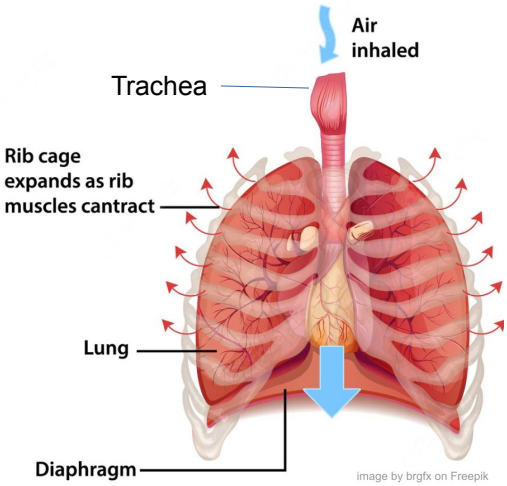
Lungs and Breathing

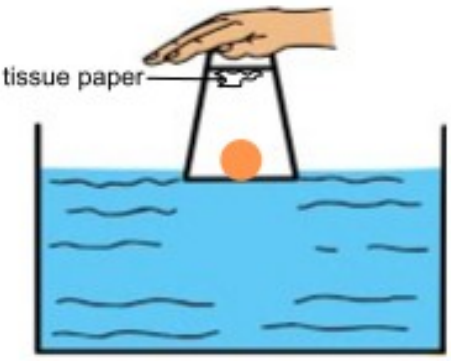
- You need to breathe air to keep help your body keep metabolizing food molecules into energy.
- Gasses like air take up space (**volume**). They exert **pressure** pushing outward on their containers
- Air moves from a high pressure zone to a low pressure zone.
- The diaphragm is a muscle that expands the volume in your chest. This decreases the pressure around your lungs, making air rush in through your trachea



Part 1: Air Takes up Space

1. Float a ping-pong ball in a tall container of water.

2. Tape a piece of tissue to the inside bottom of a cup (with no hole). Make sure it does not hang down far off the surface when the glass is turned upside-down.



3. Predict what will happen when you put the cup upside-down over the ping-pong ball and push down.
Will the ball:
(a) stay at the same height? (b) move up?
(c) move down?

Will the tissue touch the ball? Yes / No
Will the ball end up immersed in water? Yes / No

4. Try the experiment! Bring the cup down directly over the ball, open end facing down.

Does the paper inside the cup get wet? Yes / No
What is inside the cup before the experiment? _____
What is inside the cup as you are pushing it down? _____
Discuss: What happens to the ping-pong ball and why?

Air takes up space and does not allow (much) water into the cup

Part 2: Air Exerts Pressure

1. Plug the tip of a syringe with your finger. Try decreasing the volume in the syringe by pressing down the plunger.

What do you feel?

Higher pressure in syringe, pushing out OR Lower pressure in syringe, sucking in

Discuss: what is pushing back on the plunger?

2. Keep the syringe plugged and try increasing the volume by pulling out the plunger.

What do you feel?

Higher pressure in syringe, pushing out OR Lower pressure in syringe, sucking in

Discuss: what forces are acting on the plunger? Why does it try to move back in?

When air is compressed into a smaller volume, the pressure increases. When it expands to fill a bigger volume, the pressure decreases. There is still pressure from the outside air pushing back on the plunger.

3. Repeat your experiment with the ping-pong ball. Look carefully at the water level inside the cup.

Does the volume of air in the cup change as you push it down?

Volume decreases volume increases volume stays same

What does this mean about the air pressure in the cup?

Pressure is higher pressure is lower pressure is same

Discuss: Can you feel this change in pressure? Do you feel the cup pushing back against your hand?

Part 3: Model Lung

1. Attach two small balloons to the 2 bottom tips of the Y-connector. Use rubber bands to make sure they are secure.

What do the balloons represent?

Trachea Lungs Diaphragm chest cavity

2. Attach a tube to the top end of the Y-connector.

What does the tube represent?

Trachea Lungs Diaphragm chest cavity

3. Place the Y-connector and balloons into the cup with a hole in the bottom. Push the tube through the hole in the cup. You may need to use scissors to widen the hole.

What does the up represent?

Trachea Lungs Diaphragm Rib-cage

4. Cut the top end off a balloon.

5. Stretch the cut balloon over the open bottom of the cup.

What does the large balloon represent?

Trachea Lungs Diaphragm Rib-cage

4. Make a prediction:

What do you think will happen when you pull the balloon membrane downward out of the cup? What if you push upward into the cup?

Try it and see if you were right!

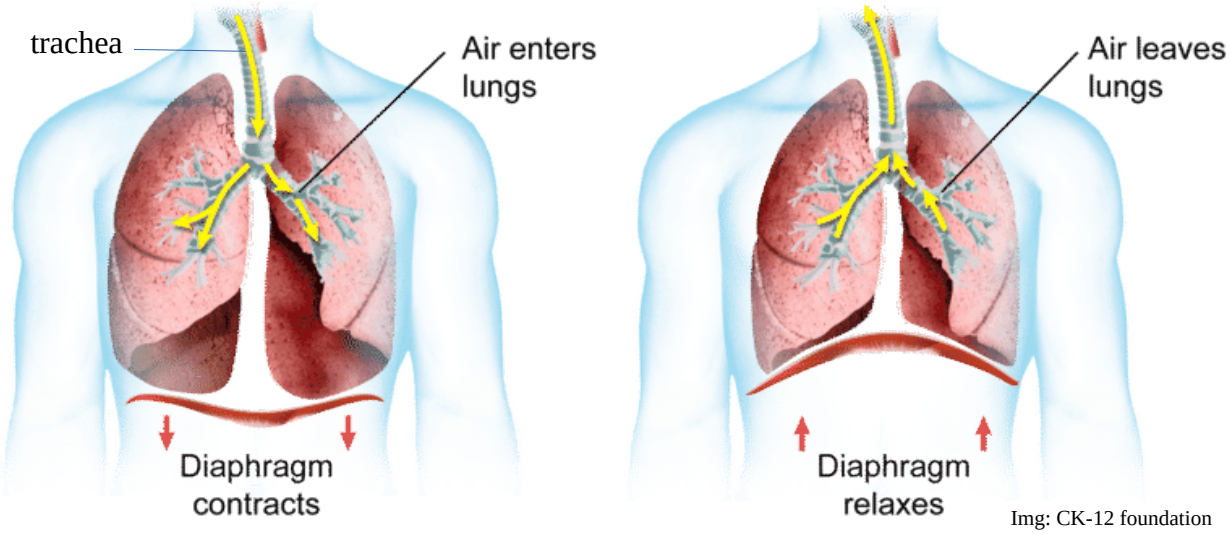
What happens to the volume inside the cup when you pull out on the balloon? Does it:

increase decrease remain the same

What happens to the air pressure inside the cup when you pull out on the balloon? Does it: increase decrease remain the same

Where does the extra air in the balloon come from? _____

Your lungs work in the same way as your model. The diaphragm is a muscle below your lungs. When it is pulled down, the lungs increase their volume and inflate like a balloon. This makes air enter into the lungs from outside --- you breathe in!



Img: CK-12 foundation