INSTRUCTOR INFORMATION

Lung Volumes and Capacities

1. The Go Direct Spirometer should be held vertically and steadily. It is helpful to brace at least one arm on a hard surface, such as a table. Deviation from this position will affect data collection.

2. To maintain good hygiene, always use the Go Direct Sprirometer with a MicroGard® bacterial filter and a disposable mouthpiece. Every student should have their own bacterial filter and disposable mouthpiece. According to the manufacturer's specs, the MicroGard filters out more than 99% of bacterial and viral aerosols.

3. It is important for students to begin data collection with an inspiration.

4. When calculating volumes, users should measure peak-to-trough (not peak-to-baseline). Alternately, users can enable the Adjusted Volume channel under Sensor Channels in the Sensor Setup menu which will correct for baseline drift.

5. For additional information about the Vernier probeware used in this experiment, including tips and product specifications, visit **www.vernier.com/manuals** and download the appropriate user manual.

6. Residual volume cannot be measured. A value of ≈1.5 L is provided for the purposes of this experiment.

7. Expected ranges in Table 1 were gathered with clinically calibrated equipment and with professional coaching. Values in the classroom may vary.

8. If you are using Go Direct sensors, see **www.vernier.com/start/go-direct** for information about how to connect your sensor.

SAMPLE DATA

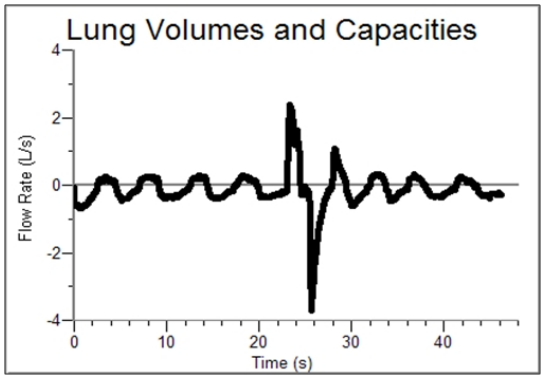

Figure 1 Flow rate data representing regular breathing, a large inhale and exhale, and recovery

Table 1		
Volume measurement	Expected range (L)	Individual (L)
Tidal Volume (TV)	0.4–0.5	1.0
Inspiratory Reserve (IRV)	2.5–3.5	1.3
Expiratory Reserve (ERV)	1.0–2.0	1.3
Vital Capacity (VC)	4.5–6.0	3.6
Residual Volume (RV)	≈1.5	≈1.5
Total Lung Capacity (TLC)	5.0–7.0	5.1

ANSWERS TO THE DATA ANALYSIS QUESTIONS

1. Tidal volume answers will vary. If the right mainstem bronchus was totally obstructed, the TV would be reduced by approximately half.

2. Data should reveal that males have larger lung capacities than females. On average, male lungs are larger than female lungs, even when controlling for height.

3. Answers will vary. Using the sample data provided:

   Minute Ventilation = (0.5 L)(18 breaths/ minute) = 9 L/minute

   If the tidal volume is 0.2 L, use the following equation to solve for respiratory rate:

   (0.2 L)(x) = 9 L/minute

   x = 45 breaths/minute

4. Total lung capacity and vital capacity are both reduced in conditions that result in an increase in stiffness or recoil of the lungs.

5. Total lung capacity and vital capacity are both increased in severe emphysema, where a loss of lung tissue leads to a reduction in stiffness and recoil.

6. Expiratory reserve volume is dependent on passive forces acting to compress the chest. When immersed in water there is a greater pressure exerted on the chest, causing a slightly greater expulsion of air with each exhalation. The expiratory reserve volume is reduced.

