



Measuring forced vital capacity with PocketLab spirometer

Exploration

A spirometer is an apparatus often used in the medical field to find the cause of shortness of breath. A spirometer can rule out lung diseases like asthma, bronchitis, and emphysema. A spirometer can measure forced vital capacity. Forced vital capacity is the amount of air exhaled during a forced breath. Explore what factors affect forced vital capacity.

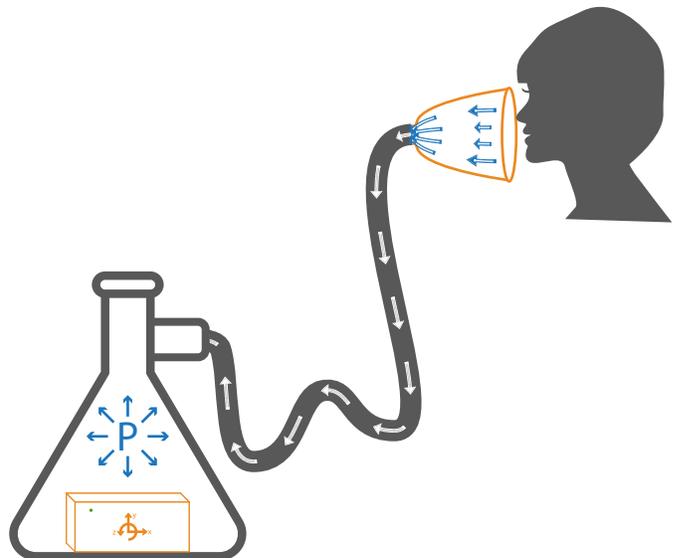
Objective:

In this exploration, students will:

1. Build a PocketLab Spirometer and learn how to relate the barometer readings to a person's forced vital capacity.
2. Investigate what variables affect a person's forced vital capacity

Materials

- Beaker with hose attachment and stopper
- Hose
- Optional: Funnel or mouthpiece for hose
- PocketLab

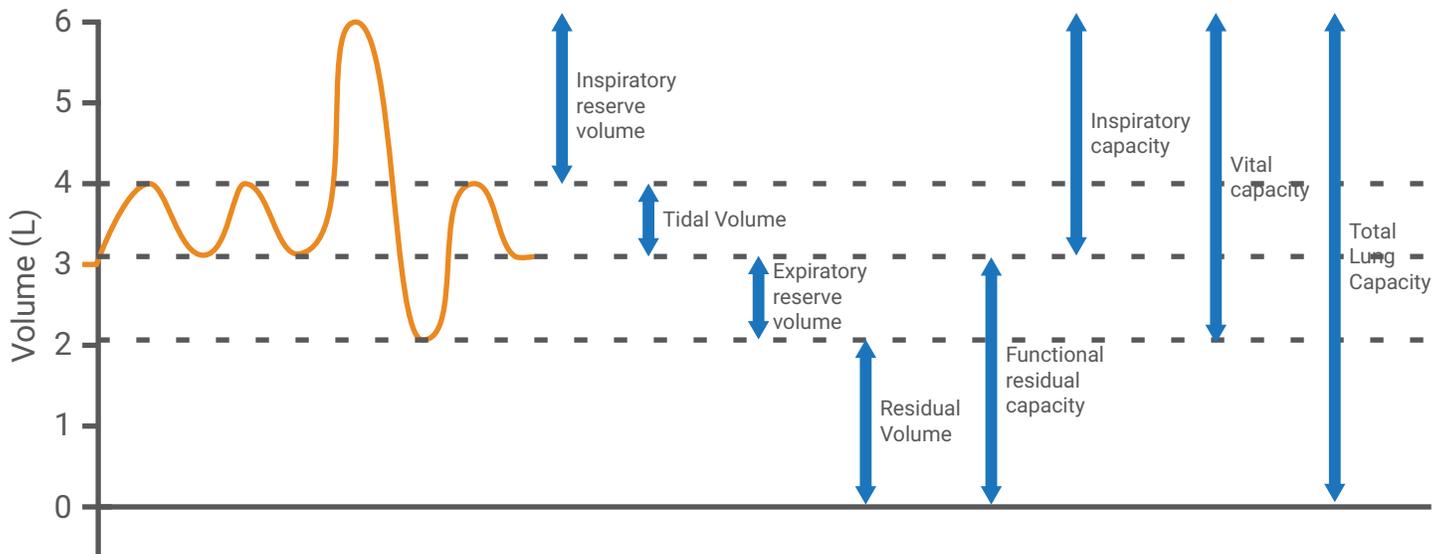


Method:

1. Connect the PocketLab and place it inside the beaker.
2. Seal the beaker with the stopper and attach the hose.
3. Record the pressure inside the beaker with the PocketLab's barometer.
4. Breathe normally and then inhale into the hose. Note the spike in pressure when exhaling.
5. Take a maximum inhale, then through the hose, exhale as hard as you can. Note the spike in pressure when exhaling.
6. Try a max inhale and exhale into the spirometer while recording the pressure. Note the change in the graph.
7. Record different variables between your lab group or class. (Examples: height, age, weight, athletic ability, gender, etc.) You will compare how these variables are related to one's forced vital capacity in you analysis and conclusions.

PocketLab Spirometer

- The PocketLab Spirometer does not directly measure forced vital capacity. Forced vital capacity is the total volume of air that can be exhaled after a maximum inhalation. Instead, the PocketLab Spirometer correlates forced vital capacity with the change in pressure in the beaker when someone exhales into it, after a full inhale. The change in pressure is correlated to the volume of air expired after maximum inhalation.
- Pictured is a diagram of a graph from a medical spirometer, not a PocketLab Spirometer. Note: the medical spirometer is measuring volume of air in the lung.



Key Terms

Tidal Volume: The volume of air inhaled and exhaled without effort.

Inspiratory Reserve Volume (IRV): The max volume of air inhaled with effort on top of the normal tidal volume.

Expiratory Reserve Volume (ERV): The max volume of air that can be exhaled with effort on top of the normal tidal volume.

Vital Capacity: The total volume of air that can be exhaled after a maximum inhalation.

Residual Volume: The volume of air remaining in the lungs after a maximum inhalation. Lungs always need some amount of air.

Total Lung Capacity: The vital capacity plus the residual volume.

Predictions

- For each variable tested, predict the relationship between that variable and forced vital capacity. Explain your prediction.

Data Analysis and Observations

- For each variable tested, explain the relationship between that variable and forced vital capacity. Compare the results to your prediction.

Conclusions

- What variables are related to forced vital capacity? Why do you think those variables have an effect?
- Explain how the PocketLab is used to measure forced vital capacity.
- How do you think smoking tobacco would affect forced vital capacity? Explain.
- Why do you think forced vital capacity is important to someone's health?
- Compare the data from the PocketLab Spirometer to the graph of a common spirometer used in the medical profession (previous page). How are the data and the graph similar and different?

