PHYSICS 102 - PHYSICS OF MUSIC
Dr. Richard E. Berg
Test #1 - March 8, 2004

INSTRUCTIONS

When you get this:

1. **Do not turn the page and look at the questions until you are so instructed.**

2. **Put your name and student number on the answer sheet, *letters and dots*.**

3. **Wait to start the test until you are so instructed.**

4. **You will have until 11:55 to finish your test, should you need that amount of time.**

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Before beginning the test please enter your name, last name first (both in letters and by blackening the letters in the columns under the name line) and your social security number (enter the numbers without hyphenation, leaving line J blank, both writing the numbers and blackening the numbers in the columns under the identification number line).

Each question is on a line numbered from 1 through 100. You are to answer each question either in the affirmative (Yes, True) or in the negative (No, False) by blackening either response A/1 for affirmative or response B/2 for negative. Leaving an answer blank, or blackening responses C/3, D/4, or E/5 are not correct answers. Your score is the number of correct answers, so guessing may help.

Fruits used in grandma's old-fashioned apple-raisin pie include:
(1) apples.
(2) passion fruit.
(3) sugar.

Examples of periodic motion include:
(4) a pendulum swinging to and fro.
(5) a super ball bouncing without losing energy.
(6) swinging a rock around your head on a string.
(7) a mass bouncing up and down on a spring.
(8) a child sliding downhill on a sled.
(9) a child swinging on a swing.
(10) the moon revolving around the earth.
(11) motion represented by a sine wave.

Examples of simple harmonic motion include:
(12) a pendulum swinging to and fro.
(13) a super ball bouncing without losing energy.
(14) swinging a rock around your head on a string.
(15) a mass bouncing up and down on a spring.
(16) the moon revolving around the earth.
(17) motion represented by a sine wave.

Which of the following periods and frequencies go together?
(18) 1 millisecond, 1000 Hertz.
(19) 5 milliseconds, 20 Hertz.
(20) 1 second, 1 Hertz.
(21) 500 microseconds, 20 kilohertz.

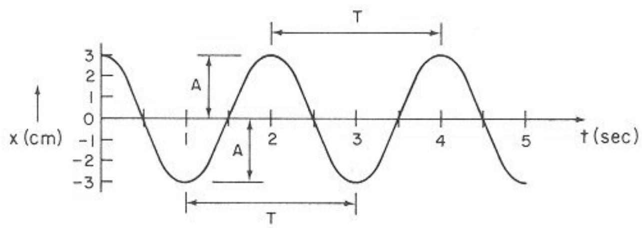

Figure 1

The oscillation in Figure 1:
(22) has an amplitude of 2 V.
(23) has a period of 1 millisecond.
(24) has a frequency of 0.5 Hertz.
(25) includes exactly two periods.

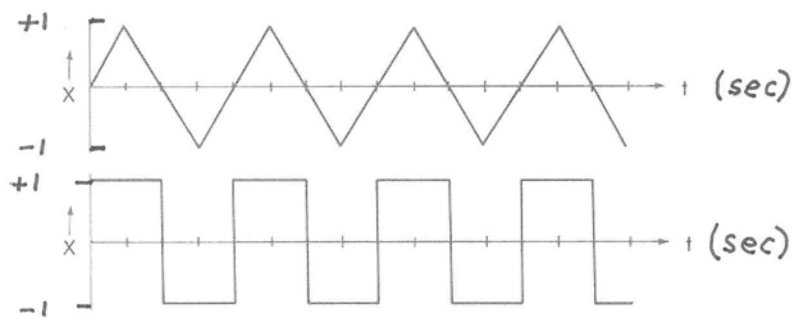

Figure 2a (upper) and 2b (lower); both have the same horizontal and vertical scales

Compared with the wave in Figure 2a, the wave in Figure 2b:
(26) has a shorter period.
(27) has a longer wavelength in air.
(28) travels with a greater velocity in air.
(29) sounds higher in pitch.
(30) has a greater amplitude.
(31) has the same timbre.

The following are examples of resonances:
(32) breaking a glass beaker with a sound wave.
(33) a sonic boom.
(34) the Psychoacoustic Vibration Transducer (demo with straw and paper clip pendulums).
(35) the Tacoma Narrows bridge collapse.
(36) Chladni figures in a square metal plate.
(37) standing waves in a stretched string.
(38) standing waves in an air column.

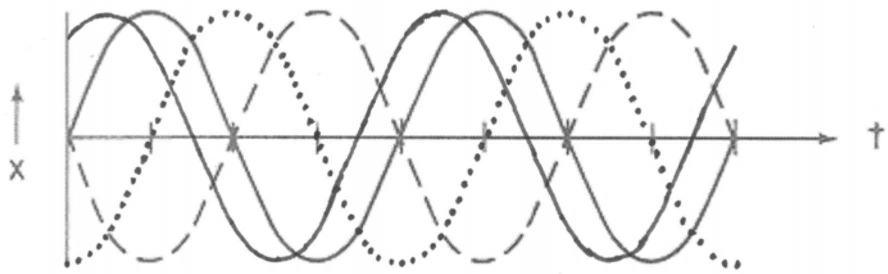

Figure 3

Referring to Figure 3 above:
(39) All of these waves have the same frequency.
(40) The phase difference between the two solid curves is 90^{o}.
(41) The phase difference between the dashed curve and the dotted curve is 180^{o}.
(42) Two of the curves are “out of phase.”
(43) Two of the curves have a phase difference of 45^{o}.

The Kundt’s tube demonstration, using a glass tube with cork dust in the bottom, shows:
(44) standing waves.
(45) refraction.
(46) diffraction.

Two stereo speakers are placed close to each other and music played in the monaural mode. What happened when the phase of one of the two stereo speakers is reversed?
(47) The treble sounds increased in volume while the bass sounds remained the same.
(48) The bass sounds became significantly softer.
(49) This experiment demonstrates interference.
(50) This experiment demonstrates polarization.

A small speaker without a baffle produces a weak, tinny sound. The speaker is then positioned behind a large board over a hole the size of the speaker. This experiment demonstrates:
(51) diffraction.
(52) refraction.
(53) interference.

A sound wave is sent down a Quinke’s tube, a tube that divides into two parts, one longer than the other, and then recombines in a single tube before the sound is picked up by a microphone. This experiment demonstrates:
(54) refraction.
(55) interference.
(56) equality of provision.

The speed of sound:
(57) is about 345 m/s in air.
(58) is about 34,500 Hz in air.
(59) is greater in aluminum than in air.
(60) is much slower than the speed of light.

If ALL of the air were pumped out of a jar containing a ringing bell:
(61) we could no longer hear the bell.
(62) we could no longer see the bell.

Tuning bars of 400 Hz and 402 Hz are sounded simultaneously with the same intensity.
(63) You hear a 401 Hertz tone.
(64) This creates the Doppler effect.
(65) You hear one beat per second.
(66) The two tuning bars interfere either constructively or destructively, depending upon their phase relationship at that instant of time.

The Doppler effect occurs:
(67) when a train with its whistle blasting passes your car at a crossing.
(68) when you listen as someone rotates a high-frequency whistle around their head on a string.
(69) only when an airplane moves by at a speed above Mach 2.

A sonic boom:
(70) occurs only at the time when an airplane accelerates from below to above the speed of sound.
(71) occurs when you crack a whip.
(72) follows around an airplane if it moves at a speed greater than the speed of sound.
(73) initially forms a conical-shaped shock wave for a supersonic plane.
(74) occurs when lightning strikes.

The tones produced by a twirling corrugated tube are:
(75) the notes of the overtone series.
(76) harmonics of the fundamental frequency of the tube.
(77) standing waves.
(78) resonant frequencies of the tube.
(79) the same series of notes as those produced by a stretched string with the same fundamental frequency.

Figure 4

Referring to the standing wave in Figure 4 above:
(80) This is a representation of a standing wave in an open tube.
(81) This is the fundamental.
(82) If the length of the tube is 3.45 meters, the frequency of this standing wave is 25 Hz.
(83) The first harmonic is one octave lower than the wave shown.
(84) The point labeled 1 is a node.
(85) The point labeled 2 is a node.

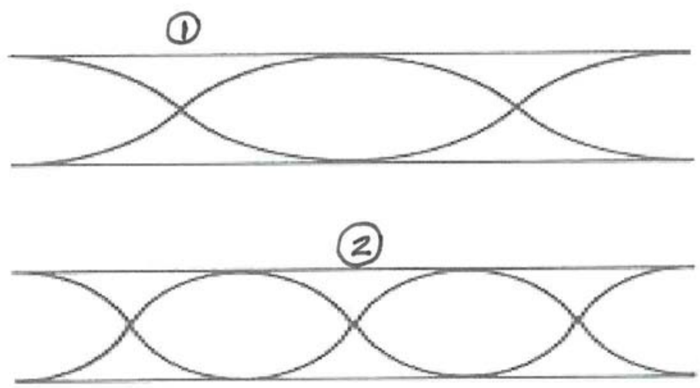

Figure 5a (upper) and 5b (lower).

Referring to the standing waves in Figure 5a and 5b above:
(86) These figures represent standing sound waves in open tubes.
(87) For (a), the wavelength is the length of the tube.
(88) These are the first and second harmonics of the tube.
(89) The frequency of (b) is greater than that of (a).
(90) The wavelength of (b) is greater than that of (a).
(91) The frequencies are one octave apart.
(92) The point labeled 1 is a node.
(93) The point labeled 2 is an antinode.
(94) Figure (a) contains two loops.

A wire of length L and mass per unit length W is stretched by a tension F so that it produces a fundamental frequency f = 200 Hz.

(95) If the length is halved the frequency becomes 400 Hz.

(96) If the weight per unit length is increased the frequency becomes lower.

(97) If the tension is increased the frequency becomes lower.

(98) If the weight per unit length is decreased by a factor of four, the frequency rises by a factor of two.

(99) If the tension is increased by a factor of four, the frequency rises by one octave.

(100) If both the weight per unit length and the tension are increased by a factor of 9, the frequency will be 200 Hz.

WHEN YOU ARE FINISHED:

1. Gather ALL of your stuff together and
2. Bring it along when you when you come down to the fron
3. Put your test alphabetically in the letter boxes
4. Pick up an answer sheet
5. Leave directly by the front door.