

MAKING DECISIONS WITH DATA

Lesson 2: How Thick Are You?

Australian Curriculum: Mathematics - Year 5

ACMSP118: Pose questions and collect categorical or numerical data by observation or survey.

ACMSP119: Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies.

ACMSP120: Describe and interpret different data sets in context.

Lesson abstract

Students conduct a short test of viscosity for four common household products. They time how long it takes for each product to flow down a slope a specified distance. They represent this data on a column graph. Based on the data that they collect, they make statements about the viscosity of a selection of liquids.

Mathematical purpose (for students)

To represent numerical data effectively on a column graph.

Mathematical purpose (for teachers)

Students draw a simple column graph to display the results of a scientific experiment. They also engage in a complex reasoning activity, and check the results using the collected data.

At the end of this lesson, students will be able to:

- Record data and represent it on a column graph.
- Make decisions about the accuracy of the data that they collect.
- Use data to order a list of liquids based on viscosity.
- Reason logically to combine several pieces of related information.

Lesson Length 90 minutes approximately

Vocabulary Encountered

Lesson Materials

- viscosity
- sample
- rate

- Scootle: What the world is made of: properties of liquids - TLF-IDL3253
- Scootle: Types of matter: solids, liquids and gases TLF-IDL5821
- paper plates (at least one per group of students)
- 2 clear plastic cups
- stopwatch (ideally one per group)
- 12 common household fluids of different viscosities - eg tomato sauce, honey, yoghurt, surface cleaning fluid, jam, shampoo, etc
- paper towel - for cleaning up
- post-it notes (several different colours)
- [Student Sheet 1 - Recording Sheet](#) (1 per student)

We value your feedback after this lesson via <http://tiny.cc/lesson-feedback>



Using Maths in Science

Exploring the connections between maths and science

- Go to Scootle and watch the video: What the world is made of: properties of liquids - TLF-IDL3253.
- To review the properties of solids, liquids and gases, refer to the resource on Scootle: Types of matter: solids, liquids and gases TLF-IDL5821.

Teacher Notes

- This lesson makes a deliberate effort to link to the Australian Curriculum: Science topic for Year 5 that looks at the properties of solids, liquids and gases. Testing the viscosity of liquids is a common activity in this topic and there are digital resources available on Scootle, Primary Connections and other on-line locations. This lesson presents a variation on this experiment.
- The mathematics focus of this lesson is to take the data from the experiment and to represent it effectively as a column graph.
- Note regarding using Scootle: What the world is made of: properties of liquids - TLF-IDL3253 - the important part of this interactive resource is the description about viscosity. There is also a link at the end ("To Do") that describes an activity similar to the viscosity test in this lesson.
- The resource on Scootle: Types of matter: solids, liquids and gases TLF-IDL5821 will provide a revision of the properties of solids, liquids and gases.

Clarifying Viscosity

- Have two clear plastic cups, one containing water and the other containing honey.
- Ask students if the water and honey are both liquids. How do they know? What are the properties of liquids that they can observe?
- Discuss the idea of viscosity, using the cups of water and honey as examples.

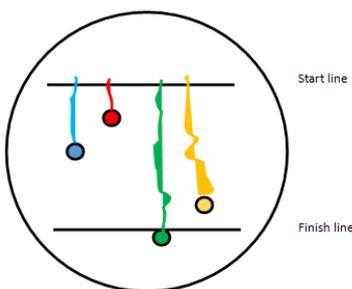
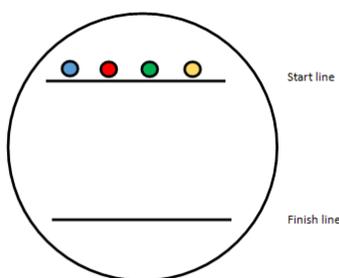
Expected Student Response

- They are both liquids because:
 - They flow.
 - They take the shape of the container that they are in.
 - They have a definite volume but an indefinite shape.

Experimenting with Liquids

The viscosity test

- Materials required per pair of students:
 - Paper plate
 - Four common liquids - e.g. Tomato sauce, sunscreen, yoghurt, honey, PVA glue, liquid soap etc
 - Stopwatch or timer
- Method:
 - Students fill in the names of the entire set of 12 liquids to be tested by the class on [Student Sheet 1 - Recording Sheet](#) and make predictions about their viscosities. They rank the list in order 1-12 (1=fastest/least viscous; 12=slowest/most viscous).
 - Students work in pairs and choose four liquids to test from the range of 12 liquids available.
 - Ensure that the liquids are distributed randomly between pairs and that all 12 are being tested.
 - Also ensure that there is overlap between groups so that all liquids are tested by multiple groups.
 - Draw parallel "start" and "finish" lines that are 10 cm apart on a paper plate.
 - Place a small drop of each liquid onto the paper plate, behind the start line.
 - Tilt the plate vertically.
 - Time how long it takes each liquid to get to the finish line.



- Record your four time measurements on [Student Sheet 1 - Recording Sheet](#).

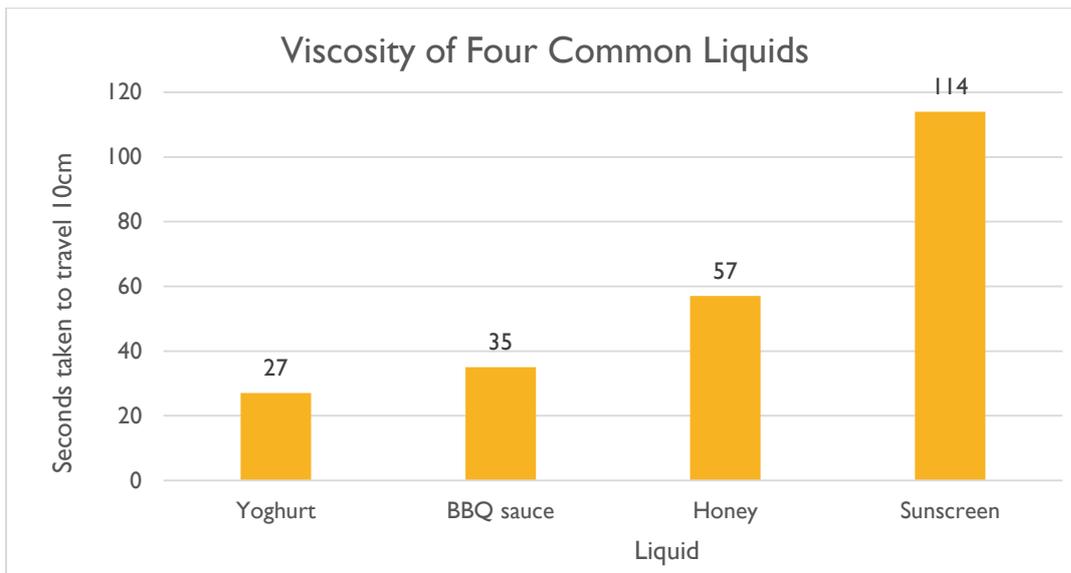
Expected Student Response

Liquid	Honey	Sunscreen	Yoghurt	BBQ Sauce
Time	57 seconds	114 seconds	27 seconds	35 seconds

Data Presentation

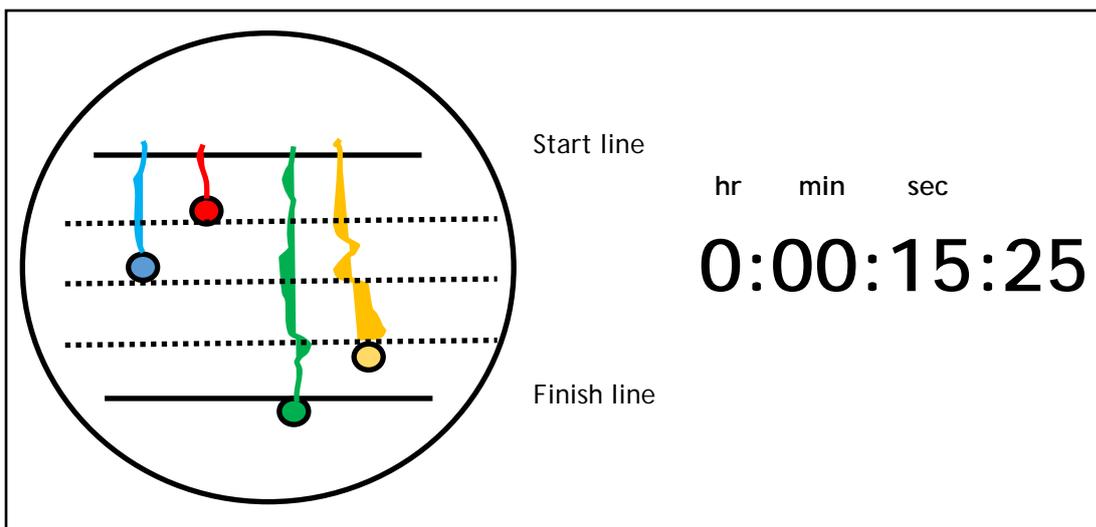
- Graph your data for the table.
- Arrange the columns in order from low viscosity (fastest) to high viscosity (slowest).

Expected Student Response



Extending Prompt

Here is an image from another group. What statements can you make about this data?



Expected Student Response

- The dotted lines show the distance from the start to the finish line divided into quarters.
- The order of the liquids ranked from least to most viscous is green, yellow, blue, red.
- The blue liquid might take about twice as long as the green, or a bit more than 30 seconds.
- The yellow liquid might get to the finish line in the next 4 or 5 seconds.
- The red is going to be the slowest. In 15 seconds it has gone less than a quarter of the distance so it is going to take at least 1 minute to get to the finish line.

Organising the Data

Putting it together

- Ask students to rank their four liquids in order from least viscous (fastest) to most viscous (slowest).
- Ask students to consult other groups to look at the ranking for liquids that they did not test.
- Using this information, arrange all 12 liquids in order from least to most viscous.

Expected Student Response

- Groups should be able to list their own data to show the relative viscosity of each liquid. The data does not need to be shared at this point but might look like this:

Rank	Group 1	Group 2	Group 3	Group 4	Group 5	etc.
1. Least viscous (fastest)	Tomato sauce	Sunscreen	Shampoo	Yoghurt	Yoghurt	...
2.	Moisturiser	BBQ sauce	Yoghurt	BBQ sauce	Conditioner	...
3.	Jam	Honey	Honey	Honey	BBQ sauce	...
4. Most viscous (slowest)	Treacle	Jam	Tomato sauce	Tomato sauce	Golden Syrup	...

- Each group writes the names of the liquids onto post-it notes, and a number to indicate the ranking (1 for least viscous, 4 for most viscous).
 - Choose groups to put out their lists in order.
 - Ask a second group to add in their information around the liquids of Group 1
 - Continue adding group information one at a time to build a list of all 12 liquids
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- Group 1 puts out the list of liquids in order:



- Group 2 adds its liquids. These students know where on the scale to place jam and they know their other liquids are less viscous (faster) than jam but they don't know where to put them in relation to tomato sauce and moisturiser:



- Group 3 adds more liquids. Tomato sauce can be used as a reference point:

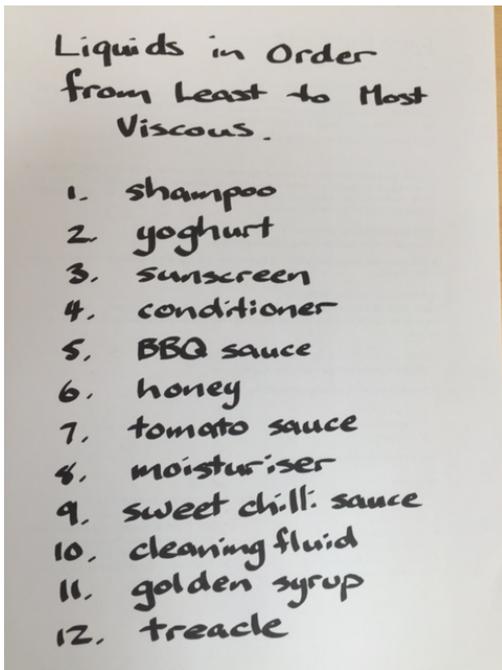


- Group 4 has several pieces of information that are useful. They know that BBQ sauce is between yoghurt and honey. They also know that honey is between tomato sauce and BBQ sauce:



- This process can continue until the class has enough information to make a completely organised list of liquids.

- Liquids organised in order from least to most viscous:



Teacher Notes

- It is important that students only share the rankings for their liquids and not tell the other groups the actual timings they recorded.
- The process of organising this list will require some significant reasoning from the students. They will need to justify their placement of each item based on what they know about the liquids on either side of it.
- It is quite possible that they will not be able to reach complete agreement about one or two of the liquids. At this point it might be useful to look at the timings for those liquids.

From Rankings to Timings

- Once you have an agreed order of viscosity, ask groups to estimate the timings for the liquids that they did not measure. Ask groups that did test those liquids to confirm the accuracy of the estimates.

Other Interesting Things about Liquids

Highly viscous liquids

- What are some examples of liquids that are highly viscous?
 - At Questacon in Canberra there is slow flow synthetic rubber that has been flowing through a large hour glass for over 30 years.
 - Can you find other examples of highly viscous liquids?

Is glass a liquid?

- The stained glass in the windows of many old cathedrals is thicker at the bottom than at the top. For many years people believed this was because the glass was acting like a liquid and flowing downwards. What is the current research saying about this?

