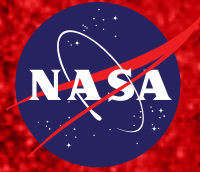


National Aeronautics and  
Space Administration



# Christa's Lost Lessons

Effervescence  
Grade: 5-8

For more of Christa's lessons and  
accompanying videos filmed in orbit,  
visit [www.challenger.org/christa](http://www.challenger.org/christa).

[www.nasa.gov](http://www.nasa.gov)

# Effervescence

## Background Guide



Grade Level:  
**5<sup>th</sup>-8<sup>th</sup>**



Suggested Time:  
**55-60 minutes**



Standards:

- [MS-PS1-2](#): Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- [5-PS1-4](#): Conduct an investigation to determine whether the mixing of two or more substances results in a new substance.
- [CCSS.ELA-LITERACY.RST.6-8.3](#): Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- [CCSS.ELA-LITERACY.RST.9-10.9](#): Compare and contrast findings presented in a text to those from other sources (including their own experiment) noting when the findings support or contradict previous explanations of accounts.

### Key Vocabulary and Background

- **Effervescence**: The presence of bubbles in a liquid; effervescence is produced by both a chemical reaction and physical phenomena
- **Coalesce**: Coming together to form one mass or whole
- **Acid**: Substance that donates hydrogen atoms
- **Base**: Substance that accepts hydrogen ions
- **Chemical Reaction**: Two or more molecules interact and the molecule changes
- **Reaction Rate**: The speed at which a chemical reaction is proceeding (in this case how quickly bubbles form)
- An antacid neutralizes stomach acid and is composed of sodium bicarbonate and citric acid

### Objective

- Show how effervescence happens in microgravity.
- Study how the bubbles formed are affected by the size of the antacid and shaking of the bottle.

### Essential Questions

- What is effervescence and how is it affected by microgravity?
- When added to water, does the size of an antacid tablet affect the amount of bubbles/rate of bubbles produced in the chemical reaction?
- When Earth's gravity is present, how is effervescence affected?

### Materials

- Antacid tablets
- Water (4 oz. per container unless otherwise specified)
- Clear containers with lids
- A timer
- Measuring cups
- A knife (to cut antacid tablet)

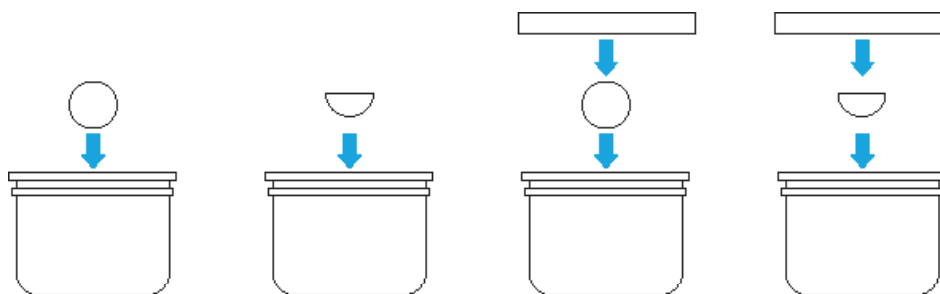
## Teacher Preparation

Make sure that each of the four containers has equal amounts of water, then prepare to perform the experiment with :

- one full antacid tablet in a container without a lid
- one half antacid tablet in a container without a lid
- one full antacid tablet in a container with a lid

- one half antacid tablet in a container with a lid.

Obtain a timer to time the reaction rates of the tablets in each situation. Be sure to pre-cut tablets for students to avoid injury.



## PROCEDURE

### ENGAGE (5 min)

Materials needed: Antacid tablet.

#### Opening Demonstration:

- Hold up the antacid tablet and show it to your classroom.
- Ask students what they think will happen if you drop it into a cup of water.
- What do the students think the tablet is composed of?
- Explain that you are going to learn about something called **effervescence**.

#### Discussion Questions:

- This experiment uses water. How do you think water behaves in microgravity?
- Do you think a can of soda would fizz the same way in microgravity as it does on Earth?
- If you opened a can of soda (or something else that fizzes) in microgravity, where would the bubbles go? How do you think they would behave?

## EXPLORE (5 min)

Materials needed: Effervescence video: [Find at www.challenger.org/Christa](http://www.challenger.org/Christa); attached handouts.

### Video Viewing:

- At this time, show the designated video with the Effervescence lesson.
- Students should take notes on the video using the handout on page six.

## EXPLAIN (35 min)

Materials needed: Antacid tablets, measuring cups, water, clear containers with lids, timer, pen/pencil, attached handouts (one set for each student).

# EXPERIMENT

### In Class:

- Students should predict the outcome of this experiment now that they are performing it in Earth's gravity. Have students record this prediction.
- Next, replicate the experiment in your classroom. You can do this as a class or in small groups. Small groups are recommended to allow students to perform the experiment more than once in order to compare results.
- Gather materials and prepare them as listed on page 3.
- If not being demonstrated in front of the class, students should do this in pairs or groups. One student should be designated timer, and one the operator of the experiment, while others record observations and assist in executing the experiment.
- Drop a whole antacid tablet into an uncovered jar. Start the timer as soon as the tablet hits the water. Keep time until all of the tablet is dissolved. Notice the amount of bubbles being produced. How does this compare to the video filmed on the International Space Station? Record time and observations on the attached handouts as reaction proceeds.
- Repeat this process for the half tablet. Does it take more or less time to completely dissolve? How many bubbles does it produce in comparison to the full tablet? What about the tablets on the International Space Station? Record time and observations as reaction proceeds.
- Next, drop another full tablet into a container that has a sealable lid. Drop the tablet in, start the timer, and put the lid on the container (make sure to seal it tightly). Shake the container a few times like Ricky Arnold did on the International Space Station. How is the reaction affected?
- Are the bubbles forming faster or slower? Are they bigger or smaller? What is happening to the antacid tablet? Record time and observations as the reaction proceeds.

- Repeat this process for a half tablet. Does it take more or less time to completely dissolve?
- How did water behave differently in your classroom than in microgravity? Were bubbles produced faster, slower or at the same rate in microgravity? Why do you think this is? How was the reaction rate affected by shaking the bag? Record your answers on the final page of the handout.
- Repeat experiment if materials are available to compare test results.

### ELABORATE (5 min)

Materials needed: N/A

#### Effervescence, Acids, and Bases:

- Provide a definition/review of **effervescence**, **acids**, and **bases**.
- **Effervescence**: The presence of bubbles in a liquid. Effervescence is produced by both a chemical reaction and physical phenomena.
- **Acid**: Substance that donates hydrogen atoms.
- **Base**: Substance that accepts hydrogen atoms.
- Explain how an antacid is a base, which is the opposite of an acid. Heartburn is caused by acid in your stomach, so when you take an antacid, the base interacts with the acid and neutralizes it, which makes you feel better.

### EVALUATE (5 min)

Materials needed: N/A

#### Final Questions and Wrap-Up:

- Why did the astronaut use plastic bags instead of plastic containers?
- How did the size of the tablets affect the reaction rate?
- How did shaking the container affect the reaction rate?
- How did you have to set up the experiment differently with Earth's gravity?

**Extension and Enrichment:** Students can test this effect in other liquids in addition to water. Does the tablet behave the same in oil, soda, or other types of liquid?

**Additional Resources:** Printable worksheets included

# EFFERVESCENCE



## VIDEO NOTES

As you have discussed with your teacher, effervescence is the presence of bubbles in a liquid. NASA Astronaut Ricky Arnold is going to perform an experiment on the International Space Station that demonstrates what effervescence looks like in microgravity. Write down your observations as you watch the video.

**Effervescence Experiment Video:** Use the word bank to fill in the definitions below.

particles	hydrogen	processing	liquid	bubbles	together
mass	whole	change	gas	quickly	molecules

**Effervescence:** The release of \_\_\_\_\_ in a \_\_\_\_\_.

**Acid:** Molecules that can donate small, charged \_\_\_\_\_ called \_\_\_\_\_ ions.

**Base:** Accepts \_\_\_\_\_ ions.

**Chemical Reaction:** Two or more \_\_\_\_\_ interact and the \_\_\_\_\_.

**Reaction Rate:** How \_\_\_\_\_ the reaction is \_\_\_\_\_.

**Coalesce:** Coming \_\_\_\_\_ to form one \_\_\_\_\_ or \_\_\_\_\_.

How does water behave in microgravity? Record your observations.

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What happened when Ricky Arnold put the tablet inside the water bubbles?

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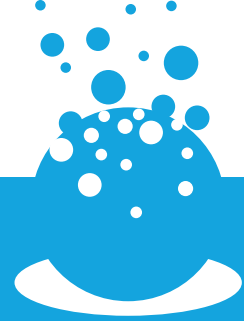
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How did the full tablet reaction compare to the half tablet reaction?

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# EFFERVESCENCE



## EXPERIMENT

Now that you have watched NASA Astronaut Ricky Arnold demonstrate what effervescence looks like in space, you are going to test it out in your classroom! What do you think the difference will be between your experiment and Ricky's?

**Hypothesize:** Make your prediction of what will happen to your tablets in Earth's gravity. Will the reaction look the same? Will more bubbles be produced?

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### Materials:

- Antacid tablets (2 full, 2 half)
- Measuring cups
- Water
- 4 clear containers (2 with lids, 2 without)
- Timer
- Pen/Pencil

### Directions:

- Assign the following roles to people in your group:
  - Conductor: Will be measuring water, pouring it into glasses, and dropping the tablets into the jars.
  - Recorder: Will keep time of reactions.
  - Overseers: Will record data and observe reactions.
- Add measured amount of water to each jar. (note: This should be designated on the box of antacids; the typical recommended amount is 4 oz.) Make sure the amount is consistent in each jar.
- Drop a whole antacid tablet into an uncovered jar. Start the timer as soon as the tablet hits the water. Keep time until all of the tablet is dissolved. Notice the amount of bubbles being produced. Record your data and observations.

Time Recorded: \_\_\_\_\_

Observations: \_\_\_\_\_

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- Repeat with an uncovered jar and a half tablet.

Time Recorded: \_\_\_\_\_

Observations: \_\_\_\_\_

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# EFFERVESCENCE



- Next, drop another full tablet into a jar that has a sealable lid. Drop the tablet in, start the timer, and put the lid on the container (make sure to seal it tightly). Shake the container for three seconds, just like Ricky Arnold did on the space station. How is the reaction affected? Record your data and observations.

**Time Recorded:** \_\_\_\_\_

**Observations:** \_\_\_\_\_

\_\_\_\_\_

- Repeat with the second covered jar and a half tablet. Record time and observations as the reaction proceeds.

**Time Recorded:** \_\_\_\_\_

**Observations:** \_\_\_\_\_

\_\_\_\_\_

**Data:** Record your data and observations in the table below.

Type of Jar	Tablet Size	Time	Amount of Bubbles Compared to Micro-Gravity	Amount of Bubbles Compared to Other Jars
Uncovered	Full			
Uncovered	Half			
Covered	Full			
Covered	Half			



# EFFERVESCENCE



## CONCLUSION

How did water behave differently on Earth than it did in microgravity?

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Were bubbles produced faster, slower, or about the same on Earth compared to microgravity? Why do you think this is?

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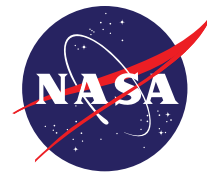
How was the reaction rate affected when you shook the container?

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