

Arts & Science 2D06

Make-up Quiz #5 2014 Feb 7

Name:

NB: Mark values are given in brackets [] beside each problem. Write all your answers on the quiz paper. No books or notes allowed. Time to write quiz: 50 minutes.

Solution for quadratic equation: $x = (-b \pm \sqrt{b^2 - 4ac})/2a$

Surface area of sphere: $A = 4\pi r^2$ Volume of sphere: $V = \frac{4}{3}\pi r^3$

Bernoulli's equation: $P + \rho gy + \frac{1}{2}\rho v^2 = \text{const}$

Period of simple pendulum: $T = 2\pi\sqrt{\frac{L}{g}}$ Wave speed: $v = f\lambda$

SHM equation of motion: $x = A \cos(\omega t + \varphi)$ where $\omega = \sqrt{k/m} = 2\pi/T$

Air pressure at sea level $P_0 = 1.013 \times 10^5 \text{ N/m}^2$

Density of air at sea level $\rho_{air} = 1.29 \text{ kg/m}^3$

Density of water $\rho_{H_2O} = 1000 \text{ kg/m}^3$

1. [3] When the atmospheric pressure increases, what happens to the absolute pressure at the bottom of a pool?

- (a) It does not change.
- (b) It increases by an amount smaller than the change in atmospheric pressure.
- (c) It increases by the same amount.
- (d) It increase by a greater amount.
- (e) The change depends on the depth of the pool.

Explain/derive your choice in the space below.

2. [4] A sphere of radius 10.0 cm floats in equilibrium. It is partially submerged in water with its lowest point 5.00 cm below the water's surface.

(a) What is the buoyant force acting on the sphere?

(b) What is the weight of the sphere (as it floats)?

3. [3] If you double only the mass of a vibrating mass-and-spring system, what effect will this have on the system's total mechanical energy?

(a) An increase in the total energy by a factor of $\sqrt{2}$.

(b) An increase in the total energy by a factor of two.

(c) An increase in the total energy by a factor of three.

(d) An increase in the total energy by a factor of four.

(e) No change in the total energy.

Explain/derive your choice in the space below.

4. [5] A simple harmonic oscillator has an amplitude of 3.50 cm and a maximum speed of 28.0 cm/s. What is its speed when the displacement is 1.75 cm?

5. [5] In a section of horizontal pipe with a diameter of 3.00 cm the pressure is 5210 Pa and water is flowing with a speed of 1.50 m/s. The pipe narrows to 2.50 cm. What is the pressure in the narrower region?

[20] total marks