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Approximate Timeline

Students are expected to keep up with class work when absent.

	CHAPTER 14 – VIBRATIONS & WAVES	
Day	**Plans for the day**	**Assignments for the day**
1	• Section 14.1 – Periodic Motion ○ Definitions ▪ Simple Harmonic Motion ▪ Period ▪ Amplitude ○ Hooke's Law ○ Pendulums ○ Resonance	• Assignment 14.0 & 14.1 • Read section(s) 14.2
2	• Section 14.2 – Wave Properties ○ Types of Waves ▪ Mechanical vs. Electromagnetic ○ Mechanical Waves ▪ Transverse waves (demos) ▪ Longitudinal waves (demos) ▪ Surface waves (demos) ▪ Parts of Waves (chalkboard)	•
3	• Section 14.2 – Wave Properties ○ Speed, Period, Frequency, Wavelength ○ Example problems galore	• Assignment 14.2 • Read section(s) 14.3
4	• Section 14.3 – Wave Behavior ○ Waves at Boundaries (demos) ○ Superposition of Waves ▪ a.k.a. Interference (demos) ▪ Standing waves (demos) ○ Reflection of waves (demos) ○ Refraction of waves (demos) ○ Diffraction (demos)	•
5	• Continue day 4	•
6	• Continue day 4	• Assignment 14.3
7	• Review for Chapter 14 Test	•
8	• Chapter 14 Test	• Read section(s) 15.1

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Study Guide
Chapter 14 Quizzes

Quiz 14.1 – Periodic Motion

1. Define the following terms.
    a. periodic motion
    b. simple harmonic motion
    c. period
    d. amplitude
    e. pendulum
    f. resonance
2. Use your understanding of simple harmonic motion to describe springs and pendulums.
3. Solve problems involving springs.
4. Solve problems involving pendulums.

Sec Quiz tion 14.2 – Wave Properties

5. Define the following terms.
    a. wave pulse
    b. periodic wave
    c. transverse wave
    d. longitudinal wave
    e. surface wave
    f. wavelength
6. Solve problems involving a wave's speed, frequency, and period.

Quiz 14.3 – Wave Behavior

7. Define the following terms.
    a. incident wave
    b. reflected wave
    c. principle of superposition
    d. interference
8. Know the three things that happens when a wave encounters a boundary.

Study Guide
Chapter 14 Test

At the completion of chapter 14 you should…

1. Know the definitions of the following terms.
    a. Periodic Motion
    b. Simple Harmonic Motion
    c. Period
    d. Amplitude
    e. Hooke's Law
    f. Pendulum
    g. Resonance
    h. Wave
    i. Wave pulse
    j. Periodic Wave
    k. Transverse Wave
    l. Longitudinal Wave
    m. Surface Wave
    n. Trough
    o. Crest
    p. Wavelength
    q. Frequency
    r. Incident Wave
    s. Reflected Wave
    t. Principle of Superposition
    u. Interference
    v. Standing Save
    w. Normal
    x. Law of Reflection
    y. Refraction
2. Know the three types of waves.
3. Know the three types of mechanical waves.
4. Know the difference between a pulse and a traveling wave.
5. Be able to calculate the velocity, period, frequency or period of a wave.
6. Know what happens to a wave at the boundary between two media.
7. Know the principle of superposition.
8. Define interference and give examples of both types of interference.
9. Know the law of reflection
10. Define normal, angle of incidence and angle of reflection.
11. Define and explain refraction.
12. Define and explain diffraction.

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Assignment 14.0 – Vocabulary

Define each of the following terms.

1. Periodic Motion

2. Simple Harmonic Motion

3. Period

4. Amplitude

5. Hooke's Law

6. Pendulum

7. Resonance

8. Wave

9. Wave Pulse

10. Periodic Wave

11. Transverse Wave

12. Longitudinal Wave

13. Surface Wave

14. Trough

15. Crest

16. Wavelength

17. Frequency

18. Incident Wave

19. Reflected Wave

20. Principle of Superposition

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21. Interference

22. Standing Wave

23. Normal

24. Law of Reflection

25. Refraction

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Assignment 14.1 – Periodic Motion

<u>Short Answer</u>: Answer each question in the space provided. Write or print clearly. IF I CAN'T READ IT, IT'S WRONG.

1. What is periodic motion? Give three examples of periodic motion.

2. A) What is the difference between frequency and period? B) How are they related?

3. What is simple harmonic motion? Give an example of simple harmonic motion.

4. How can the spring constant of a spring be determined from a graph of force versus displacement?

5. The period of a pendulum depends on what factors?

6. What conditions are necessary for resonance to occur?

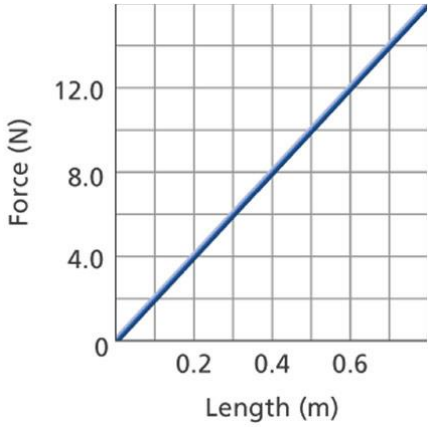
7. Can a pendulum clock be used in the orbiting *International Space Station*? Explain.

<u>Problems:</u> Solve each of the following problems. Show all work. Circle your answer expressed with the correct number of significant figures and units.

8. Each of the coil springs of a car has a spring constant of 25,000 N/m. How much is each spring compressed if it supports one fourth of the car's 12,000 N weight?

9. Force versus length data for a spring is plotted on the graph at right.

A) What is the spring constant of the spring?



B) What is the energy stored in the spring when it is stretched to a length of 0.50 m?

10. How long must a pendulum be to have a period of 2.3 s on the Moon, where g = 1.6 m/s^2?

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Assignment 14.2 – Wave Properties

<u>Short Answer</u>: Answer each question in the space provided. Write or print clearly. IF I CAN'T READ IT, IT'S WRONG.

1. How many general methods of energy transfer are there? Give two examples of each.

2. What is the primary difference between a mechanical wave and an electromagnetic wave?

3. What are the differences among transverse, longitudinal, and surface waves?

4. Suppose you send a pulse along a rope. How does the position of a point on the rope before the pulse arrives compare to the position after the pulse has passed?

5. What is the difference between a wave pulse and a periodic wave?

6. What is the amplitude of a wave and what does it represent?

7. Describe the relationship between the amplitude of a wave and the energy it carries.

8. Suppose you hold a 1 m long metal bar in your hand and hit its end with a hammer, first, in a direction parallel to its length, and second, in a direction perpendicular to its length. Describe the waves produced in the two cases.

9. Suppose you repeatedly dip your finger into a sink full of water to make circular waves. What happens to the wavelength as you move your finger faster?

10. What happens to the period of a wave as the frequency increases?

11. What happens to the wavelength of a wave as the frequency increases?

<u>Problems:</u> Solve each of the following problems. Show all work. Circle your answer expressed with the correct number of significant figures and units.

12. The Sears Tower in Chicago sways back and forth in the wind with a frequency of about 0.12 Hz. What is its period of vibration?

13. An ocean wave has a length of 12.0 m. A wave passes a fixed location every 3.0 s. What is the speed of the wave?

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14. Water waves in a shallow dish are 6.0 cm long. At one point, the water moves up and down at a rate of 4.8 oscillations/s.

A) What is the speed of the water waves?

B) What is the period of the water waves?

15. A sonar signal of frequency 1.00×10^6 Hz has a wavelength of 1.50 mm in water.

A) What is the speed of the signal in water?

B) What is its period in water?

C) What is its period in air?

16. A sound wave of wavelength 0.60 m and a velocity of 330 m/s is produced for 0.50 s.

A) What is the frequency of the wave?

B) How many complete waves are emitted in this time interval?

C) After 0.50 s, how far is the front of the wave from the source of the sound?

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Assignment 14.3 – Wave Behavior

<u>Short Answer</u>: Answer each question in the space provided. Write or print clearly. IF I CAN'T READ IT, IT'S WRONG.

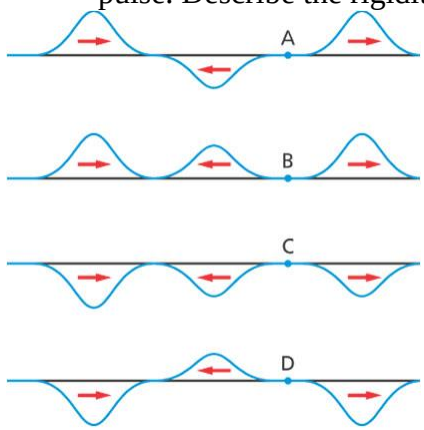
1. When a wave reaches the boundary of a new medium, what happens to it?

2. How does a spring pulse reflected from a rigid wall differ from the incident pulse?

3. A) Describe interference. B) Is interference a property of only some types of waves are all types of waves?

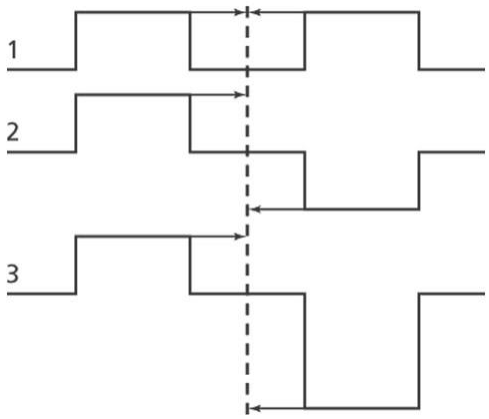
4. What happens to a spring at the nodes of a standing wave?

5. In each of the four waves below, the pulse on the left is the original pulse moving toward the right. The center pulse is a reflected pulse; the pulse on the right is a transmitted pulse. Describe the rigidity of the boundaries at A, B, C, and D.



<u>Problems:</u> Solve each of the following problems. Show all work. Circle your answer expressed with the correct number of significant figures and units.

6. Sketch the result for each of the three cases shown in the figure below, when the centers of the two approaching wave pulses lie on the dashed line so that the pulses exactly overlap.



7. The wave speed in a guitar string is 265 m/s. The length of the string is 63 cm. You pluck the center of the string by pulling it up and letting go. Pulses move in both directions and are reflected off the ends of the string.

A) How long does it take for the pulse to move to the string end and return to the center?

B) When the pulses return, is the string above or below it resting location?

C) If you plucked the string 15 cm from one end of the string, where would the two pulses meet?

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8. Sketch the result for each of the three cases shown in the figure below, when the centers of the two approaching wave pulses lie on the dashed line to that the pulses exactly overlap.