by a stationary device that produces a sound wave and then detects the reflection. The arm of a patient shows an artery that is angled at $\vartheta = 20.00°$ to the ultrasound's line of travel. The frequency of the ultrasound detected after reflecting back from the blood is increased by 5495 Hz from the original ultrasound frequency of exactly 5 MHz that was sent in. The speed of sound in blood is 1540 m/s. *{Hint: the Doppler formula uses as source speed the component of source velocity parallel to the beam.}*



What is the velocity of the blood in the artery (speed and direction)?