Name: _____   Date: _____

6.5 Making Connections: Logarithmic Scales in the Physical Sciences

1. Determine the pH, correct to one decimal place, of a solution with each hydronium ion concentration.
   a) 0.000 316 mol/L
   b) 7.9×10^{-9} mol/L

2. Calculate the hydronium ion concentration, correct to two decimal places, if the pH of a solution is
   a) 2.2   **b)** 11.6

3. Use the sound level scale given on page 351 of the text.
   a) How many times as intense is a normal conversation compared to a whisper?
   b) How many times as intense is normal city traffic compared to a shout?

4. The intensity of sound in a library is estimated to be one thousandth that of normal conversation. What is the decibel rating for the library?

5. How many times as intense is an earthquake with a magnitude of 7.2 than an earthquake with a magnitude of 5.6?

6. If an earthquake is 390 times as intense as an earthquake with a magnitude of 4.2 on the Richter scale, what is the magnitude of the more intense earthquake?

7. The absolute magnitude of star A is –4.5 and that of star B is 0.2.
   a) How many times as bright is star A than star B, to the nearest unit?
   b) If the apparent magnitudes of two stars are –2.5 and 1.3, respectively, which star is closer to Earth? Justify your answer.

8. The amount of power per unit area carried by sound at the threshold of hearing (0 dB) is 10^{-12} W/m². Calculate the power per unit area carried by sound from each source.
   a) a normal conversation (60 dB)
   b) a chain saw operating at a distance of 1 m (117 dB)

9. If the Richter scale is altered so that it compares *energy released* instead of *intensity* , the definition of the scale becomes $M_2 - M_1 = \log_{31}\left(\dfrac{E_2}{E_1}\right)$.
   a) If the magnitude of an earthquake is increased by 1 on the scale, by what factor is the energy released multiplied?
   b) What is the magnitude of an earthquake that releases 200 times the energy of an earthquake with magnitude 4.5?
   c) How many times greater is the energy released from an earthquake with magnitude 9.0 than that of an earthquake with magnitude 6.5?