

Here is a circuit with an AC voltage source of 10V @ 1kHz, $C1 = 0.1\mu F$ and $R1 = 1000\text{ Ohms}$.

Question 1

What kind of filter is the circuit above?

- ☒ Band Stop
- ☐ Band Pass
- ☐ High Pass
- ☐ Low Pass

Question 2

What is the cutoff point of this filter in Hertz?

- ☒ 1.56 Hz
- ☐ 1562.5 Hz
- ☐ 1572 Hz
- ☐ 159.24 Hz

Question 3

What is the peak voltage measured by voltage probe PR2?

- ☒ 9.88 V
- ☐ 4.82 V
- ☐ 9.22 V
- ☐ 2.42 V

Question 4

What is the total impedance of the circuit in Ohms?

- ☒ 1471 Ohms
- ☐ 1080 Ohms
- ☐ 1542 Ohms
- ☐ 1013 Ohms



A Helmholtz resonator is made from a cubic cardboard box whose length, width and height are dimension a . The neck is made from a mailing tube whose diameter is b and length is c .

$$f = \frac{c}{2\pi} \sqrt{\frac{\pi}{V}}$$

The frequency of a Helmholtz resonator is given by the above equation.

Question 1

If dimension a is 0.1m and dimension b is 0.05m, how long does the neck c have to be such that the resonant frequency is 100 Hz?

- ☒ 50.24 mm
- ☐ 5.09 mm
- ☐ 11.83 mm
- ☐ 2.98 mm

Question 2

If dimension a is 0.1m and dimension b is 1m, what diameter neck is needed such that the resonant frequency is 500 Hz?

- ☒ 50.24 mm
- ☐ 118.34 mm
- ☐ 103.12 mm
- ☐ 123.40 mm

Question 3

If dimension b is 0.05m and dimension c is 5m, what does the box edge length a have to be such that the resonant frequency is 750 Hz?

- ☒ 27.56 mm
- ☐ 54.25 mm
- ☐ 20.94 mm
- ☐ 14.13 mm



1 pts

You are building a custom speaker cabinet on a budget, so you decide on a bass-reflex speaker design. You go out and buy a decent driver, a JBL 2123H, whose cone mass is 0.025kg and compliance is $1.4 \times 10^{-4} \text{ m/N}$.

Question 1

What is the free-air resonance of the driver in hertz?

- ☐ 127.68 Hz
- ☐ 255.36 Hz
- ☐ 42.56 Hz
- ☒ 85.12 Hz

1 pts

Question 2

You will eventually put a tweeter in your speaker to take care of the high frequencies. For now, you want to make part of a crossover network (low pass filter) that starts attenuating frequencies higher than 3000Hz. You run around in your parts bin for some electrical components. You find a 500 Ohm resistor. What value of capacitor in microfarads do you need to make a low pass filter with a cutoff point of 3000Hz?

- ☐ 0.1 μF
- ☒ 10.0 μF
- ☐ 0.01 μF
- ☐ 1.0 μF

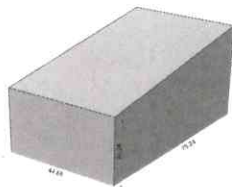
1 pts

Question 3

In order to make a good speaker, you want to tune the Helmholtz resonance of the ported speaker box to the free-air resonance of the driver. If the volume of the speaker enclosure is 0.05 m^3 and the length of the port is 0.01m, what does the area of the port have to be in square meters?

- ☒ 0.00241 m^2
- ☐ 0.241 m^2
- ☐ 0.000243 m^2
- ☐ 0.0243 m^2

1 pts



Reverb time becomes a problem in large rooms because the long distances that sounds have to travel increases the time between echoes and the volume of air in the room stores more energy. Reverb can add to the ambiance of an interior space when controlled, but can also interfere with intelligibility if unabated. The room pictured above is not rectangular, but rather wedge-shaped. The dimensions are in feet.

Question 1

What is the RT_{60} @ 1000 Hz of the room if the average absorption coefficient of the surface materials is 0.25 Sabine?

- ☐ 2.42 s
- ☒ 6.09 s
- ☐ 1.46 s
- ☐ 2.38 s

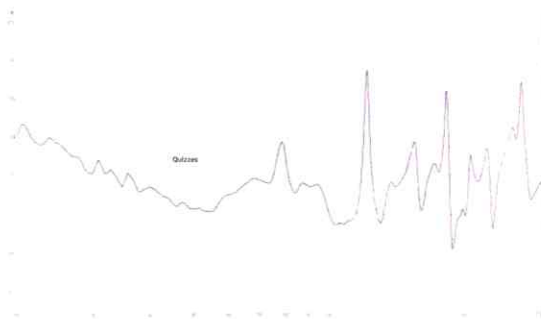
1 pts

Question 2

How many occupied, upholstered chairs (at 0.9 Sabine each) must you put in this room to make the RT_{60} @ 1000 Hz 1 second?

- ☒ 96
- ☐ 126
- ☐ 164

1 pts



Small rooms have resonance due to standing waves that occur between surfaces in the room. These are typically most noticeable in small rooms because the distances are small and therefore the wavelengths of the standing waves are short, giving rise to frequencies in the audible region. If one were to conduct an experiment to determine the room modes empirically, one might play a number of frequencies of the same amplitude into the room and then record the sounds in the room for frequency analysis. If a particular frequency excites a room mode, its amplitude will be greater than the other frequencies. Given the spectrum above, can you determine the X- and Y-dimensions of the room if the first peak (781 Hz) is due to the X-axis wall mode and the second peak (1562 Hz) is due to the Y-axis?

Question 1

1 pts

What is the X-Dimension of the room in meters for a fundamental mode of 781 Hz?

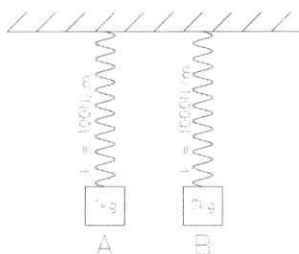
- 1.105 m
- 8.84 m
- 4.42 m
- 3.21 m

Question 2

1 pts

What is the Y-Dimension of the room in meters for a fundamental mode of 1562 Hz?

- 1.22 m
- 5.29 m
- 2.64 m
- 0.61 m



One spring-mass system A consists of a 1 kg mass suspended by a spring with a spring constant $k = 1000$ N/m. Another spring-mass system B consists of a mass suspended by a spring with a spring constant of $k = 1000$ N/m.

Question 1

1 pts

What is the extension length of the spring in system A in meters?

- 0.92 m
- 0.014 m
- 0.009 m
- 9.8 m

Question 2

1 pts

What would the mass in system B have to be such that both systems have the same extension length?

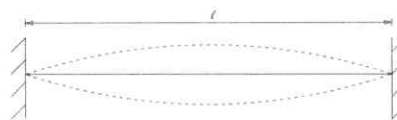
- 10 kg
- 0.1 kg
- 1 kg
- 100 kg

Question 3

1 pts

What mass would you have to suspend in system B so that both systems vibrate at the same frequency?

- 10 kg
- 1 kg
- 0.1 kg
- 100 kg



The drawing above depicts a string stretched between two walls that are some distance L apart. The dotted lines show the standing wave pattern of the fundamental mode.

Dimension $L = 10$ m, the diameter of the wire is 1 mm and the density is 7700 kg/m^3 and the tension is $1 \times 10^2 \text{ N}$

Question 1

1 pts

What is the velocity of a transverse wave on this string?

- 604.50 m/s
- 406.72 m/s
- 1209.00 m/s
- 406.72 m/s

Question 2

1 pts

What is the frequency of the second harmonic?

- 303.36 Hz
- 606.72 Hz
- 1209.36 Hz
- 406.76 Hz

Question 3

1 pts

What is the wavelength of the third harmonic?

- 6.67 m
- 0.47 m
- 3.32 m
- 30 m