

What Is Viscosity?

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Lesson Summary for Grades 5-8

In this lesson students experiment with the viscosity of corn syrup, mineral oil, vegetable oil, water, and honey. Cross-curricular activities in language arts, social studies, and math are included.

Science Activity: Viscosity in a Jar

Students test the viscosity of various liquids.

Source 1: Sarquis, M. and Woodward, L. "Birthday Water Globes," *Science Projects for Holidays Throughout the Year*; McGraw-Hill: New York, 1999; pp 15-23. (ISBN 0070647585)

Source 2: Ihde, J., unpublished activity by chemistry teacher (retired) at Wausau West High School (Wausau, WI).

Key Science Topics:

- density
- physical properties
- viscosity

Key Process Skills:

- observing
- inferring
- experimenting
- recording and interpreting data
- communicating

Sixth Grade Proficiency Outcomes for Science:

- Strand I: Outcomes 3, 4, and 5.
- Strand II: Outcome 7.

Introducing the Activity:

The activity takes 10-15 minutes to set up, 20-30 minutes to perform, and 10-15 minutes to clean up. Gather the following materials: large baby food jars with lids (enough for each group to have 5), marbles (enough for 1 per jar), corn syrup, mineral oil, vegetable oil, water, honey, paper and pencil, small poster boards for graphs (1 per group), and colored pencils or markers.

This activity can be introduced using the Language Arts Activity 1 or with a class demonstration of the temperature and viscosity. For example: Before heating some honey, ask students what they think will happen to the honey (besides getting hot) when it is heated. Heat the honey and then pour it out. Tell the students that the same thing

happens to motor oil and ask why this could be bad. A jar of the honey could also be placed in the refrigerator at the beginning of class to be observed as to the thickening of the honey in colder temperatures.

Activity Procedure:

1. Divide the class into groups of four or five students. There should be a student recorder, reporter, materials handler, and timekeeper.
2. A marble is placed in the bottom of each jar.
3. The materials handlers fill the jars respectively with corn syrup, mineral oil, vegetable oil, honey, and water. Replace the lids tightly.
4. The jars are turned over simultaneously and the groups observe and record the marbles that reach the bottom first, second, third, fourth and fifth.
5. The groups repeat the experiment and compare the results of the two trials. If different results are recorded in the two trials a third trial will be necessary to verify results.
6. The groups then experiment with each liquid individually and time how long it takes the marble to reach the bottom. The individual times are recorded and later graphed.
7. The groups come back together as a class and share which marble reached the bottom first, second, third, fourth and fifth. Have the groups discuss why the marbles sank as they did (viscosity) and discuss why the marbles sank (density).

Explanation:

Viscosity is the property of a fluid that tends to prevent it from flowing when subjected to an applied force. High-viscosity fluids resist flow and low-viscosity fluids flow easily. How strongly a moving layer of fluid pulls adjacent layers of fluid along with it determines its viscosity. An increase or decrease in temperature affects viscosity. The viscosity of a fluid decreases with a decrease in density that occurs when the temperature increases. In a less-dense fluid, fewer molecules are available per unit of volume to transfer motion from the moving layer to the stationary layer. This then affects the speed of the different layers. Momentum is transferred less readily between the layers and the viscosity falls. The students research viscosity before beginning this activity. The hands-on experience with the various liquids gives the students an opportunity to observe liquids of various viscosities and how the marble behaves in each of the liquids. The students should draw the conclusion that the marble sinks more slowly in the liquids with greater viscosity. Demonstrating how honey behaves when heated should help the students infer why it is important to use the right viscosity of oil in automobiles. Hopefully they infer that the less viscous the oil, the thinner it becomes when heated, creating less protection for the automobile engine. In colder climates a lower viscosity is needed so the oil will not become like gum. A mixture of lower viscosity oil (10) provides lubrication when the engine is cold and higher viscosity (30) lubricates when the engine is hot. At lower temperatures the higher viscosity by itself would be like gum and at high temperatures the lower viscosity would be like water. A mixture of the two provides protection at high and low temperatures.

Language Arts Activity 1

Students write a journal entry.

The students write a journal entry describing their experiment.

Sixth Grade Proficiency Outcomes for Writing:

- Strands I, II, III, IV: Outcomes 1-8.

Language Arts Activity 2

Students build research skills.

Divide the class into groups of four. Two groups work on the Internet and two groups use encyclopedias. If a student knows a mechanic he or she can also do an interview. The groups research viscosity and then report their findings to the class. As part of their research, have the groups answer the following questions:

- What is viscosity?
- Why is motor oil made at different viscosities?
- What are the advantages of low- and high-density oils?
- What is the benefit of multiple viscosity oils?

Sixth Grade Proficiency Outcomes for Reading:

- Strand IV: Outcome 16.

Social Studies Activity

Students investigate petroleum and its uses.

Discuss with students why trade with other countries is important to maintaining appropriate amounts of petroleum for the production of various goods. Have students research the goods that are made from petroleum.

Sixth Grade Proficiency Outcomes for Citizenship:

- Strand IV: Outcome 15.

Math Activity

Students graph recorded data.

The students time each marble as it sinks in the various liquids and record the times. Use the data to create a graph. Have the groups share and compare their graphs.

Sixth Grade Proficiency Outcomes for Math:

- Strand VI: Outcome 17.
- Strand VIII: Outcome 21 and 22.

References

Encarta Online Encyclopedia. Microsoft, 2000.

Tolman, Marvin N. *Hands-on Physical Science Activities for Grades K-8*; Parker: West Nyack, NY, 1995. (ISBN 0132301784)