Chapter 12 Sound Worksheet #1

Questions 1 and 2 refer to the following:

SHATTERING GLASS

An old television commercial for audio recording tape showed a singer breaking a wine glass with her voice. The question was then asked if this was actually her voice or a recording. The inference is that the tape is of such high quality that the excellent reproduction of the sound is able to break glass.

This is a demonstration of resonance. It is certainly possibly to break a wine glass with an amplified singing voice. If the frequency of the voice is the same as the natural frequency of the glass, and the sound is loud enough, the glass can be set into a resonant vibration whose amplitude is large enough to surpass the elastic limit of the glass. But the inference that high-quality reproduction is necessary is not justified. All that is important is that the frequency is recorded and played back correctly. The wave-form of the sound can be altered as long as the frequency remains the same. Suppose, for example, that the singer sings a perfect sine wave, but the tape records it as a square wave. If the tape player plays the sound back at the right speed, the glass will still receive energy at the resonance frequency and will be set into vibration leading to breakage, even though the tape reproduction was terrible. Thus, this phenomenon does not require high-quality reproduction and, thus, does not demonstrate the quality of the recording tape. What it does demonstrate is the quality of the tape player, in that it played back the tape at an accurate speed!

1) Explain why the glass in the given situation would *not* break if the tape player did *not* play back at an accurate speed.

2) Based on the given situation, list *two* properties that a singer's voice must have in order to shatter a glass.

Questions 3 and 4 refer to the following:

A student plucks a guitar string and the vibrations produce a sound wave with a frequency of 650 hertz.

3) The sound wave produced by the situation described can *best* be described as a

A) electromagnetic wave of varying wavelengths
B) mechanical wave of varying frequency
C) longitudinal wave of constant frequency
D) transverse wave of constant amplitude

4) Based on the given information, calculate the wavelength of the sound wave in air at STP. [*Show all work, including the equation and substitution with units.*]