

Name: _____

Skill Sheet 15.1

Decibel Scale Problems

This skill sheet provides practice problems in using the decibel scale.

The decibel scale relates the amplitude of sound waves to their loudness. Since the range of amplitudes our ears can hear is very large, a logarithmic scale is used. By compressing the high end of the scale and expanding the low end of the scale, the logarithmic scale adjusts the very large range of amplitudes so that we can relate the amplitudes to the way they sound. Increasing a sound's amplitude by a factor of 10 raises its level on the logarithmic scale by 20 decibels (dB). Increasing a sound's amplitude by a factor of 100 raises its level by 40 dB; by 1,000, 60 dB and so on.

The loudness of the sound is proportional to the amplitude of the sound wave. Each increase of 20 dB will sound about twice as loud to your ears. Use the following table to help you answer the questions in Parts 1 and 2.

10-15 dB	A quiet whisper 3 feet away
30 dB	A house in the country
40 dB	A house in the city
45-55 dB	The noise level in an average restaurant
65 dB	Ordinary conversation 3 feet away
70 dB	City traffic
90 dB	A jackhammer cutting up the street 10 feet away
110 dB	A hammer striking a steel plate 2 feet away (very loud)
120 dB	The threshold of physical pain from loudness

1. Loudness problems

Solve these loudness problems using the table of decibel scale. The first problem is done for you:

1. Questions about city sounds:

- How many decibels does city traffic have? *Answer:* According to the table, city traffic has a decibel reading of 70 dB.
- How many decibels would a sound have if its loudness was twice that of city traffic? *Answer:* Since every 20 dB increase in decibels sounds about twice as loud, the sound relating to 90 dB (70 dB + 20 dB) would sound twice as loud.
- Which sound corresponds to the decibel level determined in 1(b)? *Answer:* A jackhammer 10 feet away corresponds to 90 dB.

2. How many decibels would a sound have if its loudness was four times that of a 10 dB quiet whisper?

3. How much louder would a 30 dB sound be than a 10 dB quiet whisper?

4. A house in the country has a loudness of 30 dB. How many times louder does a 90 dB jackhammer 10 feet away sound?
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5. How many decibels louder is a house in the city than a house in the country?
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6. How much louder would a house in the city sound than a house in the country?
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2. Amplitude problems

Solve the following amplitude problems using the table of decibel scale. Remember that the amplitude of the sound wave increases by a factor of 10 for every 20 dB difference. The first problem is done for you.

1. How much greater is a jackhammer 10 feet away's amplitude than city traffic?

Answer: Since every 20 dB increase in decibels has 10 times greater amplitude, a jackhammer 10 feet away (90 dB) has an amplitude 10 times greater than city traffic (70 dB).

2. How much larger in amplitude would a 30 dB sound be than a 10 dB quiet whisper?
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3. How much greater is the amplitude of the sound waves of the jackhammer 10 feet away than the sound waves of a house in the country?
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4. An ordinary conversation is 65 decibels. In a restaurant, people talk more quietly at around 45 decibels. What is the difference in amplitude of sound waves produced during normal conversation and sound produced when people are talking in a restaurant?
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