Physics 235 Fall 2011: Exam #3

Form #1

YOU MUST ENTER THE FORM NUMBER ON YOUR SCANTRON TO RECEIVE YOUR SCORE

Please print your name:

Instructions

1. Fill in your name above
2. Fill in your name, ID number, and **form number** on your scantron sheet
3. This will be a 1 hour 50 minute, closed book exam.
4. You may use a calculator, please do not share calculators
5. The exam includes 20 multiple choice questions which will be machine graded. Each question is worth 5 points. No partial credit will be given.
6. For this exam, you can bring three 3x5 cards with any notes you wish to have. You will also be given all physical constants that you might require to do all the problems.

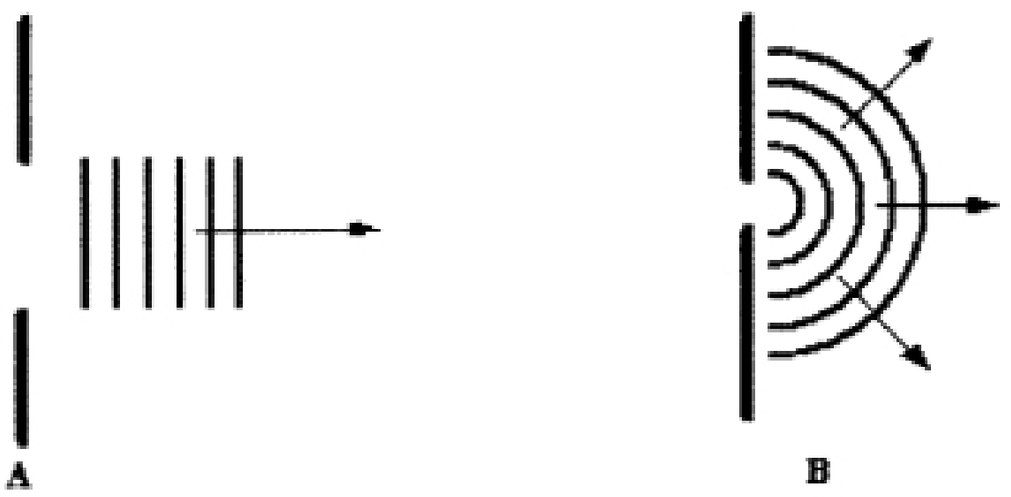
Constants you might need:

$k = 8.99 \times 10^{9}\ Nm^2/C^2$
$\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$
Mass of the electron: 9.1×10^{-31} kg
Magnitude of the electron charge: 1.6×10^{-19} C
Mass of the proton: 1.67×10^{-27} kg
speed of sound in air = 340 m/s
$k_B = 1.38 \times 10^{-23}\ m^2kg/s^2K = 1.38 \times 10^{-23}$ J/K
$\mu_0 = 4\pi \times 10^{-7}$ Tm/A
$I_0 = 10^{-12}\ W/m^2$ Threshold of Human Hearing

1. Two loudspeakers are 2.30 m apart. A person stands 2.90 m from one speaker and 4.30 m from the other. What is the lowest frequency at which destructive interference will occur at this point? The speakers are being driven in phase. Assume the speed of sound is 340 m/s.
   A) 121 Hz
   B) 210 Hz
   C) 240 Hz
   D) 290 Hz
   E) 305 Hz

2. What is the intensity of a 115 dB sound? You may take the minimum intensity you can hear (I_0) to be 10^{-12} W/m^2.
   A) 0.3 W/m^2
   B) 3000 W/m^2
   C) 0.1 W/m^2
   D) 1.6×10^{-6} W/m^2
   E) 2.5×10^{-3} W/m^2

3. Water waves approach an aperture. The resulting patterns are shown for two different cases, **A** and **B**, in which the wavelength and aperture size are varied.



Which one of the following statements concerning these cases is true?
   A) Neither figure shows diffraction. In both cases, the wavelength is much smaller than the aperture.
   B) Diffraction occurs in **A**, but not in **B** because the wavelength in **A** is much smaller than the aperture.
   C) Diffraction occurs in **B**, but not in **A** because the wavelength in **B** is much smaller than the aperture.
   D) Both figures show diffraction. In both cases, the wavelengths are approximately the same size as the aperture.
   E) Diffraction occurs in **B**, but not in **A** because the wavelength in **B** is approximately the same size as the aperture.

4. For a diffraction horn loudspeaker, sound emerges through a rectangular opening. The opening of a diffraction horn has a width of 0.15 m. If the speaker emits a continuous tone with a wavelength of 0.11 m, at what angle does the first minimum occur?
   A) 47°
   B) 39°
   C) 23°
   D) 12°
   E) 8.4°

5. A guitar string has a linear density of 8.30×10^{-4} kg/m and a length of 0.660 m. The tension in the string is 52.0 N. When the fundamental frequency of the string is sounded with a 196.0-Hz tuning fork, what beat frequency is heard?
   A) 6 Hz
   B) 4 Hz
   C) 12 Hz
   D) 8 Hz
   E) 2 Hz

6. When a tuba is played, the player blows into one end of a tube that has an effective length of 3.50 m. The other end of the tube is open. If the speed of sound in air is 343 m/s, what is the lowest frequency the tuba can produce?
   A) 8.00 Hz
   B) 12.0 Hz
   C) 16.0 Hz
   D) 24.0 Hz
   E) 49.0 Hz

7. A double slit is illuminated with monochromatic light of wavelength 6.00×10^{2} nm. The $m = 0$ and $m = 1$ bright fringes are separated by 3.0 cm on a screen which is located 4.0 m from the slits. What is the separation between the slits?
   A) 4.0×10^{-5} m
   B) 8.0×10^{-5} m
   C) 1.2×10^{-4} m
   D) 1.6×10^{-4} m
   E) 2.4×10^{-4} m