

Spirometry

OBJECTIVE/RATIONALE

Respiration is the process that allows for the exchange of oxygen and carbon dioxide. The student will identify terms associated with respiratory function by measuring respiratory volumes.

TEKS 121.13 (c) 8A, 8B

TAKS ELA 1, 5
Mathematics 4, 8, 10
Science 1, 2

National Science Education Standards A9-12; C9-12; F9-12; G9-12

National Health Care Skills Standards .01, .02, .03, .04, .05, .06, .07

National Curriculum Standards for School Mathematics S1; S3

KEY POINTS

- I. Respiration
 - a. External Respiration - Gas exchange between blood and alveoli.
 - b. Internal Respiration - Gas exchange between blood and tissue cells.

- II. Pulmonary Ventilation - air movement into and out of lungs.
 - a. Inspiration - Diaphragm and intercostal muscles contract resulting in increased volume and decreased pressure in the thoracic cavity; air rushes in.
 - b. Expiration - Diaphragm and intercostal muscles relax resulting in decreased volume and increased pressure in the thoracic cavity; air pushed out.

- III. Respiratory Volumes
 - a. Tidal Volume - normal amount of air inhaled or exhaled.
 - b. Inspiratory Reserve Volume - amount of air that can be forcefully inhaled after normal inhalation.
 - c. Expiratory Reserve Volume - amount of air that can be forcefully exhaled after normal exhalation.
 - d. Vital Capacity - maximum amount of air that can be exhaled after maximum inhalation.
 - e. Residual Volume - amount of air left in lungs after forced exhalation.

- IV. Factors Altering Normal Function:
 - a. Diseases
 - b. Disorders
 - c. Pollutants in environment
 - d. Trauma

ACTIVITIES

I. Complete the Spirometry Lab Investigation.

MATERIALS / RESOURCES

Wet Spirometer - Sargent Welch #WL26007 phone # 1-800-727-4368

Mouthpieces - Sargent Welch #WL26009

*Teacher note: invite a respiratory therapist to explain respiratory volumes and with the laboratory investigation.

ASSESSMENT

Laboratory Investigation Rubric

ACCOMMODATIONS

For reinforcement, the student will design a collage of behaviors that affect normal respiratory function.

For enrichment, the student will analyze a case study of disease or disorder that alter respiratory function.

REFLECTIONS

SPIROMETERY LABORATORY INVESTIGATION

Purpose:

In this laboratory investigation, the student will identify terms associated with respiratory function by measuring respiratory volumes.

Background Information:

Materials:

Wet Spirometer
Mouthpieces

Procedure:

1. Use a spirameter to measure and calculate the respiratory volumes and capacities listed below.
2. Record results in data table.
3. Repeat twice.
4. Calculate average for 3 attempt.

Data:

Show your results with a graph.

| | Volume I | Volume II | Volume III | Average |
|----------------------------|----------|-----------|------------|---------|
| Tidal volume | | | | |
| Inspiratory Reserve Volume | | | | |
| Expiratory Reserve Volume | | | | |
| Vital Capacity | | | | |
| Residual Volume | | | | |

Conclusion:

1. How did your respiratory volumes and capacities compare to the normal average?

2. What are possible explanations for your deviation from the normal averages?

3. What are some factors that could **negatively** affect respiratory volumes and capacities?

4. What are some factors that could **positively** affect respiratory volumes and capacities?

5. What are some of the consequences of unhealthy behavior related to respiratory functions?

Respiratory Volumes and Capacities

| Measurement | Average Volume | Description |
|----------------------------|---------------------------------|--|
| Tidal Volume | 500 ml | amount of air inhaled or exhaled normally (normal exhalation in spirometer) |
| Inspiratory Reserve Volume | 2100-3100 ml | amount of air that can be forcefully inhaled after normal inhalation (force air in, breath out normally into spirometer, subtract tidal volume from #) |
| Expiratory Reserve Volume | 1000-1200 ml | amount of air that can forcefully exhaled after normal exhalation (normal breath, force exhalation into spirometer) |
| Vital Capacity | 4800 ml | maximum amount of air that can be exhaled after max. inhalation $VC=TV+IRV+ERV$ |
| Residual Volume | 900 ml females 1200 ml males | amount of air left in lungs after forced exhalation. Use average values. |