Unit 7 Waves

Saman tha 5

More Properties of Waves

Why?

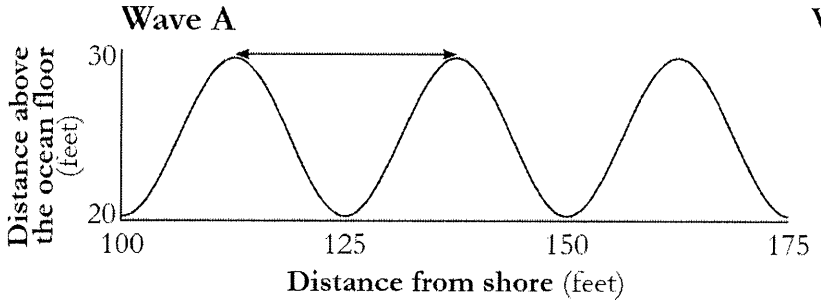
When people visit the ocean, they immediately notice one property of waves – their amplitude. Parents allow toddlers to splash in the water if the wave amplitude is very low. Teenagers love to play in the water when the amplitude is moderate. Surfers dream of high amplitude waves. Emergency responders worry about damage and injury from extremely large amplitude waves like tsunamis.

However, waves have more properties than just amplitude. Let's explore two more of these properties.

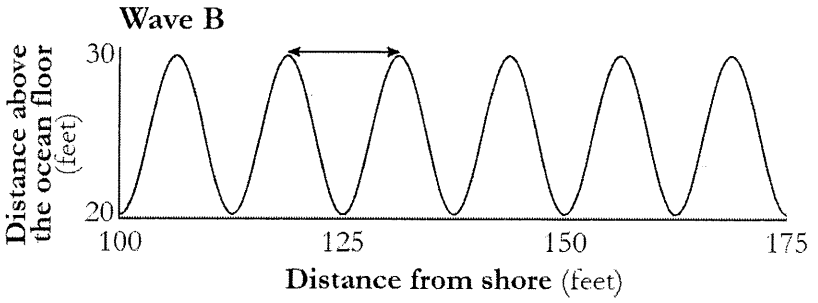
As you work through the following questions, be sure to follow your team role(s).

Model 1 – The distance between water waves in the open ocean

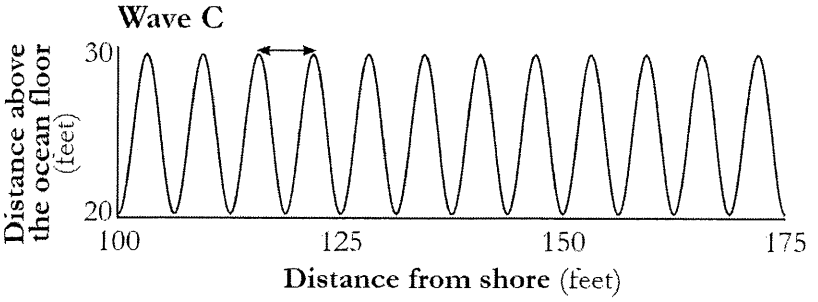
Three different wavelengths



Wavelength (↔)	Amplitude (↕)
25 feet	5 feet



12.5 feet	5 feet



6.25 feet	5 feet

Use the information in Model 1 to answer questions 1 – 7.
Reach agreement with your team before writing down your consensus answers.

1. How many different wavelengths are included in Model 1?

2. **Highlight** the wavelength arrows (⟷) shown in Model 1.

3. Look closely at the graphs in Model 1.

   a. What is the label on the **x-axis** (horizontal axis)?

   b. Circle this label on each of the graphs.

4. Look closely at all three graphs in Model 1.

   a. **Draw** a double-ended arrow (↕) on each graph to show the **amplitude** of Waves A, B, and C. You recall that amplitude is ½ of the wave height.

   b. What is the amplitude of Wave A? _____ Wave B? _____ Wave C? _____

5. Complete the data table below. Use information from Model 1.

Wave	**Wavelength** (feet)	**Amplitude** (feet)
A		5
B	12.5	
C		

6. Does a change in wavelength cause a change in amplitude? Look carefully at your data in the table above. Choose the **one** statement that accurately describes the relationship between the **wavelength and amplitude** of a wave

   a. As the wavelength decreases, the amplitude also **decreases**.

   b. As the wavelength decreases, the amplitude **remains the same**.

   c. As the wavelength decreases, the amplitude **increases**.

STOP Send a spy to check yours answers for questions 4 and 5 with two other teams.

9. Find the term **frequency** in Model 2. Its definition is located beneath the term. Write the definition here:

10. Complete the data table below for the waves shown in Model 1 and Model 2.
Be careful! Use information from **Model 1** and **Model 2**.

Wave	Wavelength (feet)	Frequency (waves per second)
A		0.05
B	12 .5	
C		

11. Complete the sentences below to **describe the relationship between wavelength and frequency**.

As the wavelength decreases, the frequency _____.

As the wavelength increases, the frequency _____.

Check your answer with your teacher before you continue.

12. Imagine that you measure Wave X. Its wavelength is about 3 feet.
Based on data from Models 1 and 2:

a. **Predict the frequency** of Wave X. Include the correct unit.

b. Explain how your team estimated the answer.
Hint: What patterns in the data helped you reach your answer?

What I Still Wonder...

13. Write one additional question you have about frequency, wavelength, or something else related to waves.

Extension Questions

14. Which mathematical equation best matches the relationship between wavelength and frequency for water waves in the ocean? Use data from Model 1 and Model 2. Show enough calculations to support your answer.

a. (wavelength) + (frequency) = 1.25 feet per second

b. (wavelength) – (frequency) = 1.25 feet per second

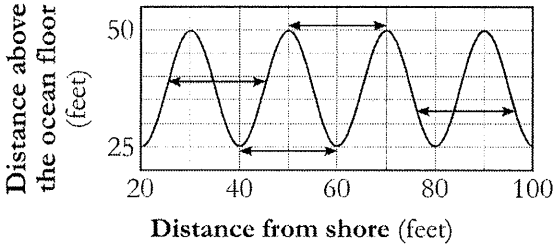
c. (wavelength) x (frequency) = 1.25 feet per second

d. (wavelength) ÷ (frequency) = 1.25 feet per second

15. **Challenge**! The speed (velocity) of an ocean wave is measured in **feet per second**. Propose a mathematical way to calculate the **speed of a wave** when you know the wavelength and frequency of the wave. Use data from Model 1 and Model 2 to support your answer.

16. We have learned how to measure wavelength by drawing a double-ended arrow from one wave crest to an adjacent wave crest in a graph of distance from shore vs. distance above ocean floor.

a. Work with your team to **estimate the length** of each of the arrows shown below.

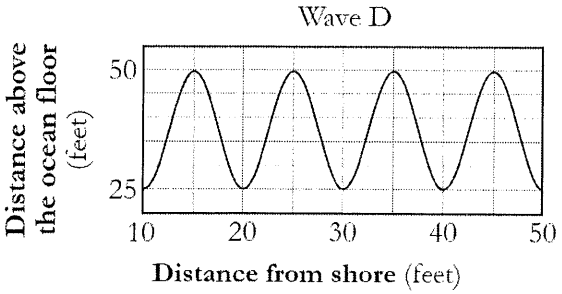


b. Based on your measurements, explain how a person can **measure the wavelength without using crest-to-crest measurements**.

7. Estimate the **wavelength** of Wave D.

a. **Draw** an arrow on the diagram to show what you are measuring.

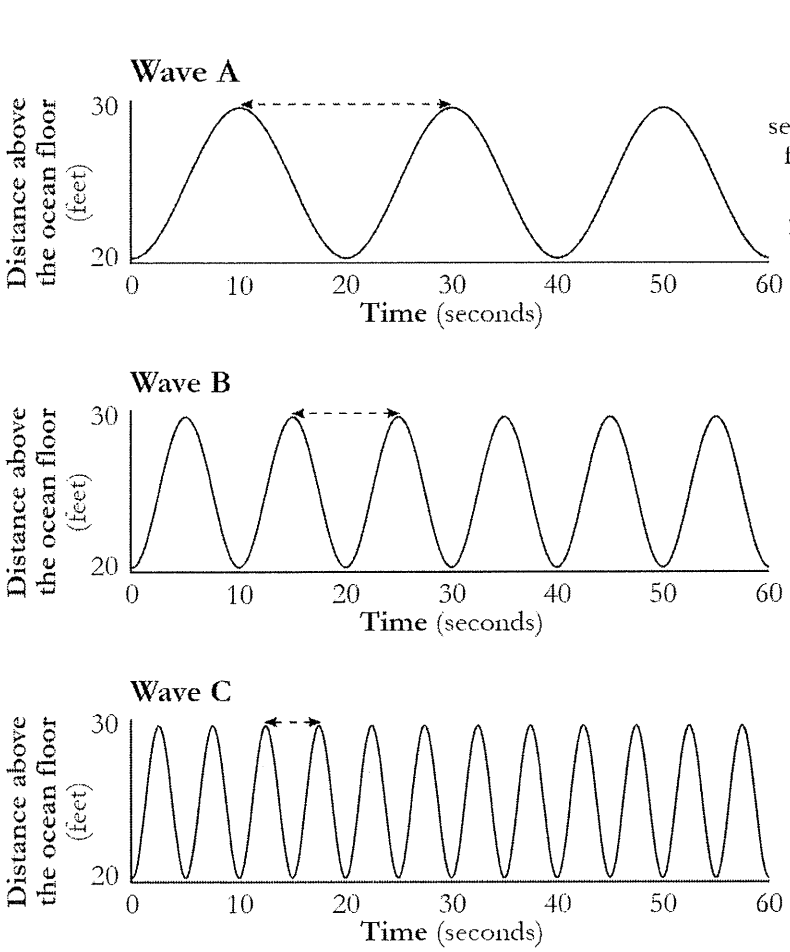
b. Write the wavelength, including the correct unit:



Read This!

When people visit the ocean, they also notice **how often waves hit them** as they stand in the water. This is another property of waves. In Model 2 we will explore more of the ideas and terms that scientists use when they study the behavior of waves.

Model 2 – How many water waves pass by in one second?



	Period (←- -→) Number of seconds it takes for one wave to pass	Frequency Number of waves that pass each second
Wave A	**20 seconds**	**0.05 waves each second**
Wave B	**10 seconds**	**0.1 wave each second**
Wave C	**5 seconds**	**0.2 waves each second**

Use the information in Model 2 to answer questions 8 – 12.
Reach agreement with your team before writing down your consensus answers.

8. Look closely at the graphs in Model 2. They contain data for **the same waves we analyzed in Model 1.**

a. Describe how the **x-axis label** in Model 2 compares to the **x-axis label** in Model 1.

b. What does the symbol ←- -→ represent in Model 2?

c. **Highlight** the "period" arrow in each graph.

d. Compare the highlighted arrows in Model 2 with the highlighted arrows in Model 1. Explain why these two types of **horizontal arrows represent different properties** of Waves A, B, and C.