Purpose: In this lab you will measure several pulmonary volumes using a device called a spirometer. You will then use this data to calculate several other pulmonary volumes.

Hypothesis: On a separate sheet of paper, predict the following:
- How many mL of air can your lungs hold on a deep breath?
- How many times do you breathe per minute when at rest (don’t cheat, make a prediction now)?
- How many mL of air do you breathe in and out while breathing normally at rest?
- How much air (in mL) remains in your lungs after your exhale normally?

You have just made a prediction of your Vital Capacity (VC), Breathing Rate (BR), Tidal Volume (TV), and Expiratory Reserve Volume (ERV)

Procedure: (all data needs to be in organized and easy to read data table)

1. Attach a sterilized mouthpiece to the side limb of the spirometer.

2. Rotate the spirometer dial until the needle is aligned with the “0” mark. The dial is marked in increments of 100cc. 100cc is equal to 100 mL (therefore 1000 cc = 1000 mL = 1 L).

3. Hold the spirometer by the base, taking care that the air holes are not blocked.

4. Pinch your nostrils with your free hand to keep air from escaping through your nose. Perform the breathing maneuvers for vital capacity, tidal volume, and expiratory reserve volume according to the directions given below. Record your data under your hypothesis.

5. When you are finished with the spirometer, unscrew the bottom part and dry with a tissue. DO NOT IMMERSE IN WATER!

6. Measure your height in cm, without shoes. Record this data along with you age in your data table.

BREATHING MANEUVERS

A. Measured Vital Capacity (VC) - Set the spirometer dial to “0.” Sit as straight as possible. Inhale as deeply as you can, then exhale all of the air through the spirometer. Record you data for Vital Capacity. Repeat twice more, and then calculate your average vital capacity measurement.

B. Tidal Volume (TV) - Set the spirometer dial to “0.” Sit upright and rest quietly for 5 minutes before performing this test. Then exhale 5 normal breaths into the spirometer. (Do not inhale through the spirometer). Record the reading then divide by 5 to calculate an average TV.

C. Expiratory Reserve Volume (ERV) - Set the spirometer dial to “0.” Sit upright and rest quietly for 2 minutes before performing this test. Then, after a normal exhale, exhale as much as you can through the spirometer. Record your data. Repeat two more times and calculate your average ERV.

D. Breathing Rate (BR) - Sit upright and rest quietly for 2 minutes. Have your partner count the number of breaths you take in one minutes. Record your data.
Results:

Calculations:

Go to Mr. B's website to download the data table for the pulmonary lab.

Sort the data for each gender by Vital Capacity from largest to smallest.

Use the spreadsheet to calculate the following:

1) Table 1: Average female VC, TV, ERV, BR. Min and Max Values
2) Table 2: Average male VC, TV, ERV, BR. Min and Max Values

Residual Volume is calculated for you already in Table 2.
This is the amount of air remaining in the lungs after maximum forced expiration. You cannot measure this with a spirometer. For the average male RV = 1200cc. For the average female RV = 900cc. (No calculation needed here).

3) Table 3: Inspiratory Reserve Volume for your data, female average, male average:
This is the amount of air that can be inhaled in excess of a normal expiration during normal breathing.
IRV = VC – TV – ERV

4) Table 3: Inspiratory Capacity for your data, female average, male average:
This is the normal amount of air that can be inhaled after a normal expiration.
IC = VC – ERV

5) Table 3: Total Lung Capacity for your data, female average, male average:
This is the maximum volume of air that your lungs can hold.
TLC = VC + RV

6) Table 3: Minute Volume of Respiration for your data, female average, male average:
This is the total volume of air taken in during one minute.
MVR = TV x BR

7) Table 4: Calculated VC: There is a formula to calculate the normal VC based on your age and height. Enter your height, age, and gender adjust factor (3600 for males and 2690 for females) in the table and your wonderful teacher has already created the formula that will compute your calculated VC.
You’re welcome.

For males: VC = 52H - 22A - 3600
For Females: VC = 41H - 18A - 2690

H = height in cm
A= age in years
VC = vital capacity in mL

Reduce the size of the cells so you can fit your result tables for printing.
PRINT OUT ONLY THE RESULT TABLES WITH THE CALCULATIONS (NOT THE ENTIRE CLASS DATA).
After your calculations, **type** in paragraph form, an analysis following the “how to write a lab analysis” handout.

For the **results section**, compare your individual data/calculations for your gender’s calculated averages (VC, TV, ERV, BR, IRV, IC, TLC, and MVR). **How much** above or below the class average were you for each respiratory volume analyzed in this lab? For example: “My measured breathing rate was 21 breaths per minute (bpm) which was 6 bpm higher than the male class average of 15 bpm.”

**Additional Question:**

How did your measured Vital Capacity (spirometer) compare to the calculated Vital Capacity (table 4)? Be specific here: **how much** above or below was your measured result vs the calculated result? Offer a suggestion explaining why these values are different.

**Research Two Respiratory Disorders from the list below.**

**You are required to select disorders from two different categories.**

- Obstructive conditions (e.g., emphysema, bronchitis, asthma attacks)
- Restrictive conditions (e.g., fibrosis, sarcoidosis, alveolar damage, pleural effusion)
- Vascular diseases (e.g., pulmonary edema, pulmonary embolism, pulmonary hypertension)
- Infectious, environmental and other "diseases" (e.g., pneumonia, tuberculosis, asbestosis, particulate pollutants).

Be sure to include citations within your summary and a bibliography.

Include: symptoms, how it is caused/spread, how can risk of contracting the disorder be minimized, possible cures or treatment.