LESSON Fluid Flow	GRADE: 8 STRAND: Fluids
CRITICAL LEARNING: BIG IDEAS	
How does the flow of fluids affect our lives?	
FOCUS QUESTIONS	
What factors affect the flow rate of a fluid? How are viscosity and flow rate connected?	
CURRICULUM EXPECTATIONS	
2. Developing Investigation and Communication Skills By the end of Grade 8, students will: 2.1 follow established safety practices for using apparatus, tools, and materials (e.g., use syringes and tubing for the purposes for which they were designed) 2.5 use scientific inquiry/experimentation skills (see page 12) to identify factors that affect the flow rates of various fluids Sample problem: Devise an experiment to find out how the flow rate of a fluid is affected by changing its temperature; by changing the angle or tilt at which it is poured; by changing the diameter of the tube through which it is poured. 2.4 investigate applications of the principles of fluid mechanics (e.g., in aeronautical research, shipping, food services, plumbing, hydrodynamic engineering) 2.7 use appropriate science and technology vocabulary, including viscosity, density, particle theory of matter, hydraulic, and pneumatic, in oral and written communication	**LEARNING GOALS** This lesson allows students to experiment with a variety of household liquids to determine their flow rate and compare their viscosities.

2.8 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., using appropriate scientific and/or technological conventions, create a technical drawing of a pneumatic/hydraulic device; create a brochure or a multimedia presentation outlining safe and unsafe uses of the device that was modelled) 3. Understanding Basic Concepts By the end of Grade 8, students will: 3.1 demonstrate an understanding of viscosity and compare the viscosity of various liquids (e.g., water, syrup, oil, shampoo, ketchup)	
MINDS ON...(*ELICIT & ENGAGE*)	**ASSESSMENT & E.VALUATION**
1. Motivate the students by notifying them that they have just received "box seats" to the "Incredible Indy 500mm!" The challenge of all challenges! Invite them to gather around the "track" (1m X 30 cm piece of plastic) to meet the competitors. Indicate that after the introductions they will be given the opportunity to discuss with a partner and then vote on which competitor they feel will be the most successful in today's preliminary race! 2. Hold up a clear container of cooking oil. "Introducing..Sammy Slime! Most likely to be found hanging around the kitchen, he is a versatile fellow who is particularly popular during Sunday morning brunch where his unique qualities allow eggs and hash browns to be easily removed from the frying pan. Let's hear it for Sammy Slime! 3. Hold up a clear container of handsoap. Our second competitor today is Harvey Handsoap who is equally as popular however for different reasons. Harvey 's worldwide fame is due to his ability to use his unique characteristics to sanitize even the dirtiest of digits. Found everywhere from hospitals to gas stations, put your hands together for Harvey Handsoap!! Now the audience has a minute to reflect before voting on which of these most capable competitors will walk away with the highest award for "Viscosity Valour" the "Final Fluent Fluid Feature." 4. Give the students the chance to "Think Pair Share" while reflecting on the qualities of each competitor. Take a tally of which competitor they think will be the fastest. Have students attempt to explain "why" they have voted for their favourite competitor. 5. Give one volunteer a green flag, one volunteer a yellow flag and one volunteer a checkered flag. Instruct the students on the role of each flag. (Green flag-go, Yellow flag-caution, in case of any collisions/mixing, Checkered flag indicates the first fluid across the finish line!) [have students make up the flags from construction material]	The debriefing session serves as a formative assessment

6. Hold the race! Gentlemen prepare yourselves...On your mark, get set...go! to the wave of the green flag! Pour both liquids down onto the top of the piece of plastic that has been set up on a slant.(racetrack) Have some students provide the commentary. 7. Once the race is over and the checkered flag is waved have a debriefing with the class. • Have students reflect on their predictions. • Begin to stimulate thinking by asking questions like. How could we alter the liquids in some way to affect their rate of flow? ex. heating the oil. • As we have seen in our experiment, all liquids do not flow equally. Which liquids flow slowly, and which liquids flow faster? • Can you speed up or slow down the flow rate of liquids? • What other methods could be used to compare the flow rates? • Can you predict the flow rates based on the physical properties of the liquids?	
ACTION! (*EXPLORE & EXPLAIN*)	**ASSESSMENT & EVALUATION**
<u>EXPLORE</u>: 1. Give the students the opportunity to hold their own "Indy 500mm." Each group will gather "Time Trials" for each of their liquids. "Finals could be held between the two fastest liquids!" 2. Using a Guided instructional approach, give students the following experiment: • Purpose : To determine the Flow Rate and compare the Viscosity of different liquids • Hypothesis : Create a table, and predict the flow rates from fastest to slowest, and the viscosity from most to least of different liquids • Procedure : - Set up an inclined ramp. - Make a start line - Measure and mark a distance of 50 cm down the ramp. - Time how long it takes the liquid to travel down the ramp.	* See Consolidation section.

EXPLAIN:

- Observations :

  Create a table.

  Record the time it takes for each liquid to travel 50 cm.

  Determine the flow rate using 50(cm)/time (sec)

- Rank the liquids from fastest to slowest.

  Rank the liquids from most viscous to least viscous.

- Conclusion:

  Determine which liquid was fastest and least viscous and which liquid was slowest and most viscous.

  Create a graph to compare the results

CONSOLIDATION (*ELABORATE, EVALUATE, & EXTEND*)	ASSESSMENT & EVALUATION
Examine the question, "Does temperature affect the viscosity of liquids?" Have students go to the following website: www.seed.slb.com/flash/science/lab/liquids/visco_exp/en/viscosity.htm Using the "Viscosity Explorer" students explore the viscosity of a variety of liquids at different temperatures using the following procedure: • choose the same liquid for each beaker • choose a different temperature for each beaker • compare the rate at which the steel balls fall to the bottom of each beaker. • repeat the experiment several times using a variety of temperatures. • Repeat experiment to compare the effect of temperature on the viscosity of a number of different liquids.	Have students: - create a chart that lists the results of the "Action" investigation. - draw pictures of what they think is happening to the particles of the fluids at each temperature, in their "Viscosity Explorer" investigation and explain why they got the results that they observed. - record their thoughts and ideas on how temperature differences could affect the performance of the motor oil in protecting a car's engine from excessive heating. - predict what would happen to the viscosity of the oil as its temperature gets very high in a small car engine with high RPM's.

Youth Science Canada "Smarter Science: Fluids Flow". Youth Science Canada (http://www.smarterscience.ca/smarterscience/viewlessonplan.php?id=66) 22 April, 2010

CONSOLIDATION:

Schlumberger Excellence in Educational Development Inc. "Viscosity Explorer". SEED. (http://www.seed.slb.com/flash/science/lab/liquids/visco_exp/en/viscosity.htm?width=620&height=500&popup=true) 14 April, 2010