PHYS 2325 - Dr. Honan - Test 4 - B Name _____

Possibly Useful Information: $g = 9.80\,\frac{\text{m}}{\text{s}^2}$,

For Air (1atm, 20°C): $\rho = 1.203\,\frac{\text{kg}}{\text{m}^3}$, $v_{\text{sound}} = 343\,\frac{\text{m}}{\text{s}}$, $B = 1.42 \times 10^5\,\text{Pa}$

For Copper: $\rho = 8960\,\frac{\text{kg}}{\text{m}^3}$, $Y = 11 \times 10^{10}$ Pa, $S = 4.4 \times 10^{10}$ Pa, $B = 14 \times 10^{10}$ Pa

Problem 1 Short answer

A mass hangs from a spring. It is stretched a certain distance from equilibrium and released from rest it starts oscillating about its equilibrium position. If it were stretched by twice the amount before being released, then by what factor would the following quantities increase?

_____ (i) the maximum speed: (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) 1 (e) $\sqrt{2}$ (f) 2 (g) 4

_____ (ii) the frequency: (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) 1 (e) $\sqrt{2}$ (f) 2 (g) 4

_____ (iii) the total energy: (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) 1 (e) $\sqrt{2}$ (f) 2 (g) 4

Problem 2

(a) A particle moves in simple harmonic motion with a period of 0.3 s and an amplitude of 6 cm. What are the speed and acceleration of the particle when it is 4 cm from the equilibrium position?

(b) The period of small oscillations of a physical pendulum is 2 s on Earth and 3 s on Planet X. What is the acceleration of gravity on Planet X?

(c) A 5 kg mass swings at the end of a 3 m long string. What is the *frequency* of small oscillations?

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Problem 3

(a) Under what tension will a copper wire with a 1.8-mm diameter stretch by 0.22%?

(b) A uniform rod of length L swings without friction about one end. What is its period of small oscillations?

Problem 4

(a) What is the intensity of sound with a sound level of 85 dB and a frequency of 750 Hz?

(b) What are the pressure amplitude and displacement amplitude of the sound in part (a)?

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Problem 5 A string has a linear density of 1.6×10^{-3} kg/m. Suppose traveling down this string is a wave of the form: $y(x,t) = (0.015\text{ m})\sin[\,(4\text{ m}^{-1})\,x - (140\text{ s}^{-1})\,t\,]$.
(a) Consider a point on the string as this wave passes. What is the maximum speed of this point and what is the frequency of its oscillation?

(b) What is the tension in the string and the power carried by the wave?

Problem 6 Out in space two identical spherical masses of radius R and mass M are released form rest a distance d (measured between their centers, where $d > 2R$) apart. What is their speed when the spheres collide? Both masses will move with the same speed.

Problem 7 An unknown mass hangs at the end of a spring, with a force constant of 160 N/m. It makes 120 full oscillations of amplitude 1.4 cm in 15 s. What is the value of the unknown mass? (10 points)