Follow the Air

Model how changing pressure moves air through the lungs

HAP.9.b "Use a model to illustrate how pressure gradients move air into and out of the lungs."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the changes in lung volume, circle the comparisons of inside and outside pressure, and number the two airflow directions in the order they occur. Use your marks to trace how a volume change leads to airflow.

Why Air Moves

1. A model of breathing can begin with two spaces: the air inside the lungs and the air outside the body. An open airway connects them. Air moves through that airway from higher pressure to lower pressure, not because the lungs pull on individual air molecules. Pressure is the push made by air molecules striking surfaces. In this model, the chest cavity is a container whose size can change. The lungs follow changes in chest size because their surfaces are coupled to the chest wall by thin layers of fluid and tissue. That connection helps a change in chest size become a change in lung size.

2. When the diaphragm contracts, it flattens and moves downward. Muscles between the ribs can also lift the rib cage up and out. These movements enlarge the chest cavity, and the lungs expand with it. As lung volume increases, pressure inside the lungs falls below outside air pressure. A model should show an arrow from outside air through the open airway into the lungs. This phase is inhalation. As air enters, lung pressure rises toward outside pressure. When the two pressures match, there is no pressure-driven flow, even though the lungs still contain air.

3. During quiet exhalation, the diaphragm relaxes and rises, while the rib cage settles down and inward. Elastic tissues in the lungs recoil, making lung volume smaller. The same air now occupies less space, so pressure inside the lungs becomes greater than outside air pressure. A model should reverse the arrow: air travels from the lungs through the airway to the outside. As air leaves, inside pressure falls toward outside pressure until the pressures match again. The diaphragm does not push air through the airway directly. Its movement changes volume, which changes pressure, which sets the direction of airflow.

2 ANSWER WITH EVIDENCE

Use the passage

1. In a model, the rib cage moves up and out while the diaphragm moves down. Compare pressure inside and outside the lungs, then state which way to draw the airflow arrow.

2. The diaphragm relaxes after a breath. Trace the changes in lung volume and pressure that determine the airflow arrow's direction.

3. A model shows outside pressure at 100 pressure units and lung pressure at 98 pressure units. Which way does air move through an open airway, and what must happen to the pressure difference for that flow to stop?

4. A model shows lung pressure at 103 pressure units and outside pressure at 100 pressure units. Does this fit a diaphragm moving down to expand the lungs? Explain using volume and airflow.

3 YOUR TURN

Your own words

A classmate claims, “The diaphragm pushes outside air straight into the lungs.” Make a two-panel model that corrects this claim: show the instant before inhalation and a moment during inhalation. Label diaphragm position, lung volume, inside and outside pressure, and airflow arrows, then add one sentence explaining the correction.

ANSWER KEY

Follow the Air

HIGH SCHOOL · HAP.9.b

PART 1 · READ AND MARK

Underline the changes in lung volume, circle the comparisons of inside and outside pressure, and number the two airflow directions in the order they occur. Use your marks to trace how a volume change leads to airflow. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In a model, the rib cage moves up and out while the diaphragm moves down. Compare pressure inside and outside the lungs, then state which way to draw the airflow arrow.	**Lung volume increases, so inside pressure falls below outside pressure. Draw the arrow from outside air into the lungs.**
2	The diaphragm relaxes after a breath. Trace the changes in lung volume and pressure that determine the airflow arrow's direction.	**Lung volume decreases, raising inside pressure above outside pressure. The arrow points from the lungs to the outside.**
3	A model shows outside pressure at 100 pressure units and lung pressure at 98 pressure units. Which way does air move through an open airway, and what must happen to the pressure difference for that flow to stop?	**Air moves into the lungs. Flow stops when inside pressure rises to match outside pressure.**
4	A model shows lung pressure at 103 pressure units and outside pressure at 100 pressure units. Does this fit a diaphragm moving down to expand the lungs? Explain using volume and airflow.	**No. Expanding lungs would lower inside pressure below outside pressure. The higher inside pressure fits decreasing lung volume and air flowing out.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1, before inhalation: Diaphragm relaxed and domed; lung volume smaller; inside pressure = outside pressure; no airflow arrow. Panel 2, during inhalation: Diaphragm contracted, flatter, and lower; lung volume larger; inside pressure < outside pressure; arrow from outside air into lungs. The diaphragm enlarges the chest and lungs, lowering lung pressure so outside air flows in.

Accept arrows or words that correctly show air moving from higher to lower pressure through an open airway. In the two-panel model, the pressures should be equal before inhalation and lower inside the lungs during inhalation.