
Total points: 40. Total time: 1 hr. Show all your work.**You must write down your answers on this sheet.**

1. (5 pts) A cubic block of cherry wood with sides of 10.0cm has a density of $800 \frac{\text{kg}}{\text{m}^3}$. The cubic block floats in water. What percentage of the block's volume is in the air above the surface of the water?

Ans.

2. A solid object weighs 15.70 N in air. When it is suspended from a scale and submerged in water, the scale reads 5.30 N. Find the density of the object.

Ans.

3. (5 pts) How deeply would one have to dive into a pool of mercury (density equal to $13.59 \times 10^3 \frac{\text{kg}}{\text{m}^3}$) to experience a pressure of 10 atm?

Ans.

4. (5 pts) A plastic cup, 15.0 cm in height, is filled to the rim with water. A small hole is punctured in the cup at a height 9.00 cm above the bottom of the cup and is allowing water to spew out. What is the speed of the water as it exits the hole?

Ans.

Extra Credit (2 pt) How far from the bottom of the cup, will the water hit the ground?

5. (5 pts) An object connected to a spring oscillates with simple harmonic motion. The amplitude of the motion is A , the equilibrium position is $x = 0$, the angular frequency is 20.0 rad/s . What is the speed of the object when it is located at $x = \frac{A}{4}$? Ignore friction and air resistance

Ans.

6. (5 pts) A pendulum is composed of a mass of 2.00 kg suspended from the ceiling by a string. The pendulum makes 1000 complete oscillations in an hour. What is the length of the string in m ?

Ans.

7. (10 pts) A 1.8-kg object attached to an ideal spring is undergoing a simple harmonic motion. Its displacement is given by the function

$$x(t) = (0.02 \text{ mm}) \cos((16.2 \text{ rad/s})t - \pi) .$$

- (a) (2 pts) What is the displacement of the object at $t = 2.0 \text{ s}$.

Ans.

- (b) (4 pts) What is the maximum velocity of the object.

Ans.

- (c) (4 pts) Find the stiffness of the spring.

Ans.