THE EFFECTS OF VAPING/SMOKING ON THE LUNGS

STEAM Activity

The American Heart Association recognizes the importance of building healthy bodies and minds. This lesson is an introduction into combined concepts of Science, Technology, Engineering, Art and Math; better known as STEAM.

Objective:

Students will explore the effects of smoking/vaping on pulmonary (lung) health by simulating the progression of changes in lung volume.

As the student(s) blows up the balloon repeatedly, the balloon will lose elasticity, mimicking changes in lung function and structure, caused by inhalation of matter outside of normal ambient air.

Materials Needed:

- Balloon
- 5 rubber bands
- Ruler
- String ~3 feet long
- Tape
- Pen

Resources:

- [The Facts About Nicotine and Tobacco Use](#)
- [Stay Safe from Vaping & Tobacco](#)
- [Avoid Vaping Worksheets](#)
- [Student Resources and Activities](#)

Instructions:

1. Learn about **what's in an e-cigarette** and the **effects of vaping**.

- You probably know about the relationship between smoking and lung cancer, but did you know smoking is also linked to heart disease, stroke and other chronic diseases? **Watch how blood flows through your heart and lungs.**

- Review the vocabulary below.

2. Complete the activity. We recommend working on pairs or in a small group, but do not share balloons. Have 1 balloon for each person and determine who will be the blower of the balloon.

3. Host a class discussion using the suggested questions on the right.

Post Activity Group Discussion:

- Why do you think you need to pinch your nose shut while blowing air out?

- Did your vital capacity change after each rubber band? What do you think that represents?

- Did your effort to blow into the balloon change after each rubber band?

- Did you notice the difference between having ALL of the rubber bands on and ALL of them off? Why do you think smokers don't notice the difference in their lungs over many years of smoking?

- How did the starting residual volume compare to the ending residual volume? Why do you think it changed?

- When you added the rubber bands to the balloon each time, what disorder that can result from toxins in smoking or vaping did the extra resistance represent?

Vocabulary:

Alveoli: tiny air sacs in your lungs that expand to take up the oxygen you breathe in and move the oxygen into your blood.

Elasticity: how stretchable a substance is and still recoil or spring back or snap back like a rubber band returning to its original size.

Vital capacity: the maximum volume you can move by breathing completely in then completely out. This is the amount of air you can breathe to keep you alive.

Residual volume: the amount of air that you can never get out of your lungs.

This helps keep your lungs from collapsing.

Tidal volume: volume of a normal, relaxed breath. Normal tidal volume is around 500ml, but the size or age of a person can make that vary. You can calculate your predicted tidal volume by multiplying your weight by 10 then enter it in the 'calculated tidal volume' by the graph on the activity page.

Fibrosis: inhaled toxins can cause scarring and thickening of the tissue around and between the air sacs (alveoli) in the lungs. These changes make it harder to expand the lung volume and for oxygen to pass into the bloodstream
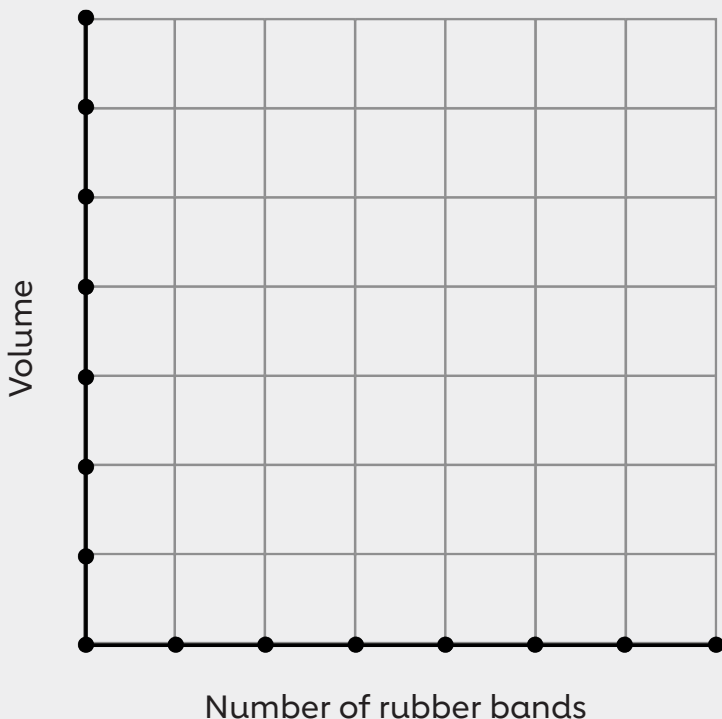
Smoking's Effects on Your Lungs

Student Name:_____ Class:_____ Date:_____

1. Put enough air in the balloon so that it takes a round shape (do not force the balloon). *This is your starting residual volume.*

2. Measure the circumference of the balloon using the string and ruler and use the equation to find the volume of the balloon. Volume = $(4/3) \times \pi \times r^3$
    This will also be your 'baseline volume' for all future measurements. Record your volume at the bottom of the page.
    *   [Sphere Volume Calculator (omnicalculator.com)](omnicalculator.com)

3. Deflate the balloon. Calculate the volume of the balloon then subtract your baseline volume, this result is your measured tidal volume. Record it at the bottom of the page. If you accidentally let the air out of the balloon, make sure the balloon has that same roundness as step one above before proceeding to the next steps.

4. Return the balloon to the starting roundness. This time you will measure only one full breath. Take the deepest breath you can, pinch your nose closed, and blow EVERYTHING you can into the balloon from that one breath until you can't exhale any more. Pinch the balloon shut so that air doesn't come out.

5. Measure the new circumference of the balloon to find the maximum volume, then subtract your baseline volume. This is your vital capacity. Record the volume at the bottom of the page.

6. Deflate the balloon, returning it to baseline roundness.

7. Add one rubber band around the center of the balloon and use a small piece of tape to hold it in place on the balloon. It will be loose until you start blowing up the balloon. Repeat steps 3-6 recording the new vital capacity and adding one more rubber band each time until you have 5 rubber bands around the balloon. It will get harder to blow the balloon up each time but make sure you blow an entire breath into the balloon each time and record each vital capacity volume. Remove all of the rubber bands and repeat steps 2-6.

8. Now repeat step 1 where you will compare the balloon now to the original balloon to see the effects on elasticity with time. *This new volume is your ending residual volume*

    Optional: Create a graph of vital capacity volume as the number of rubber bands change.

Volume

Number of rubber bands

Baseline (residual) volume _____ml

Calculated tidal volume _____ml

Measured tidal volume _____ml

1st Vital capacity _____ml

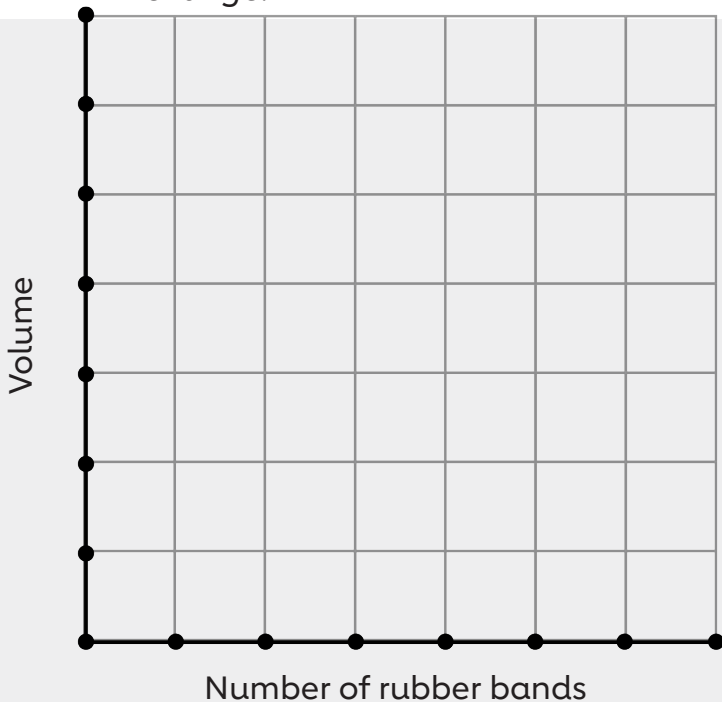2nd Vital capacity _____ml

3rd Vital capacity _____ml

4th Vital capacity _____ml

5th Vital capacity _____ml

Final baseline (ending residual) volume _____ml

Smoking's Effects on Your Lungs

Student Name:_____   Class:_____   Date:_____

1. Put enough air in the balloon so that it takes a round shape (do not force the balloon). *This is your starting residual volume.*
2. Measure the circumference of the balloon using the string and ruler and use the equation to find the volume of the balloon. Volume = $(4/3) \times \pi \times r^3$
This will also be your 'baseline volume' for all future measurements. Record your volume at the bottom of the page.
   - [Sphere Volume Calculator (omnicalculator.com)](omnicalculator.com)
3. Deflate the balloon. Calculate the volume of the balloon then subtract your baseline volume, this result is your measured tidal volume. Record it at the bottom of the page. If you accidentally let the air out of the balloon, make sure the balloon has that same roundness as step one above before proceeding to the next steps.
4. Return the balloon to the starting roundness. This time you will measure only one full breath. Take the deepest breath you can, pinch your nose closed, and blow EVERYTHING you can into the balloon from that one breath until you can't exhale any more. Pinch the balloon shut so that air doesn't come out.
5. Measure the new circumference of the balloon to find the maximum volume, then subtract your baseline volume. This is your vital capacity. Record the volume at the bottom of the page.
6. Deflate the balloon, returning it to baseline roundness.
7. Add one rubber band around the center of the balloon and use a small piece of tape to hold it in place on the balloon. It will be loose until you start blowing up the balloon. Repeat steps 3-6 recording the new vital capacity and adding one more rubber band each time until you have 5 rubber bands around the balloon. It will get harder to blow the balloon up each time but make sure you blow an entire breath into the balloon each time and record each vital capacity volume. Remove all of the rubber bands and repeat steps 2-6.
8. Now repeat step 1 where you will compare the balloon now to the original balloon to see the effects on elasticity with time. *This new volume is your ending residual volume Optional: Create a graph of vital capacity volume as the number of rubber bands change.*

Volume

Number of rubber bands

Baseline (residual) volume _____ml

Calculated tidal volume _____ml

Measured tidal volume _____ml

1st Vital capacity _____ml

2nd Vital capacity _____ml

3rd Vital capacity _____ml

4th Vital capacity _____ml

5th Vital capacity _____ml

Final baseline (ending residual) volume _____ml

Smoking's Effects on Your Lungs

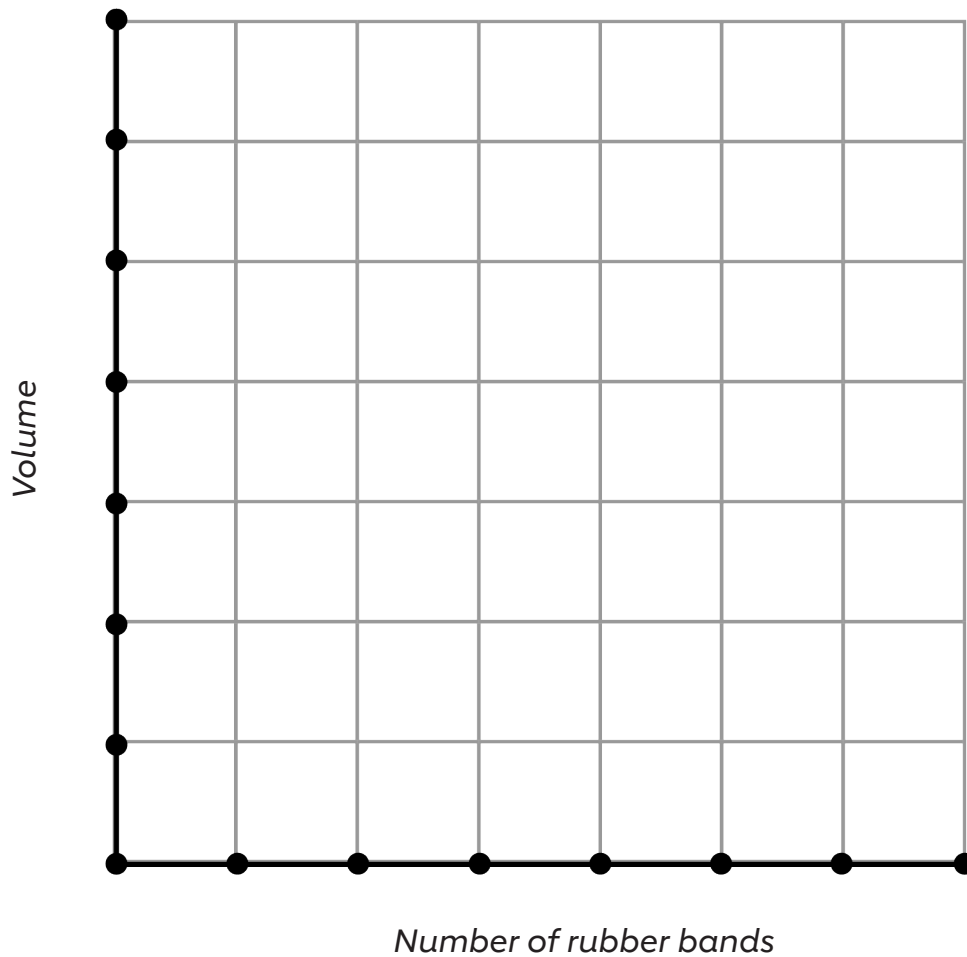Student Name:_____   Class:_____   Date:_____

1. Put enough air in the balloon so that it takes a round shape (do not force the balloon). *This is your starting residual volume.*

2. Measure the circumference of the balloon using the string and ruler and use the equation to find the volume of the balloon. Volume = $(4/3) \times \pi \times r^3$
    This will also be your 'baseline volume' for all future measurements. Record your volume at the bottom of the page.

    - [Sphere Volume Calculator (omnicalculator.com)](omnicalculator.com)

3. Deflate the balloon. Calculate the volume of the balloon then subtract your baseline volume, this result is your measured tidal volume. Record it at the bottom of the page. If you accidentally let the air out of the balloon, make sure the balloon has that same roundness as step one above before proceeding to the next steps.

4. Return the balloon to the starting roundness. This time you will measure only one full breath. Take the deepest breath you can, pinch your nose closed, and blow EVERYTHING you can into the balloon from that one breath until you can't exhale any more. Pinch the balloon shut so that air doesn't come out.

5. Measure the new circumference of the balloon to find the maximum volume, then subtract your baseline volume. This is your vital capacity. Record the volume at the bottom of the page.

6. Deflate the balloon, returning it to baseline roundness.

7. Add one rubber band around the center of the balloon and use a small piece of tape to hold it in place on the balloon. It will be loose until you start blowing up the balloon. Repeat steps 3-6 recording the new vital capacity and adding one more rubber band each time until you have 5 rubber bands around the balloon. It will get harder to blow the balloon up each time but make sure you blow an entire breath into the balloon each time and record each vital capacity volume. Remove all of the rubber bands and repeat steps 2-6.

8. Now repeat step 1 where you will compare the balloon now to the original balloon to see the effects on elasticity with time. *This new volume is your ending residual volume.*

    Optional: Create a graph of vital capacity volume as the number of rubber bands change.

Smoking's Effects on Your Lungs

Student Name:_____   Class:_____   Date:_____

Number of rubber bands

Baseline (residual) volume	_____ml
Calculated tidal volume	_____ml
Measured tidal volume	_____ml
1st Vital capacity	_____ml
2nd Vital capacity	_____ml
3rd Vital capacity	_____ml
4th Vital capacity	_____ml
5th Vital capacity	_____ml
Final baseline (ending residual) volume	_____ml