

PH202 Recitation 10

Final Exam Review

Doppler Shift

$$f_o = f_s \left(\frac{v \pm v_o}{v \mp v_s} \right)$$

v_o = speed of observer relative to medium, choose (-) if $|\Delta \vec{r}|$ is increasing, (+) if $|\Delta \vec{r}|$ is decreasing

v_s = speed of source relative to medium, choose (+) if $|\Delta \vec{r}|$ is increasing, (-) if $|\Delta \vec{r}|$ is decreasing

Standing Wave Resonance

Symmetric Boundary Conditions:

wavelength $\lambda_m = \frac{2L}{m}$, frequency $f_m = m \frac{v}{2L} = m f_1$, where $m=1,2,3,\dots$

$$\Delta f = f_{m+1} - f_m = f_1$$

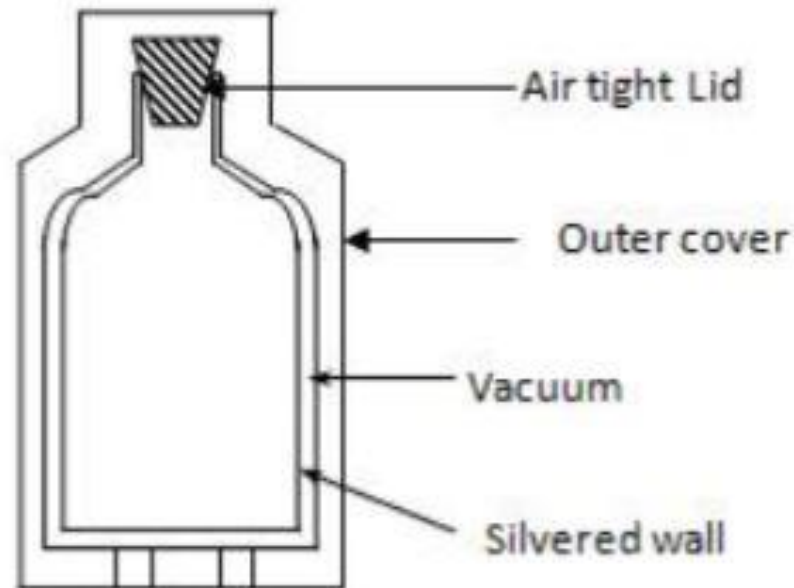
Antisymmetric Boundary Conditions:

wavelength $\lambda_m = \frac{4L}{m}$, frequency $f_m = m \frac{v}{4L} = m f_1$, where $m=1,3,5,\dots$

$$\Delta f = f_{m+2} - f_m = 2f_1$$

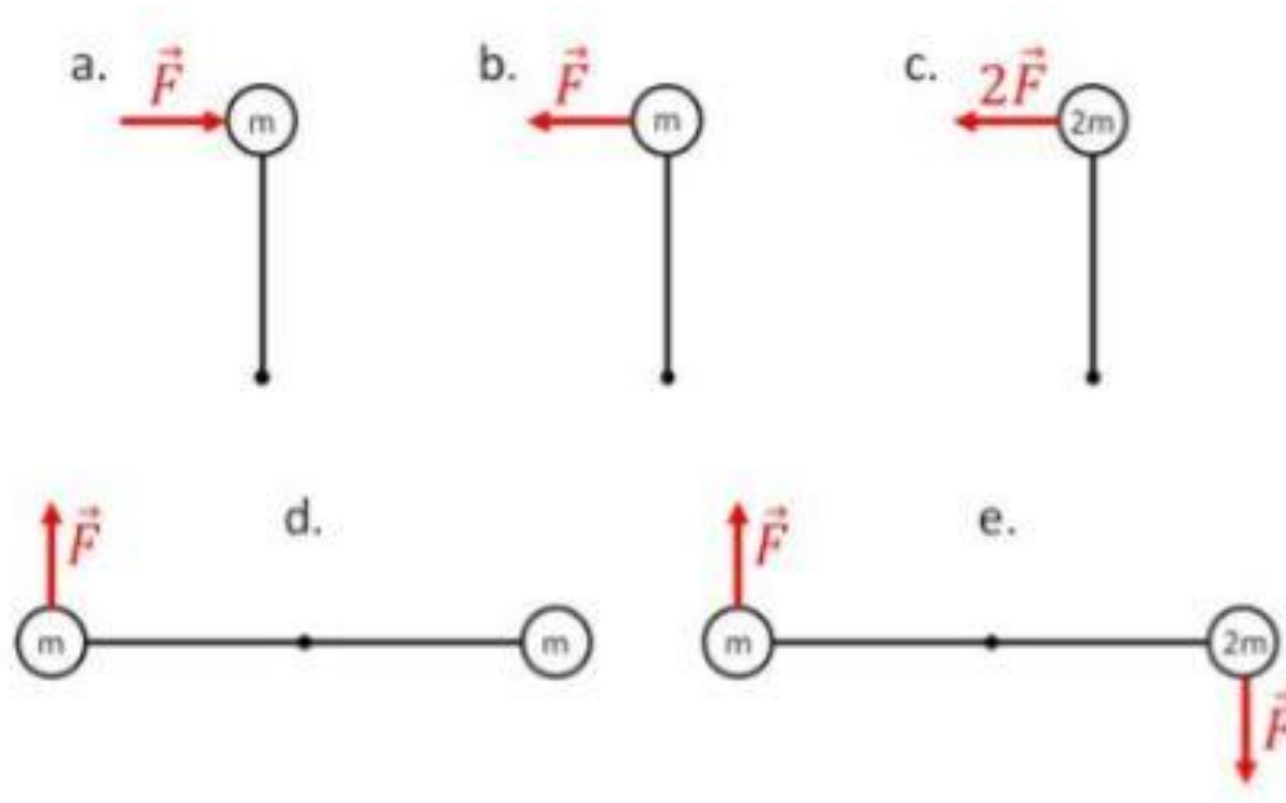
Question 1: 3 minutes

- Thermoses are designed to minimize temperature changes of their contents. The figure shows a schematic of a thermos. Explain how the design addresses all three heat transfer mechanisms.



Question 2: 3 minutes

- Rank the following angular accelerations from most negative to most positive, indicating if any are equal. Assume point masses at the end of massless rods.



Question 3: 3 minutes

- The tires of a car support the weight of a stationary car. If one tire has a slow leak, the air pressure within the tire will _____ with time, the surface area between the tire and the road will _____ with time, and the net force the tire exerts on the road will _____ with time.
 - a) Decrease, increase, remain constant
 - b) Increase, decrease, remain constant
 - c) Decrease, increase, decrease
 - d) Decrease, decrease, decrease
 - e) Increase, increase, increase
 - f) Decrease, increase, increase

Question 4: 3 minutes

- A 0.92m long pipe is closed on one end. It vibrates in the third harmonic with a frequency of 489Hz. In this situation, the speed of sound in air is closest to:
 - a) 334 m/s
 - b) 343 m/s
 - c) 350 m/s
 - d) 355 m/s
 - e) 360 m/s

Question 5: 3 minutes

- Which of the following characteristics of sound determine the “pitch” of a musical note? An example of a high pitch sound is a whistle, an example of a low pitch sound is a drum.
 - a) Amplitude
 - b) Wavelength
 - c) Frequency
 - d) Phase
 - e) Intensity

Problem 1: 7 minutes

- A. A string, 5m long, is vibrating/resonating at its 4th harmonic. If there are 48 cycles in 20s, what is the frequency, period, wavelength, and velocity of the wave in the string?
- B. If the string has a mass of 10g, what is the tension in the string?

Problem 2: 7 minutes

- A. A train is traveling at 35m/s on a still air day. You are standing alongside the train track, stationary, as the conductor blares the 150Hz horn. What frequencies do you hear as the train approaches you, and then as it leaves past you?
- B. What does the conductor on the train hear?