Name: _____ Class: _____ Date: _____

Comparing the Flow Rates of Different Liquids

Learner Outcomes:

- Investigate and compare fluids, based on their viscosity and flow rate, and describe the effects of temperature change on liquid flow.
- Describe and interpret technologies based on flow rate and viscosity

Key Terms:

Flow rate Viscosity

Background Information: How quickly fluids flow is called viscosity. Viscosity is determined by a fluid's internal resistance to friction, that keeps it from flowing. In a gas, particles move around easily with very little friction, so they can flow easily and have a very low viscosity. Fluids with a high viscosity do not flow easily.

Research Question: How does the flow rate compare for different liquids? What effect does increasing the temperature have on flow rate?

Hypothesis: Predict the order of the flow rates from the fastest flow rate to the slowest flow rate for the liquids you will be using:

_____ Fastest

_____

_____

_____ Slowest

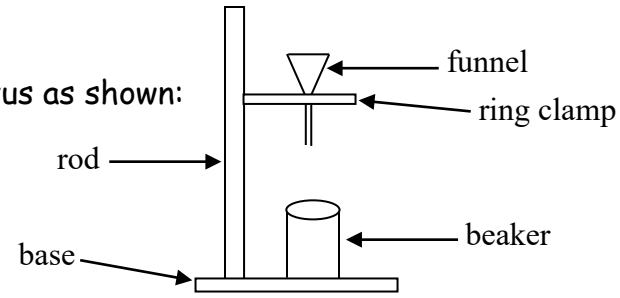
Materials:

support stand	timer	corn syrup
ring clamp	water	hot plate
2- 250mL beakers	vegetable oil	thermometer
funnel	glycerol	

This investigation / activity has been adapted from:
Mah K, Martha J, McClelland L, et al. *Science in Action 9.* Toronto, ON: Addison Wesley.

Procedure:

1. Set up the apparatus as shown:



2. Measure 200mL of water in your second beaker. Have one of your group members hold their finger at the bottom of the funnel and pour the water into the funnel.

3. At a set command, pull the finger away from the bottom of the funnel, letting the liquid drain into the catch beaker below the funnel. Time how long it takes for the funnel to empty. Record your results in the Observations table.

4. Pour out the water and wash and dry both beakers.

5. Repeat the above procedure for the other three liquids. *When you finish with a liquid, pour it back into the correct container and wash and dry your beakers.*

6. Calculate the flow rate for each of the liquids.

7. Heat 200 mL of each of the liquids on a hotplate until the temperature reaches 40-50 degrees celcius and repeat steps 2-6.

Observations:

Flow Rates at Room Temperature

Liquid	Volume (mL)	Time (s)	Flow Rate: Volume ÷ Time (mL/s)
WATER			

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Flow Rates at 40-50 Degrees Celcius

Liquid	Volume (mL)	Time (s)	Flow Rate: Volume ÷ Time (mL/s)
WATER			

Analysis:

1. From your results, list the four substances in order from most viscous (slowest flowing) to least viscous (fastest flowing).

   1st _____

   2nd _____

   3rd _____

   4th _____

2. How do your results compare to your hypothesis?

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3. Use the particle theory to explain why some liquids flow more easily than others.

4. The size of straw normally served with a milkshake is different than the size normally served with a soft drink. Why?

Conclusion: What impact did temperature have on the flow rate of the fluids tested in this experiment?

Extension:

1. Suppose you were asked to design a pipeline to carry crude oil from Fort McMurray to Edmonton. Would your pipeline need a larger or smaller diameter than one to carry water? Explain your answer.

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2. Research at least one method that oil companies use to ensure that crude oil in oil pipelines moves freely from where the oil is mined to where it is processed and refined.

3. Investigate what the numbers used to describe motor oil mean (e.g. 10W-30 and 15W-40, etc) and why different types of oil are used for different seasons. Create a consumer information pamphlet or commercial to explain the differences and recommend what types of oil consumers should use in which seasons.

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