



**Reading Supports**

**Teacher’s Guide:**

**“Cupping: Harmless Fad or Sound Science?”**

*December 2018/January 2019*

<http://www.acs.org/chemmatters>



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# Reading Supports

The pages that follow include reading supports in the form of an Anticipation Guide, a Graphic Organizer, and Student Reading Comprehension Questions. These resources are designed to help students prepare to read the article, and then locate and analyze information from the article.

* **Anticipation Guide (p. 5):** The Anticipation Guide helps to engage students by activating prior knowledge and stimulating student interest before reading. If class time permits, discuss students’ responses to each statement before reading each article. As they read, students should look for evidence supporting or refuting their initial responses.

**Or** consider the following ideas to engage your students in reading:

**Cupping: Harmless Fad or Sound Science?**

* Before reading, ask students if they have noticed circular welts on athletes such as Michael Phelps on television and if they know what causes the welts.
* Ask them how they think cupping relates to chemistry concepts.
* As they read, students should relate how cupping works to gas laws.
* **Graphic Organizer (p. 6):** The Graphic Organizer is provided to help students locate and analyze information from the article. Student understanding will be enhanced when they explore and evaluate the information themselves, with input from the teacher, if students are struggling. Encourage students to use their own words and avoid copying entire sentences from the article. The use of bullets helps them do this.

If you use the aforementioned organizers to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

* **Student Reading Comprehension Questions (p. 7):** The Student Reading Comprehension Questions are designed to encourage students to read the article (and graphics) for comprehension and attention to detail, to provide the teacher with a mechanism for assessing how well students understand the article and/or whether they have read the assignment, and, possibly, to help direct follow-up, in-class discussion, or additional, deeper assignments.

Some of the articles in this issue provide opportunities, references, and suggestions for students to do further research on their own about topics that interest them.

To help students engage with the text, ask students which article **engaged** them most and why, or what **questions** they still have about the articles. The “Web Resources for More Information” section of the Teacher’s Guide: Tools and Resources provides sources for additional information that might help you answer these questions.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Anticipation Guide

**Directions: *Before reading***, in the first column, write “A” or “D” indicating your agreement or disagreement with each statement. As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Cupping has only been used for about 20 years to improve blood flow. |
|  |  | 1. Before being placed on the skin, the air inside the cups is heated so that the air molecules move further apart. |
|  |  | 1. Larger cups are placed on fleshy areas of the body. |
|  |  | 1. The air pressure inside the heated cup stays constant as long as the cup is open. |
|  |  | 1. When air molecules slow down, the air pressure rises. |
|  |  | 1. The cups used for cupping are made of flexible materials. |
|  |  | 1. Some cupping therapists today use vacuum pumps to change the air pressure on the skin. |
|  |  | 1. The red welts produced by cupping are due to broken blood capillaries. |
|  |  | 1. Cups remain on the skin until the pressure inside and outside the cup is equalized. |
|  |  | 1. The placebo effect makes it difficult to carry out a randomized control trial to determine whether cupping is effective. |

## Graphic Organizer

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions:** As you read the article, complete the graphic organizer below to describe how cupping is related to gas laws.

|  |  |  |  |
| --- | --- | --- | --- |
|  | ***Before cupping*** | ***During cupping*** | ***What materials are used?*** |
| **Temperature:**  *Low or high?*  *How is it changed?* |  |  |  |
| **Pressure**  *Low or high?*  *How is it changed?* |  |  |  |
| **Volume**  *Low or high?*  *How is it changed?* |  |  |  |

**Summary:** On the back of this paper, write a once-sentence summary (15-18 words) of how cupping works. Then write one sentence explaining whether you would try cupping, with reasons.

## Student Reading Comprehension Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: Use the article to answer the questions below.

* 1. What is cupping?
  2. What is the placebo effect?
  3. Where and when did cupping originate?
  4. According to practitioners, how does cupping work?
  5. What is a negative side effect of cupping?
  6. (a) Name the gas law and (b) write the mathematical equation associated with the expansion of gases in direct proportion to their temperature.

**Student Reading Comprehension Questions, cont.**

* 1. Explain why the pressure inside the heated cup remains the same as before heating.
  2. So, then why does the air pressure inside the cup after it is placed on the body decrease when the air inside the cup cools?
  3. How does the type of container affect gas behavior during temperature changes?
  4. What causes the discoloration, or ecchymosis, seen on the bodies of persons who are cupping?
  5. What is the main reason doctors are skeptical of the effectiveness of cupping?

**Critical-Thinking Questions**

***Write your answers on another sheet of paper if necessary.***

* + 1. Describe the design flaw in most studies that try to assess the effectiveness of cupping and propose how this flaw could be overcome.
    2. The air in a cup is heated to 60.0 °C, and the cup is placed on Michael’s shoulder. What will be the pressure inside the cup when the air inside cools down to a room temperature of   
       27.0 °C at 1.0 atmosphere pressure?

## Answers to Reading Comprehension Questions

1. **What is cupping?**

Cupping is an ancient medical practice that involves applying warm cups to the skin in an effort to improve blood flow to that area of the body and boost performance.

1. **What is the placebo effect?**

The placebo effect is where the mind convinces the body that a treatment is working.

1. **Where and when did cupping originate?**

Cupping originated in China and dates back to at least 1500 BCE.

1. **According to practitioners, how does cupping therapy work?**

Cupping practitioners claim that cupping boosts blood flow to the cupped sections of the body.

1. **What is a negative side effect of cupping?**

Cupping can cause blood vessels to break and clot, impeding blood flow.

1. **(a) Name the gas law and (b) write the mathematical equation associated with the expansion of gases in direct proportion to their temperature.**
2. Charles’ law defines the expansion of gases in direct proportion to their temperature.
3. It uses the mathematical equation V1 / T1 = V2 / T2, where T = the absolute temperature in Kelvin and V = volume.
4. **Explain why the pressure inside the heated cup remains the same as before heating.**

As the air inside the cup is heated, gas molecules speed up and some also exit the cup. Fewer gas molecules moving quickly can exert just as much pressure as a lot of air molecules moving slowly, so the pressure inside the heated cup remains the same as before heating. Students may also include this statement as part of a more complete answer: The pressure within the cup is due to molecules colliding against the walls of the container and with each other.

1. **So, then why does the air pressure inside the cup after it is placed on the body decrease when the air inside the cup cools?**

“As the air in the cup cools, the molecules slow down and collide less frequently with each other and the walls of the cup. The pressure within the cup therefore drops.”

1. **How does the type of container affect gas behavior during temperature changes?**

The behavior of a gas during temperature changes depends on the rigidity of the container. If the container cannot change its volume by expanding or shrinking, then a change in temperature in the container will lead to a change in pressure, while the volume stays constant. If the container walls are not rigid and can expand or shrink like a balloon, then a change in the temperature of the gas will lead to a change in the volume of the container, while the pressure remains the same.

1. **What causes the discoloration, or ecchymosis, seen on the bodies of persons who are cupping?**

Ecchymosis is caused by the pooling of blood underneath the skin due to the rupture of the capillaries there.

1. **What is the main reason doctors are skeptical of the effectiveness of cupping?**

Doctors are skeptical of cupping therapy because it is difficult to carry out a randomized control trial that would help evaluate whether the improvement the patient reports is due to the therapy or due to a placebo effect.

**Critical-Thinking Questions**

1. **Describe the design flaw in most studies that try to assess the effectiveness of cupping and propose how this flaw could be overcome.**

Answers will vary. The design flaw in most studies that try to assess the effectiveness of cupping is the absence of a randomized control trial. In this type of trial, the participants in the study are divided into two groups, one that receives the treatment and another that receives a placebo. Since those receiving treatment know they are being treated, it makes it difficult to know if the treatment—or their psychological response to the treatment—is causing their improvement.

* One way that this could be alleviated is to give a full treatment to one group while only going through the motions of the treatment without using full cupping suction. If the group that receives the full treatment reports the same improvement as the group only receiving the treatment with minimal suction then this would support the idea that cupping is not generating the participant’s improvement in their symptoms.
* Another way to improve the design of the experiment is to have a way to measure the improvement in symptoms rather than relying on the patient’s opinion. This might comprise measuring and comparing the degree of movement in a joint before treatment and then after treatment.
* Yet another way to try to create validity is by comparing the results of lots of studies as mentioned in the last paragraph of the Rohrig article.

1. **The air in a cup is heated to 60.0 °C and the cup is placed on Michael’s shoulder. What will be the pressure inside the cup when the air inside cools down to a room temperature of 27.0 °C at 1.0 atmosphere pressure?**

This is an application of Gay-Lussac’s law (also known as Amontons’ law):

P1 / T1 = P2 / T2

Pressure 1 = 1.0 atm, Temperature 1 = 60.0 °C or 333.1 K (60.0 + 273.1 = 333.1)

Pressure 2 = unknown, Temperature 2 = 27.0 °C or 300.1 K (27.0 + 273.1 = 300.1)

P1 / T1 = P2 / T2 and substituting,

1.0 atm / 333.1 K = P2 / 300.1 K and rearranging terms,

P2 = 300.1 K x 1.0 atm

333.1 K

P2 = 0.90 atm, the pressure inside the cup when the air cools down to room temperature