

## WAVE TEST

**Learning Target:** *I can characterize ocean waves by frequency, wavelength, amplitude, speed.*

### TEST DESIGN RUBRIC

Exceeding Standard	Student can <i>assess</i> the impact of ocean wave frequency, wavelength, amplitude and speed on a real world situation
Meeting Standard	Student can <i>characterize</i> ocean waves by frequency, wavelength, amplitude and speed.
Approaching Standard	Student can accurately <i>define</i> the terms frequency, wavelength, amplitude and speed.
Below Standard	Student can accurately define one or two of the following terms: frequency, wavelength, amplitude and speed.
Score 0.0	No effort or progress

## STUDENT FRIENDLY RUBRIC

<p>Exceeding Standard</p>	<p>We should be able to evaluate how changes in frequency, amplitude, wavelength and speed of ocean waves impact a real-world situation. For example: We should be able to <i>predict</i> which of the following storms will result in the most damage to a seawall on the Washington coast and <i>justify</i> our answer:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <b>Storm A:</b> Waves hit the seawall with an amplitude of 10 meters, a wavelength of 100 meters and a frequency of 1 wave per minute for 24 hours</li> <li><input type="checkbox"/> <b>Storm B:</b> Waves hit the seawall with an amplitude of 5 meters, a wavelength of 20 meters and a frequency of and a frequency of 5 waves per minute for 24 hours</li> <li><input type="checkbox"/> <b>Storm C:</b> Waves hit the seawall with an amplitude of 10 meters, a wavelength of 50 meters and a frequency of 2 waves per minute for 24 hours</li> </ul> <p><b>Answer:</b> Waves with a higher amplitude will do more damage than waves with a smaller amplitude <u>because they contain more water to smash against the seawall</u>. Waves with a higher frequency will do more damage than waves with a lower frequency <u>because they smash against the seawall more often</u>. Different wavelengths have no effect on the seawall. Storm C has the same high wavelength as storm A but storm C has a higher frequency than storm C. Therefore storm C will do the most damage to the seawall.</p> <p><b>Explanation:</b></p> <p>The effect of wave <i>amplitude, wavelength and frequency</i> on the seawall is stated. Note also the REASON for each statement is also included and is underlined in the example above. Remember, don't just state your answer, explain your answer!</p>
<p>Meeting Standard</p>	<p>We should be able to sketch and label an ocean wave at the end of this unit. Each sketch should show the height of the wave (<i>amplitude</i>), the distance between the crest of one wave and the crest of the following wave (<i>wavelength</i>) and the number of waves occurring in some period of time (<i>frequency</i>).</p> <p>Given wavelength, frequency and velocity we should be able to determine the missing value of the third</p>
<p>Approaching Standard</p>	<p>To be able to demonstrate understanding of the frequency, wavelength, amplitude and speed of an ocean wave, we must be able to define each of those terms:</p> <p><i>Amplitude</i> is the height of a wave—usually measured in meters  <i>Frequency</i> is the number of waves that pass a certain point in a certain amount of time.  <i>Wavelength</i> is the distance between one wave crest and the following wave crest  <i>Speed</i> -</p>
<p>Below Standard</p>	
<p>Score 0.0</p>	

Sample test:

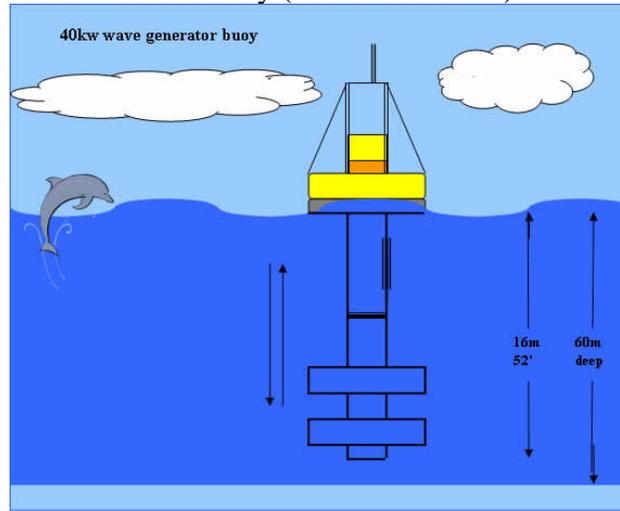
Multiple choice/fill in the blank etc (40%?) 12 pts (12 questions)

Short answer (sketch and label) (40 %?) 12 pts (sketch & labels)

Extended response (20%?) 3 pts each

Consider the following:

Engineers have designed a method to produce electricity from ocean waves and are testing it off the Oregon coast. The system consists of a buoy anchored to the ocean bottom. As waves pass under the buoy, the buoy is raised and that motion is used to turn a generator that creates electricity (*see sketch below*).



Consider the following four conditions. Predict which condition will generate the most electricity in the buoy system described above and justify your answer? (2 pt for answering correctly, 1-2 point for explaining your answer accurately, 1-2 points for using clear and accurate science language)

- Waves with a wavelength of 20 m/wave and a speed of 1 m/sec and an amplitude of 2 meters.
- Waves with a wavelength of 10 m/wave and a speed of 3 m/sec and an amplitude of 2 meters.
- Waves with a wavelength of 5 m/wave and a speed of 5 m/sec and an amplitude of 2 meters.
- Waves with a wavelength of 1 m/wave and a speed of 8 m/sec and an amplitude of 2 meters.

<Answer: The situation described in option c will generate the most amount of electricity. The amount of electricity generated depends on the amplitude and the frequency of the waves moving under the buoy. Since the amplitude is constant in all conditions, the option with the highest frequency will generate the most electricity. We can determine the frequency of option C as:

$$(5 \text{ m/sec}) / (5 \text{ m/w}) = 1 \text{ wave/sec}$$

which is the highest frequency of all the options.

(Deduct 1 point if any part of the answer is written in a sentence fragment or is not clear, not accurate or is too long)  
NOTE: I'm taking a suggestion from Dennis here and I'll be elaborating that wavelength is meters per wave. That helps the calculation a little bit. If you haven't or aren't doing that then go ahead and edit the question as appropriate for your class.

Also, I don't think very many kids will put that bit about the amount of electricity depends on amplitude and frequency. We have leave it in as a gold standard but not count points for it (my preference, I think), or we can leave it in as a single point kinda thing as a big reach for them.