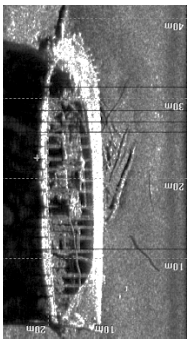
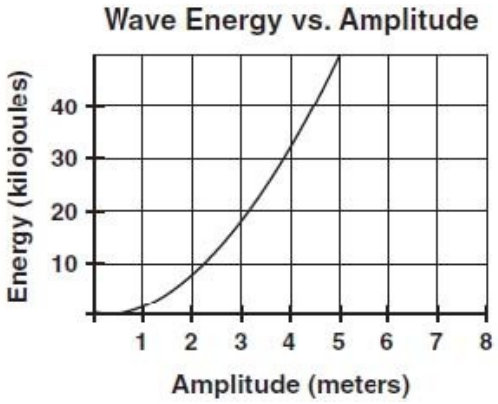
Scientists use sonar (sound waves) to help them study parts of the ocean that are difficult to see because they are too dark or far away, such as the ocean floor. For example, the picture of this ancient shipwreck (on the right) that scientists found on the ocean floor was made using only sound waves!



Unfortunately, these sounds can be harmful and confusing to marine animals, such as whales and dolphins. Scientists know that sound waves with lower energy and lower pitch are safer to marine animals. Do research on sound waves to figure out how to create lower energy and lower pitch waves that can be used to study the ocean.

1. Analyze the graph showing wave energy and amplitude below:

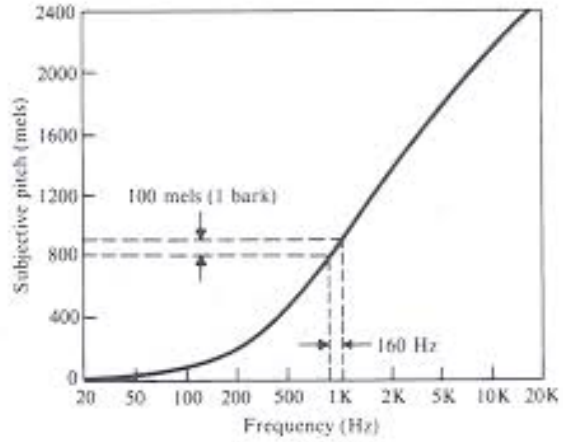


http://math-science-resources.com/2016/05/

a. Describe the graph: what relationship do you see?

b. How could you change a sound wave to lower its energy? Support with a pattern from the graph.

2. Analyze the graph showing wave frequency and pitch below:

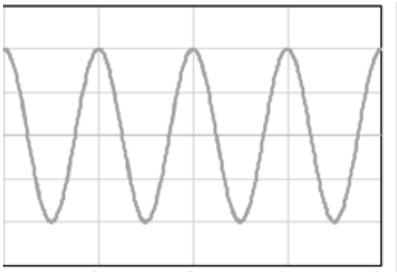


https://courses.physics.illinois.edu/phys406/sp2017/Lecture_Notes/P406POM_Lecture_Notes/P406POM_Lect7.pdf

   a. Describe the graph: what relationship do you see?

   b. How could you change a sound wave to lower its pitch? Support with a pattern from the graph.

3. Below you will see a mathematical model of the type of sound wave scientists currently use to study the ocean floor.
   a. Draw a new wave over the original sound wave to show a lower energy and lower pitch sound wave that would be safer for marine animals.



b. Describe how you changed the properties of the original sound wave.

4. Explain why the new sound wave will be safer to marine animals. Use evidence from the graphs and your wave model to support your response.