

General Physics IIA — Quiz (1 Hour)

1. **SHM - mass on a spring** (15 pts)

A 0.35 kg mass oscillates on a horizontal spring with $k = 140 \text{ N/m}$. Its amplitude is $A = 4.0 \text{ cm}$.

- (a) Find ω and T .
- (b) Find the maximum acceleration.
- (c) Find the total mechanical energy of the motion.

2. **Traveling waves** (15 pts)

A transverse wave is described by

$$y(x, t) = (1.5 \text{ cm}) \sin[(2.5 \text{ rad/m}) x + (20 \text{ rad/s}) t].$$

- (a) What direction does this wave travel (positive or negative x)? Briefly explain.
- (b) Find λ , f , and v .
- (c) What is the displacement at $x = 0.70 \text{ m}$ and $t = 0.20 \text{ s}$?

3. **Doppler effect** (15 pts)

A car is accelerating while blowing its horn. Just after the car passes a stationary person, the person hears a frequency of 961 Hz. 19.1 seconds later, the frequency heard by the person has decreased to 916 Hz. When the car is stationary, its horn emits a sound whose frequency is 1010 Hz. What is the acceleration of the car?

4. **Standing waves on a string** (15 pts)

A guitar string of length $L = 0.61 \text{ m}$ is fixed at both ends. Its linear density is $\mu = 1.8 \times 10^{-3} \text{ kg/m}$ and the tension is $T = 95 \text{ N}$.

- (a) Find the wave speed.
- (b) Find the fundamental frequency.
- (c) What tension would be needed to raise the fundamental frequency by a factor of 1.5 (keeping L and μ the same)?

5. **Standing sound waves in tubes** (15 pts)

A tube of length $L = 0.40 \text{ m}$ resonates with a 220 Hz tone at its *lowest* resonance.

- (a) Is the tube more consistent with being open-open or open-closed? Justify using the fundamental frequency formulas.
- (b) Based on your choice, estimate the speed of sound implied by these data.
- (c) Predict the next resonance frequency for that same tube.