

In this investigation, you will measure your respiratory volume using a device called a spirometer.

Question

How can you use a spirometer, which measures air as it is expired, to determine the volume of air you inspire 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 inspire or expire to the point of faintness.
- Do not inspire or inhale through the spirometer. Disinfect the spirometer and be sure to replace the disposable mouthpiece between uses.

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 inspire normally, put the mouthpiece into your mouth, and expire normally into the spirometer. Record the value as your tidal volume.
3. Reset the spirometer. Inspire and expire normally. At the end of the normal expiration, put the spirometer mouthpiece into your mouth and expire 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. Inspire as deeply as you can, and then expire normally into the spirometer. Do not force the expiration. 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.
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. Inspire as deeply as you can, and then expire 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.

Tidal Volume	Expiratory Reserve Volume	Inspiratory Capacity	Inspiratory Reserve Volume	Calculated Vital Capacity	Recorded Vital Capacity
			$IRV = IC - TV$	$VC = TV + IRV + ERV.$	

Analysis

1. Compare your calculated vital capacity with your recorded vital capacity. What might account for the difference if any?

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.

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 other factors could contribute to differences in respiratory volumes?

Male Name	Calculated Vital Capacity	Height in cm	Female Name	Calculated Vital Capacity	Height in cm
Average					

Application

6. Vital capacity can be used to determine fitness, because it shows the extent to which individuals can ventilate their lung surface. How is vital capacity affected by Emphysema?

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 inspired and expired? Explain.
