

PHYSICS 1B TEST 1

PLEASE EXPLAIN LOTS!!!!!!!!!!!!!!!!!!!!!!

1. ELEPHANT STOOL

A stool for a 58,000 N circus elephant is in the form of a cylinder of .19 square meters in area and .81 meters high. Young's modulus for the stool is 1.9×10^7 N square meter. How many meters does the stool sink when the elephant sits on it?

$$58,000 \cdot .81 / .19 / 1.9 \times 10^7$$

- A. (.013), B. .0627, C. .201, D. .411, E. .675

2. SHM DERIVATION

Show how a linear restoring force leads to simple harmonic motion.
i.e. $F = -kx$ implies $x = A \cos(\omega t)$.

3. TIMEKEEPING AND SHM

You wish to construct a spring-weight combination with a one second period. Your spring stretches .45 meters when you hang a 1.2 newton weight on it. How many kg should you use for the mass to produce a one second period?

RECALL: PERIOD=2 PI SQUARE ROOT (M/K)

$$1.2 / (4 * 3.14159 * 3.14159 * .45)$$

A. .0273, B. .0411, C. .0554, D. (.0675), E. .11

4. IMPERFECT PITCH

Air friction damps a tuning fork so the amplitude decreases by 1/10 per second. Resonance=110 Hz. What % chnge in frequency results?

$$50 * (\text{LOG}(10) / \text{PI} * (2 * 110)) ** 2$$

A. .00014, B. .000271, C. .000378, D. .000458, E. (.000555)

5. DAMPING

You want to use air friction to critically damp a spring (.79 newtons/m), mass (25 kg) combination used to detect earthquakes. The frequency is given by SQUARE ROOT $((k/m) - (R/2m)**2)$. What R is required? (newtons/(m/s))

$$\text{SQR}(4 \cdot 79 \cdot 25)$$

A. 6.28, B. 1.41, C. 55.9, D. (8.89), E. 79

6. DERIVE CRITICAL DAMPING

Derive critical damping. You can start with the equation describing damped harmonic motion.

7. HOOKE TO YOUNG

Show that the equation for Young's Modulus follows from Hooke's Law. Do more than arm waving please.

8. DHM BY COMPLEX METHODS

Derive the solution for position and frequency for damped harmonic motion by complex methods. Explain as much as possible!!