

<b>CHAPTER 7</b>	<b>Investigation 7.A: Measuring Respiratory Volumes</b>	<b>BLM 7.2.3</b>
<b>HANDOUT</b>		

**Question:** How can you use a spirometer, which measures air as it is exhaled, to determine the volume of air you inhale in a normal breath and a deep breath?

### Prediction

Predict what percentage of your vital capacity is represented by your tidal volume.

### Safety Precautions

Do not inhale or exhale to the point of faintness.

### Materials

- materials for recording data
- spirometer with disposable mouthpieces
- nose plug (optional)

### Procedure

1. Set the spirometer gauge to zero, and insert a clean mouthpiece. If you are using a nose plug, put it on.
2. Begin by taking a few relaxed breaths. Then inhale normally, put the mouthpiece into your mouth, and exhale normally into the spirometer. Record the value in the following table as your *tidal volume*.

#### Measured and Calculated Respiratory Volumes

<b>tidal volume</b>	
<b>expiratory reserve volume</b>	
<b>inspiratory capacity</b>	
<b>inspiratory reserve volume</b>	
<b>calculated vital capacity</b>	
<b>recorded vital capacity</b>	

3. Reset the spirometer. Inhale and exhale normally. At the end of the normal exhalation, put the spirometer mouthpiece into your mouth and exhale as much as you can. Make sure you do this all in one breath. Record the value as your *expiratory reserve volume*.
4. Reset the spirometer. Inhale as deeply as you can, and then exhale normally into the spirometer. **Do not force the exhalation.** Record the value as your *inspiratory capacity*.
5. Calculate your *inspiratory reserve volume* by subtracting your tidal volume from your inspiratory capacity. Record your inspiratory reserve volume.

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6. Calculate your *vital capacity* by adding your inspiratory reserve volume, expiratory reserve volume, and tidal volume. Record the value as your *calculated vital capacity*.
  
7. Reset the spirometer. Inhale as deeply as you can, and then exhale deeply into the spirometer, forcing out as much air as you can. Do this all in one breath. Record the value as your *recorded vital capacity*.

### Analysis

1. Compare your calculated vital capacity with your recorded vital capacity. Explain any difference.
  
2. Compare your inspiratory reserve volume with your expiratory reserve volume. Explain any difference.

### Conclusions

3. Can you use the spirometer to measure your total lung capacity? Explain.

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4. How might an athlete use information about his or her vital capacity? Predict how respiratory volumes relate to athletic performance.

### Extension

5. Compare your respiratory volumes with those of other students by creating a class data table. How much variation do you see? Are there patterns in this variation, such as differences between males and females, or differences based on height? What factors could contribute to differences in respiratory volumes? Design an experiment to test the effects of two of these factors.

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### Application

6. Vital capacity can be used to determine fitness, because it shows the extent to which individuals can ventilate their lung surface. Do research to determine how vital capacity is affected in two different respiratory disorders. Prepare a brief report about how these disorders affect the respiratory system and how they can be treated.
7. A ventilator is a piece of medical equipment that maintains respiratory movements in a person who is unable to breathe. Consider a young, otherwise healthy person who is paralyzed as a result of a car crash. Would it be a good idea to adjust a ventilator to maximize the volume of air inhaled and exhaled? Explain.