



**Problem 1 – Intensity of Sound**

1. When is the use of logarithmic equations to model data particularly useful?

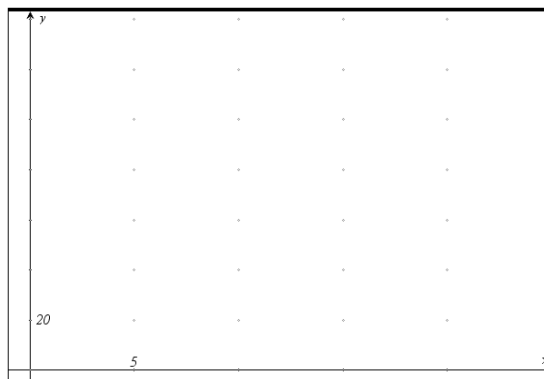
2. The equation  $\beta = 10 \log\left(\frac{I}{I_0}\right)$  is used to convert the power level of sound to decibels (dB). What does each variable in this equation represent?

$\beta =$  \_\_\_\_\_

$I =$  \_\_\_\_\_

$I_0 =$  \_\_\_\_\_

3. Sketch the graph of  $\beta = 10 \log\left(\frac{I}{I_0}\right)$ .



4. Describe the features of this graph. (What happens to the graph as  $x \rightarrow \infty$ ? What happens as  $x \rightarrow 0$ ? Is the function increasing or decreasing? What happens when  $x$  is negative? Where does the function change rapidly? Where does the function change slowly?)



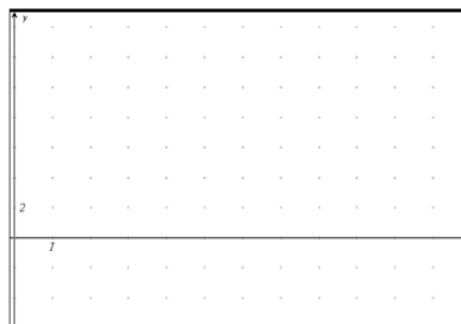
5. Which of the following events will cause damage only if exposure is long term?
- a. normal talking
  - b. Niagara Falls
  - c. busy traffic
  - d. jet engine
6. Which of the following events listed will result in hearing loss following short term exposure?
- a. Jet engine
  - b. pneumatic drill
  - c. busy traffic
  - d. normal talking
7. Elevated Trains, such as the “L” in Chicago, produce a great deal of noise. If the sound level recorded from one of these trains is 90 dB, use the equation  $\beta = 10 \log \left( \frac{I}{I_0} \right)$  to find the power ( $I$ ) in  $\frac{W}{m^2}$ . Recall that  $I_0$  is a constant,  $10^{-12} \frac{W}{m^2}$ .

## Problem 2 – pH

8. What is the definition of pH?



9. Sketch a graph of the function  $pH = -\log[H^+]$ .



10. Describe the features of this graph. (What happens to the graph as  $x \rightarrow \infty$ ? What happens as  $x \rightarrow 0$ ? Is the function increasing or decreasing? What happens when  $x$  is negative? Where does the function change rapidly? Where does the function change slowly?)

11. Why do negative values of  $x$  not make sense in the context of the pH equation?

12. Which of the following substances is most acidic?

- a. vinegar
- b. tomato juice
- c. rain water
- d. carbonated beverages

13. Which of the following is least acidic (or most basic)?

- a. sea water
- b. gastric juices
- c. milk
- d. distilled water

14. Do any of the values listed in the spreadsheet surprise you? Which ones? Why?