PhysioEx Lab Report

Exercise 7: Respiratory System Mechanics

Activity 2: Comparative Spirometry

Name: Sophia Mitchell

Date: 3 November 2025

Session ID: session-81304bb1-6485-22cd-8ac4-3d516f15defb

Pre-lab Quiz Results

You scored 100% by answering 5 out of 5 questions correctly.

1. A normal resting tidal volume is expected to be around

   You correctly answered: 500 ml.

2. Which respiratory process is impaired the most by emphysema?

   You correctly answered: expiration.

3. During an asthma attack

   You correctly answered: inspiration and expiration are impaired.

4. During moderate aerobic exercise, which respiratory variable increases the most?

   You correctly answered: tidal volume.

5. Inhaler medications for an asthma patient are designed to

   You correctly answered: dilate the patient's bronchioles.

Experiment Results

Predict Questions

1. Predict Question 1: With emphysema, there is a significant loss of elastic recoil in the lung tissue and a noticeable, exhausting muscular effort is required for each expiration. Inspiration actually becomes easier because the lung is now overly compliant.

   Using the spirogram, calculate the lung value most affected by the emphysema condition.

   Your answer: FEV_1.

2. Predict Question 2: During an acute asthma attack, airway resistance is significantly increased by (1) increased thick mucous secretions and (2) airway smooth muscle spasms.

To which lung value in the spirogram would you see the greatest change in a patient suffering from an acute asthma attack?

Your answer: FEV_1.

3 Predict Question 3: When an acute asthma attack occurs, many people seek relief from the increased airway resistance by using an inhaler. This device atomizes the medication and induces bronchiole dilation (though it can also contain an anti-inflammatory agent).

Which lung value remained relatively unchanged when comparing a patient with an acute asthma attack, acute asthma attack with inhaler, and normal?

Your answer: RV.

4 Predict Question 4: During moderate aerobic exercise, the human body will change its respiratory cycle in order to meet increased metabolic demands. During heavy exercise, further changes in respiration are required to meet the extreme metabolic demands of the body.

Which lung value will change more during moderate exercise, the ERV or the IRV?

Your answer: IRV.

Stop & Think Questions

1 When obstructive lung disease develops, what happens to the FEV_1 (%)?

You correctly answered: It decreases.

2 Compared with the normal patient, what happened to the FVC in this patient?

You correctly answered: It decreased.

3 Compared with the normal patient, what happened to the FEV_1 in this patient?

You correctly answered: It decreased.

4 Compared with the normal patient, what happened to the FVC in this patient?

You correctly answered: It decreased.

5 Compared with the normal patient, what happened to the FEV_1 in this patient?

You correctly answered: It decreased.

6 Which value in the spirogram never changed from that of the normal patient?

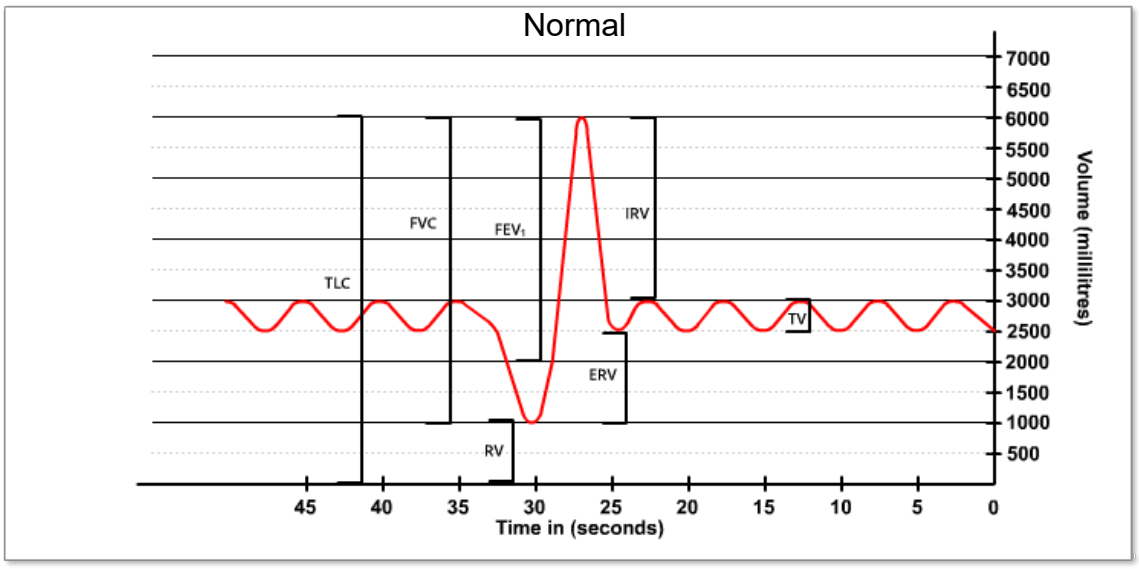
You correctly answered: TLC.

7 For both types of exercise, the tidal volumes and breathing rates were increased. Compared with normal values, did tidal volume or breathing rate increase more during moderate exercise? (Determine the percentage by which each value changed.)

You correctly answered: tidal volume.

Experiment Data

Patient Type	TV	ERV	IRV	RV	FVC	TLC	FEV_1	FEV_1(%)
Heavy Exercise	3650	750	600	1000	ND	6000	ND	ND
Moderate Exercise	1875	1125	2000	1000	ND	6000	ND	ND
Asthma Attack Plus Inhaler	500	1500	2800	1200	4800	6000	3840	80%
Acute Asthma Attack	300	750	2700	2250	3750	6000	1500	40%
Emphysema	500	750	2000	2750	3250	6000	1625	50%
Normal	500	1500	3000	1000	5000	6000	4000	80%

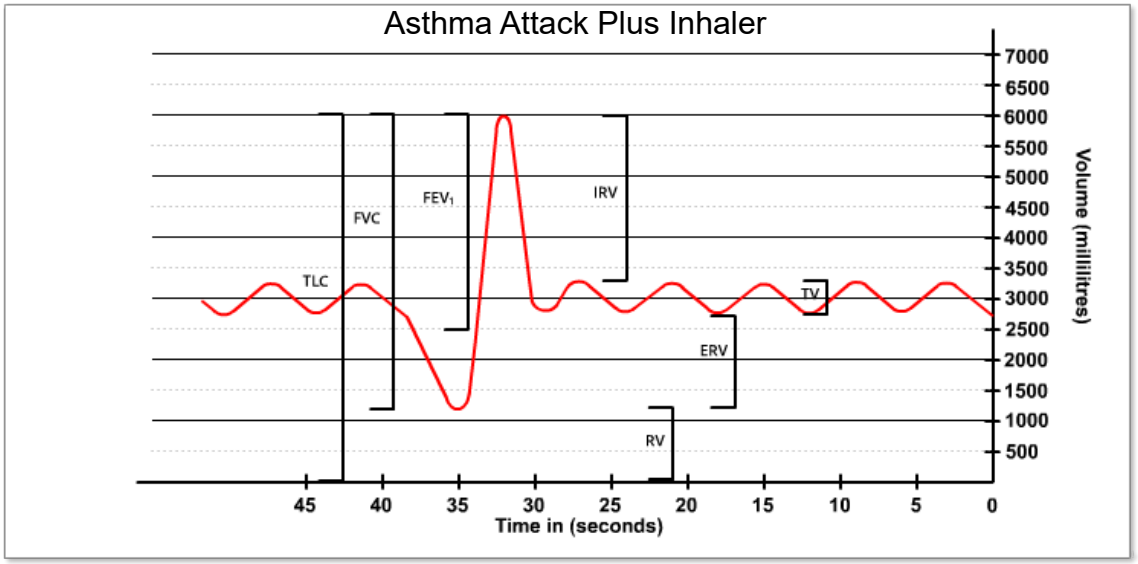


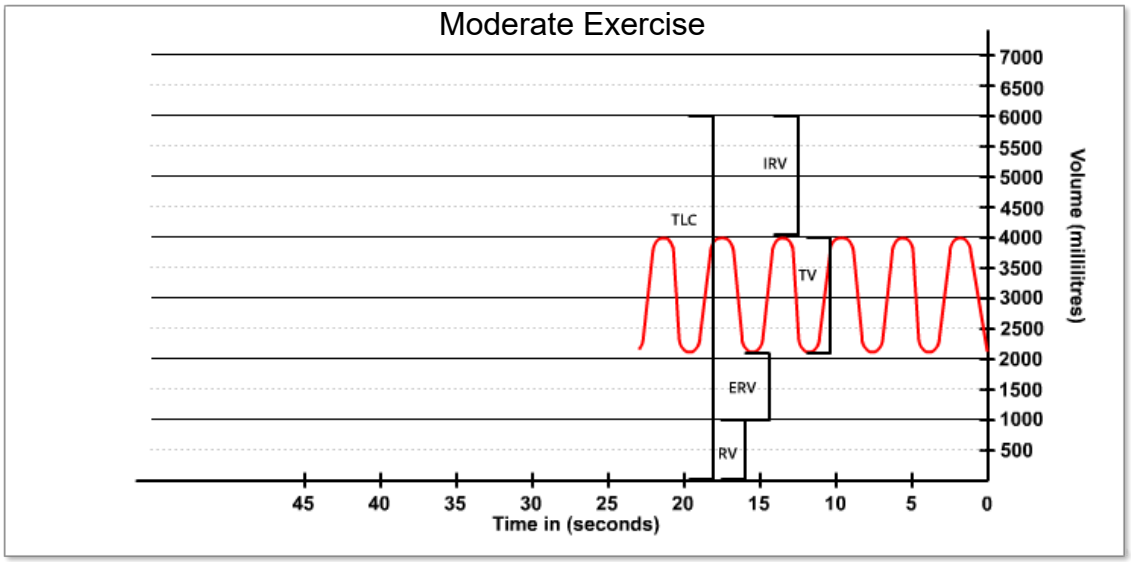
Emphysema

The spirometer shows a saw-like function with steep increase periods and gradual decrease periods oscillating between the values of LOWER VALUE = 3500 and GREATER VALUE = 4000 milliliters, performing 1 full oscillation per approximately 10 seconds. Then The air was forcefully inspired and then expired, which made one oscillation raise its maximum to 6000 milliliters and lower its minimum to 2750 milliliters.

Acute Asthma Attack

The spirometer shows a sine-like function oscillating between the values of lower value = 3000 and greater value = 3500 milliliters, performing 1 full oscillation per approximately 10 seconds. Then The air was forcefully inspired and then expired, which made one oscillation raise its maximum to 6000 milliliters and lower its minimum to 2250 milliliters.





The spirometer shows a sine-like function oscillating between the values of lower value = 1750 and greater value = 5400 milliliters, performing 1 full oscillation per approximately 1.5 seconds.

Heavy Exercise

Post-lab Quiz Results

You scored 100% by answering 5 out of 5 questions correctly.

1 Which of the following respiratory values represents a decreased *flow rate* during the obstructive lung disease(s)?

You correctly answered: FEV_1.

2 Calculate the ERV of an individual with the following respiratory volumes: TLC = 6000 ml, FVC = 4800 ml, RV = 1200 ml, IRV = 2900 ml, TV = 500 ml.

You correctly answered: 1400 ml.

3 Calculate the FVC of an individual with the following respiratory volumes: RV = 1000 ml, IRV = 3000 ml, TV = 500 ml, ERV = 1500 ml.

You correctly answered: 5000 ml.

4 What is the largest volume for the normal patient?

You correctly answered: IRV.

5 What happened to the RV for the emphysema patient and the asthmatic patient?

You correctly answered: It decreased for both patients.

Review Sheet Results

1 What lung values changed (from those of the normal patient) in the spirogram when the patient with emphysema was selected? Why did these values change as they did? How well did the results compare with your prediction?

Your answer:

ERV, IRV, RV, FVC, FEV1, FEV% values changed as the lungs had increased difficulty with deflating fully.

2 Which of these two parameters changed more for the patient with emphysema, the FVC o the FEV_1?

Your answer:

FEV1.

3 What lung values changed (from those of the normal patient) in the spirogram when the patient experiencing an acute asthma attack was selected? Why did these values change as they did? How well did the results compare with your prediction?

Your answer:

TV, ERV, IRV, RV, FVC, FEV1, FEV% changed because the airway was obstructed.

4 How is having an acute asthma attack similar to having emphysema? How is it different?

Your answer:

They are similar as they cause an obstruction in the lungs and there is less elastic recoil when the lungs expand and fill with air. It is more difficult for someone with emphysema to exhale compared to someone with asthma.

5 Describe the effect that the inhaler medication had on the asthmatic patient. Did all spirogram values return to "normal"? Why do you think some values did not return all the way to normal? How well did the results compare with your prediction?

Your answer:

The inhaler caused the TV, ERV, FEV% to return to normal but due to mucus blocking the airway my prediction was incorrect.

6 How much of an increase in FEV_1 do you think is required for it to be considered significantly improved by the medication?

Your answer:

20-25% would be enough.

7 With moderate aerobic exercise, which changed more from normal breathing, the ERV or the IRV? How well did the results compare with your prediction?

Your answer:

The IRV changed the most.

8 Compare the breathing rates during normal breathing, moderate exercise, and heavy exercise.

Your answer:

The breathing rate increased with moderate and heavy exercise, a greater increase in breathing was seen in heavy exercise.