

# **Flashcards for PH123**

Lance Nelson

7/16/2022

# Table of contents

<b>Chapter 14</b>	<b>3</b>
Sections 14.1 - 14.3 (Fluids) . . . . .	3
Section 14.4 (Buoyancy) . . . . .	3
Section 14.5 (Fluid Dynamics) . . . . .	4
Section 14.6 (Elasticity) . . . . .	4
<b>Chapter 15</b>	<b>5</b>
Sections 15.1 - 15.3 (Simple Harmonic Motion) . . . . .	5
Section 15.4 - 15.6 (Vertical Oscillations and Pendulums) . . . . .	5
Section 15.7 - 15.8 (Driven and Damped Oscillations) . . . . .	5
<b>Chapter 16</b>	<b>7</b>
Sections 16.1 - 16.4 (One-dimensional waves) . . . . .	7
Section 16.5 - 16.7 (Sound and Light) . . . . .	7
Section 16.8 - 16.9 (Power/Intensity/Doppler Effect) . . . . .	7
<b>Chapter 17</b>	<b>9</b>
Sections 17.1 - 17.4 (Standing Waves) . . . . .	9
Section 17.5 - 17.8 (Wave Interference) . . . . .	9

# Chapter 14

## Sections 14.1 - 14.3 (Fluids)

1. Explain how a suction cup works.
2. Explain why gases exert pressure.
3. Explain why liquids exert pressure.
4. What are the SI units of density?
5. What are the SI units of pressure?
6. What is a barometer? Explain how it works.
7. Some liquid is placed in a pipe that is bent into the shape of a “U”. If you draw a horizontal line that connects one side of the u-tube to the other, how does the fluid pressure on one side compare to the other side? How do you know?
8. What is atmospheric pressure on Earth?
9. What is Pascal’s principle?
10. What is the density of air at standard temperature and pressure (STP)?
11. What is the density of water at standard temperature and pressure (STP)?
12. What is the difference between gauge and absolute pressure?
13. What is the mathematical definition of (equation for) pressure?
14. What is the mathematical equation for the pressure at depth  $h$  in a fluid?
15. Where can you find the Savior’s sermon on the mount? (It’s found in more than one place.)

## Section 14.4 (Buoyancy)

1. While at the beach, you push a beach ball under the surface of the water and notice that it is quite hard to keep submerged. What is exerting an upward force on the ball. (Don’t just say buoyant force!!)
2. What determines whether an object floats or sinks when placed in a fluid?
3. Two blocks are identical in size. One is made of lead and sits on the bottom of a pond; the other is made of wood and floats on top. Upon which block is the buoyant force greater? Explain.
4. What is Archimedes’ principle?
5. Two objects are floating in water. Half of object #1 is submerged in the water and 75% of object #2 is submerged. Which object is more dense? Can you prove it mathematically?

6. (T/F) The buoyant force on a submerged object depends on both its size and shape?
7. Recite Helaman 5:12.

## Section 14.5 (Fluid Dynamics)

1. A fluid is flowing through a pipe that has a narrow section and a wider section. Why does the speed of the fluid increase in the narrow section and decrease in the wider section of the pipe?
2. What is the equation for volume flow rate? (related question: What are the SI units of volume flow rate?)
3. What is the mathematical formula for Bernoulli's equation?
4. A pipe starts at the bottom of a hill and continues until it reaches the top. The pipe is wide at the bottom and narrow at the top. Compare the pressure and flow speed at the top and bottom.
5. Draw a Venturi tube and explain how it works.
6. Use Bernoulli's principle (equation) to explain how an airplane wing (airfoil) generates lift.
7. Where is the parable of the wheat and the tares found?

## Section 14.6 (Elasticity)

1. What is the mathematical equation and SI units for tensile stress?
2. What is the mathematical equation and SI units for volume stress?
3. What is the mathematical equation and SI units for linear strain?
4. What is the mathematical equation and SI units for volume strain?
5. What is Young's modulus and what are its SI units?
6. What is Bulk modulus and what are its SI units?
7. Where is the record of Jesus calming the storm?

# Chapter 15

## Sections 15.1 - 15.3 (Simple Harmonic Motion)

1. Define “period” ( $T$ ). What are the units of period?
2. Define amplitude ( $A$ ). What are the units of amplitude?
3. Define frequency ( $f$ ). What are the units of frequency?
4. Define angular frequency ( $\omega$ ). What are the units of angular frequency?
5. What is the mathematical equation for the angular velocity( $\omega$ ) of a mass on a spring?
6. What is the phase constant ( $\phi$ )? What are the units of the phase constant?
7. What is the mathematical expression for the maximum velocity of an oscillator?
8. What is the mathematical expression for the angular velocity of an oscillator?
9. Where can you find the account of the woman who touched the Savior’s garment as he walked by and was healed after suffering for 12 years?

## Section 15.4 - 15.6 (Vertical Oscillations and Pendulums)

1. A mass is attached to a spring and allowed to oscillate horizontally. At what point in the oscillatory motion will the mass have maximum speed?
2. A mass is attached to a spring and allowed to oscillate horizontally. At what point in the oscillatory motion will the mass have zero speed?
3. What is the mathematical equation for the angular velocity( $\omega$ ) of a pendulum?
4. What is the small-angle approximation?
5. What is a physical pendulum?
6. What is the mathematical equation for the angular velocity( $\omega$ ) of a **physical** pendulum?
7. Where can you find the Savior’s teaching of the two great commandments?

## Section 15.7 - 15.8 (Driven and Damped Oscillations)

1. What is the mathematical equation for the angular velocity( $\omega$ ) of a **damped** pendulum?
2. What is a time constant( $\tau$ ) and what is the mathematical expression for the time constant for a damped oscillator?

3. What is the difference between driving frequency and natural frequency?
4. What is resonance and how is it achieved?
5. Explain how an opera singer can shatter a glass if he/she sings at just the right frequency.
6. Where can you find Mormon's counsel on having charity?

# Chapter 16

## Sections 16.1 - 16.4 (One-dimensional waves)

1. What is the mathematical expression for the speed of waves on a rope?
2. What is a mathematical expression for linear mass density ( $\mu$ )? What are the units of mass density?
3. What is a snapshot graph?
4. What is a history graph?
5. What is wavelength ( $\lambda$ ) and how is it different from period ( $T$ )?
6. What mathematical expression relates wave velocity ( $v$ ) with wavelength ( $\lambda$ ) and frequency ( $f$ )?
7. What is wave number ( $k$ ) and what is the mathematical expression to calculate it?
8. What mathematical expression relates wave velocity ( $v$ ) with angular frequency ( $\omega$ ) and wave number ( $k$ )?

## Section 16.5 - 16.7 (Sound and Light)

1. What are compressions and rarefactions?
2. What is the speed of sound in air at 20° C?
3. What is the speed of light ( $c$ )?
4. What frequency range can human ears detect?
5. When a wave encounters a boundary between one material and another, which of these three quantities change and which remain unchanged: speed, frequency, wavelength?
6. What is the meaning of index of refraction? What is the mathematical equation for calculating it?
7. What is the mathematical equation for calculating the speed of sound?
8. What is the mathematical equation for calculating the phase difference ( $\phi$ )?
9. What are the two great commandments and where in the scriptures can you find them?

## Section 16.8 - 16.9 (Power/Intensity/Doppler Effect)

1. What is the mathematical expression for intensity? What are the units of intensity?

2. What is the mathematical expression for intensity level? What are the units of sound intensity level?
3. What sound intensity level is the threshold of pain?
4. If a sound source is moving towards you, will you observe a higher or lower frequency compared to a stationary sound source?
5. If an observer is moving away from a sound source, will she observe a higher or lower frequency compared to a stationary observer?
6. The light from a receding source will have a wavelength that is: i) red shifted or ii) blue shifted?
7. What is the message of the parable of the ten virgins? Where can this parable be found?



# Chapter 17

## Sections 17.1 - 17.4 (Standing Waves)

1. What is the principle of superposition?
2. What is a standing wave?
3. What is the mathematical expression for the allowed wave frequencies for waves on a string?
4. What is a node?
5. What is an antinode?
6. What is a harmonic?
7. What is the fundamental frequency?
8. What is the mathematical expression for the allowed wave frequencies for sound waves in a pipe that is closed at both ends?
9. What is the mathematical expression for the allowed wave frequencies for sound waves in a pipe that is open at one end and closed at the other?
10. What is the mathematical expression for the allowed wave frequencies for sound waves in a pipe that is open at both ends?
11. Recite Isaiah 55:8-9

## Section 17.5 - 17.8 (Wave Interference)

1. What is meant by “path length difference”?
2. What is the mathematical condition for two waves to combine with maximum constructive interference?
3. What is the mathematical condition for two waves to combine with maximum destructive interference?
4. Explain how thin film coatings can reduce glare on your eye glasses.
5. What are beats?
6. What is the expression for beat frequency?
7. Recite John 16:33