SI A&P - Full Discipline Demo - Fetal Pig

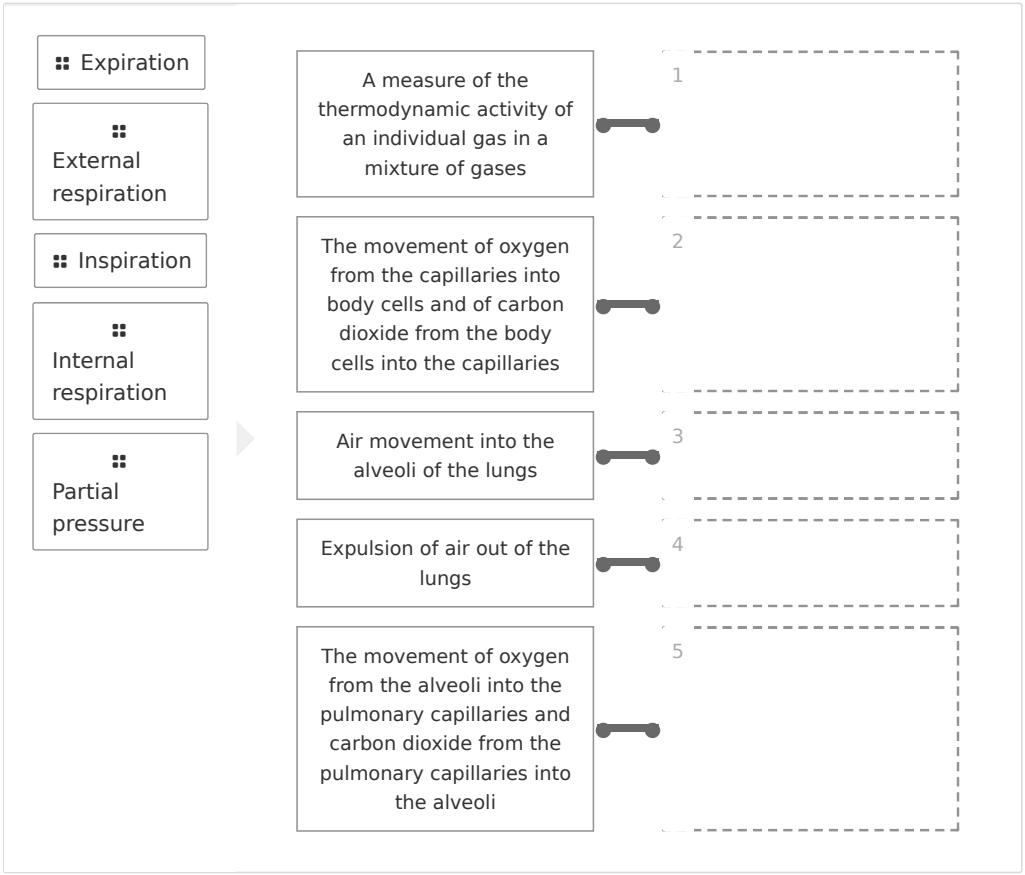
Physiology of the Respiratory System

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI A&P - Full Discipline Demo - Fetal Pig
Course	SI A&P - Full Discipline Demo - Fetal Pig
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best description.

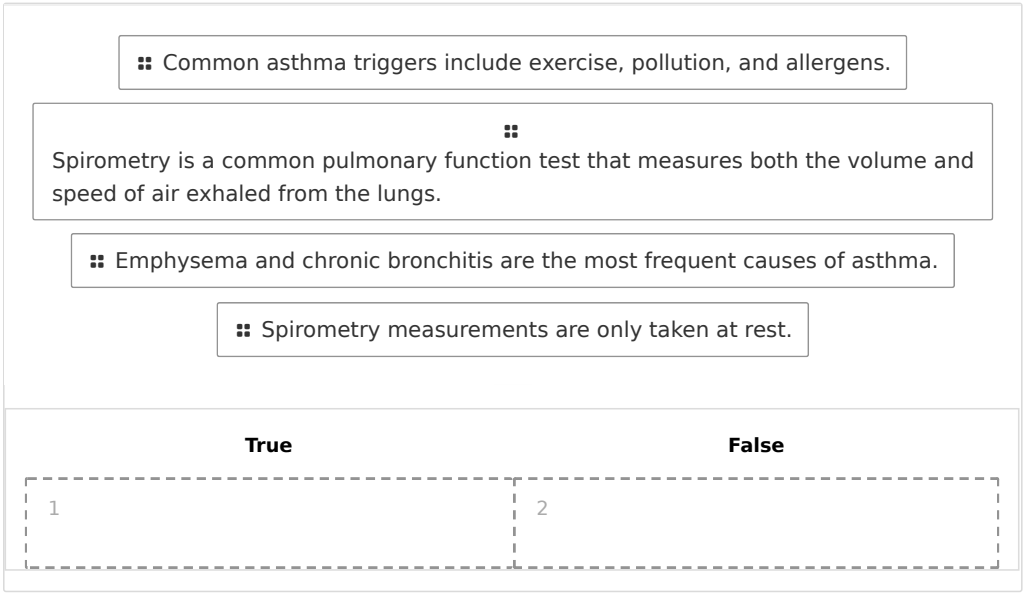


Correct answers:

1 Partial pressure 2 Internal respiration 3 Inspiration 4 Expiration

5 External respiration

Categorize each statement as true or false.



Correct answers:

1 Common asthma triggers include exercise, pollution, and allergens.

Spirometry is a common pulmonary function test that measures both the volume and speed of air exhaled from the lungs.

2

Emphysema and chronic bronchitis are the most frequent causes of asthma.

Spirometry measurements are only taken at rest.

Exploration

Gases inherently diffuse from areas of a high partial pressure to areas of low partial pressure.

- True ✔
- False

____ is an umbrella term for any progressive, chronic respiratory disease.

- Asthma
- Bronchitis
- Emphysema
- COPD ✔

The _____ represents the percentage of the patient's lung capacity they are able to exhale in one second.

- tidal volume
- minute ventilation
- FEV_1/FVC ratio ✔
- forced vital capacity

Exercise 1

Explain how the balloon, bottle, and swim cap used in this exercise functioned like structures in the respiratory system.

The balloon functioned as a lung. Like a lung, the balloon is expandable allowing for the air to move into and out of the system. The bottle functioned as the pleural cavity. Like the pleural cavity, the bottle formed a rigid space provided structure for the system. The swim cap functioned as a diaphragm. Contraction of the swim cap created more space in the cavity allowing for an influx of air, just like the diaphragm in the pleural cavity of the human body.

How were changes in pressure observed in the model used in this exercise? Reference Panel 1 and explain inspiration and expiration in your answer.

Changes in pressure were observed by the inflation and deflation of the balloon as the swim cap was pulled down and then released as recorded in Panel 1. Pressure decreased inside the bottle when the swim cap was pulled down resulting in air flowing into the balloon. Pressure of air inside the bottle increased when the swim cap was release causing air to flow out of the cavity.

A respiratory cycle begins when the diaphragm contracts, creating more space in the pleural cavity for the lungs to expand and lowering the intrapleural pressure. Air moves into the alveoli of the lungs from the comparatively higher pressure of the external environment into the region of lower pressure inside the lungs, a process called inspiration (also referred to as inhalation). When the diaphragm relaxes, the intrapulmonary pressure increases, forcing the lungs to deflate and reversing the pressure differential between the lungs and the external environment, resulting in the expulsion of the air out of the lungs, a process called expiration (also referred to as exhalation).

What do the results of puncturing a hole in the bottle suggest about the importance of pressure for the movement of air in the human respiratory circuit? Reference Panel 2 in your explanation.

The hole in the bottle resulted in no net movement of air into or out of the balloon when the swim cap was pulled and released as recorded in Panel 2. The results suggest that without an intact pleural cavity, the movement of air into and out of the lungs would not be possible and therefore the respiratory circuit would not function properly.

Photo 1: Completed Respiratory Model
(SAMPLE ANSWER BELOW)

Panel 1: Balloon Observations with Intact Model

(SAMPLE ANSWER BELOW)

The balloon inflated slightly as the swim cap was pulled downwards.

Photo 2: Punctured Respiratory Model

(SAMPLE ANSWER BELOW)

Panel 2: Balloon Observations with Punctured Model

(SAMPLE ANSWER BELOW)

The balloon inside the bottle did not change size when the swim cap was pulled down.

Exercise 2

How are FVC and FEV_1 values impacted by exercise in healthy individuals? Include the definition for each value in your explanation.

FVC and FEV_1 remain relatively unchanged after exercise in healthy individuals. The FVC is the amount of air a patient can forcibly breathe out after breathing in as deeply as possible, and the FEV_1 is the amount of air a patient can force out of their lungs in one second. From the values obtained through the forced expiratory volume measurements, predictions can be made for the volume of air that the lungs can maximally hold.

How is asthma detected from the results of spirometry testing? Which of the four patient graphs indicated symptoms of asthma?

Asthma results in bronchoconstriction in response to a trigger, such as exercise. Spirometry results post-exercise that indicate reduced lung volume and air flow compared to results pre-exercise that appear normal suggest the patient is suffering from asthma. Patient 2 in this exercise produced graphs consistent with asthma.

How is COPD detected from the results of spirometry testing? Which of the four patient graphs indicated symptoms of COPD?

COPD includes conditions such as chronic bronchitis and emphysema that result in reduced pulmonary function both pre and post exercise in the absence of triggers. Unlike asthma, COPD symptoms do not improve with the administration of a bronchodilator. Patient C testing results are indicative of COPD.

Data Table 1: Patient A Spirometry Data
(SAMPLE ANSWER BELOW)

Measurement	Predicted Values	Resting Value	Exercise Value
FVC	4.93-5.91	5.319	5.012
FEV_1	4.88	4.63	4.02
FEV_1/FVC	83.3%	87%	80.2%

Panel 3: Patient A Spirometry Graph Interpretation
(SAMPLE ANSWER BELOW)

Both spirometry graphs display normal curves for pre and post exercise lung pulmonary function.

Data Table 2: Patient B Spirometry Data
(SAMPLE ANSWER BELOW)

Measurement	Predicted Values	Resting Value	Exercise Value
FVC	2.16-2.74	2.69	2.48
FEV_1	2.45	2.48	0.86
FEV_1/FVC	89.7%	92.3%	34.7%

Panel 4: Patient B Spirometry Graph Interpretation
(SAMPLE ANSWER BELOW)

Spirometry graphs before exercise displays a normal curve, but spirometry graphs after exercise has a smaller peak and a much more convex curve indicating reduced pulmonary function.

Data Table 3: Patient C Spirometry Data
(SAMPLE ANSWER BELOW)

Measurement	Predicted Values	Resting Value	Exercise Value
FVC	2.52-3.17	2.02	2.06
FEV_1	2.47	1.06	1.09
FEV_1/FVC	78.9%	52.5%	52.3%

Panel 5: Patient C Spirometry Graph Interpretation
(SAMPLE ANSWER BELOW)

Both spirometry graphs display a low peak and a convex curve pre and post inhaler application.

Data Table 4: Patient D Spirometry Data
(SAMPLE ANSWER BELOW)

Measurement	Predicted Values	Resting Value	Exercise Value
FVC	2.29-2.97	2.89	2.82
FEV_1	2.68	2.48	2.40
FEV_1/FVC	88.6%	85.8%	85.1%

Panel 6: Patient D Spirometry Graph Interpretation
(SAMPLE ANSWER BELOW)

Both spirometry graphs display a normal curve for pre and post exercise pulmonary function.

Competency Review

Partial pressure is determined by the _____.

- moles of gas
- container volume
- temperature
- All of the above ✔

_____ is the process of moving air out of the lungs.

- Internal respiration
- Inspiration
- Expiration ✔
- Inhalation

Symptoms of asthma are not present at all times.

- True ✔
- False

Symptoms of asthma include _____.

- shortness of breath
- coughing
- wheezing
- All of the above ✔

Spirometry measurements are typically taken at rest and immediately after exercise.

- True ✔
- False

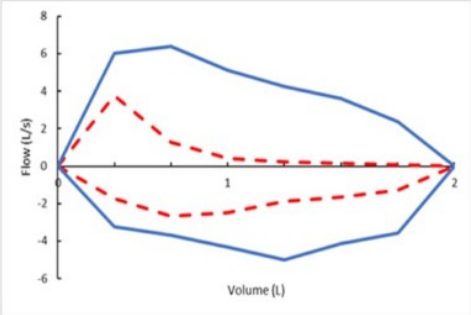
A FEV_1/FVC ratio that is lower than _____% indicates a blockage of the airway.

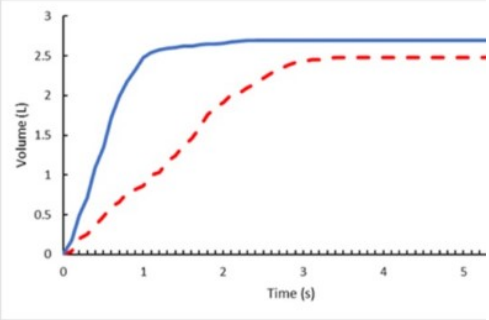
- 100
- 70 ✔
- 50
- 30

When modeling the pleural cavity with a plastic bottle, balloon, and swim cap, the swim cap functions as the ____.

- lungs
- heart
- diaphragm ✔
- ribs

The spirometry data and graphs below are indicative of a healthy patient.





	Predicted Values	Resting Value	Exercise Value
FVC	2.16-2.74	2.69	2.48
FEV_1	2.45	2.48	0.86
FEV_1/FVC	89.7%	92.3%	34.7%

- True
- False ✔

Extension Questions

Patients should avoid eating a large meal 2 hours prior to performing a spirometry test. Apply your knowledge of the respiratory cycle and spirometry testing to explain how an overextended stomach could influence spirometry test results. (SAMPLE ANSWER BELOW)

An overextended stomach would leave little room for the diaphragm to contract, which would limit how much the pleural cavity could expand to allow for proper inhalation/inflation of the lungs. Results of a spirometry test would likely indicate lower than actual air volume readings.