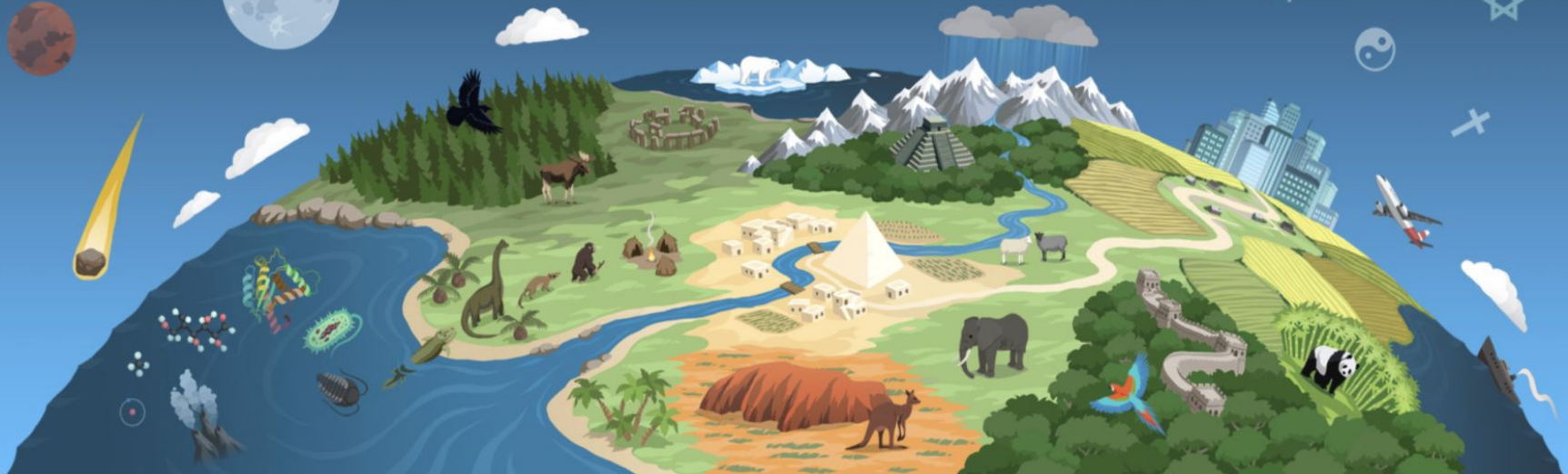
Binogi in Your Science Classroom

Grade 8 (ON) - Understanding Matter and Energy Fluids
Fluids: Investigate the Properties of Fluids



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Resource Guide for Teachers

Please visit:
https://escapeprojects.ca/ for additional resources and information

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Grade 8 Fluids: Learning Objectives and Big Ideas

Overall Expectation

C1. Relating Science and Technology to Our Changing World: analyse uses of various technologies that rely on the properties of fluids, and assess the impact of these technologies on society and the environment

Specific Expectation

1.2 assess the environmental and social impacts of fluid spills, including impacts on First Nations, Métis, and Inuit communities, and including the cost and technical challenges related to cleanup and remediation efforts (ON Science Grade 8 Curriculum, p. 3)

Learning Objectives

Demonstrate an understanding of the properties of fluids as it applies to society, environment and people.

Big Ideas

Understand the effects that certain substances can have on the environment.

Assessment

1. Assessment FOR

2. Diagnostic questions, Minds On, Action, Consolidation

3. Assessment AS: Consolidation

Scientific Terms and Resources/Materials

Vocabulary

fluids, buoyant, density, liquids, flow rate, viscosity, adhesion, cohesion, surface tension, Particle Theory of Matter, toxic, chemicals, sulfur, acid rain, pesticides, smelters, mines, sewage.

Pair/Group Activities

Please follow your school's **Covid-19 safety protocols** for any pair/group activities.

Language Friendly Pedagogy

At the beginning of the lesson, students will be invited to add key terms in their Concept Detective and add any new words that they come across throughout the lesson.

Binogi Related Resources

Immiscible Liquids and Emulsions

Binogi Related Resources

Map - p. 18

The Story of the Great Lake Activities - p. 19

Additional Binogi Resources

Sea pollution

Pressure in liquids

The blood (fluid of life): "a clever system for transporting things"

At the beginning of class… (5 ~ 10 min)

1. Share learning objectives - Understand the effects of fluid spills on society and the environment, including the cost of the cleanup and the effort involved.
2. Co-create success criteria
    - Sample :
        - ***I can understand the effects of mixing different substances and the impact it has on our environment.***
3. Ask the students to add the following words in their Concept Detective which they will fill in throughout the lesson: ie: fluids, Archimedes' Principle, buoyant, density, liquids, flow rate, viscosity, adhesion, cohesion, surface tension, Particle Theory of Matter.
4. Diagnostic Questions: Teachers should systematically start with 2 or 3 diagnostic questions. Examples of diagnostic questions can be found:

    a) using the previous year's specific expectations;

    b) students taking part in Binogi quizzes - Immiscible Liquids and Emulsions & .

Minds On

Instruction	Assessment Focus Look Fors	Notes
1. POE (Predict, Observe, Explain) Teacher will demonstrate oil mixing with water. Before teacher mixes, ask students to predict what will happen. Students will observe during the mixing and then explain what they saw. 2. Students watch Binogi video: https://app.binogi.ca/l/immiscible-liquids-and-emulsions 3. Have a class discussion connecting this video with what happens on bigger scales such as during an oil spill.	How do students represent their understandings and linkages between concepts? How does the activity connect to, and help prepare students for problem solving? How are you interacting with your students?	Teacher records answer / wonderings / understandings. Asks students to elaborate/explain their responses with the class.

Action

Task Component	Instruction	Assessment Focus Look Fors	Notes
Materials: **paper, markers, blocks, ruler, graph paper**	Story of the Great Lakes Activity 1.Show students the **map** (p. 11) to the great lakes system and point out how the water goes through all the great lakes and into the Atlantic. 2. Students will take part in the **Story of the Great Lakes Activity** (p. 12). This is an interactive activity. This lesson can also be used to teach, and/or, tie in environmental science. 3. Have a class discussion on what happened during the activity. Or you can address some of the discussion questions as a whole class.	What role do I and my students play during the problem solving process? What strategies do we predict students will use to do the math? What strategies are students using to do the math?	Have your students watch the videos in the language of their choice. Record students' thoughts. Think-pair-share: student thinks on their own first, then they share with their partner, then with the class.

Consolidation/Reflection

Instruction	Assessment Focus Look Fors
1. Have a class discussion on what happened during the activity. Or you can address some of the discussion questions as a whole class. 2. Have students think about some of the possible answers to the individual questions at the bottom of the activity handout. 3. Students complete their Concept Detective.	How are you consolidating student learning? Which strategy was used (Congress, Gallery Walk, Bansho, etc.) and why? How do you determine what should be highlighted? How is it connected to the learning goal/expectations? How is student thinking annotated? What roles do you and your students take on during the consolidation?

Extensions & Differentiation/Modifications

Extension/Homework - Students can measure the salinity, turbidity or pH of the bowl of water once the experiment is done and can graph the data using tables or graphs and report their findings.

Parent and Community Connection

Home Assignment

Concept Detective - students can complete any terms they did not complete and add any mathematical terms they wish to include in their glossary with their parents.

EXAMPLE of parent/community activity:

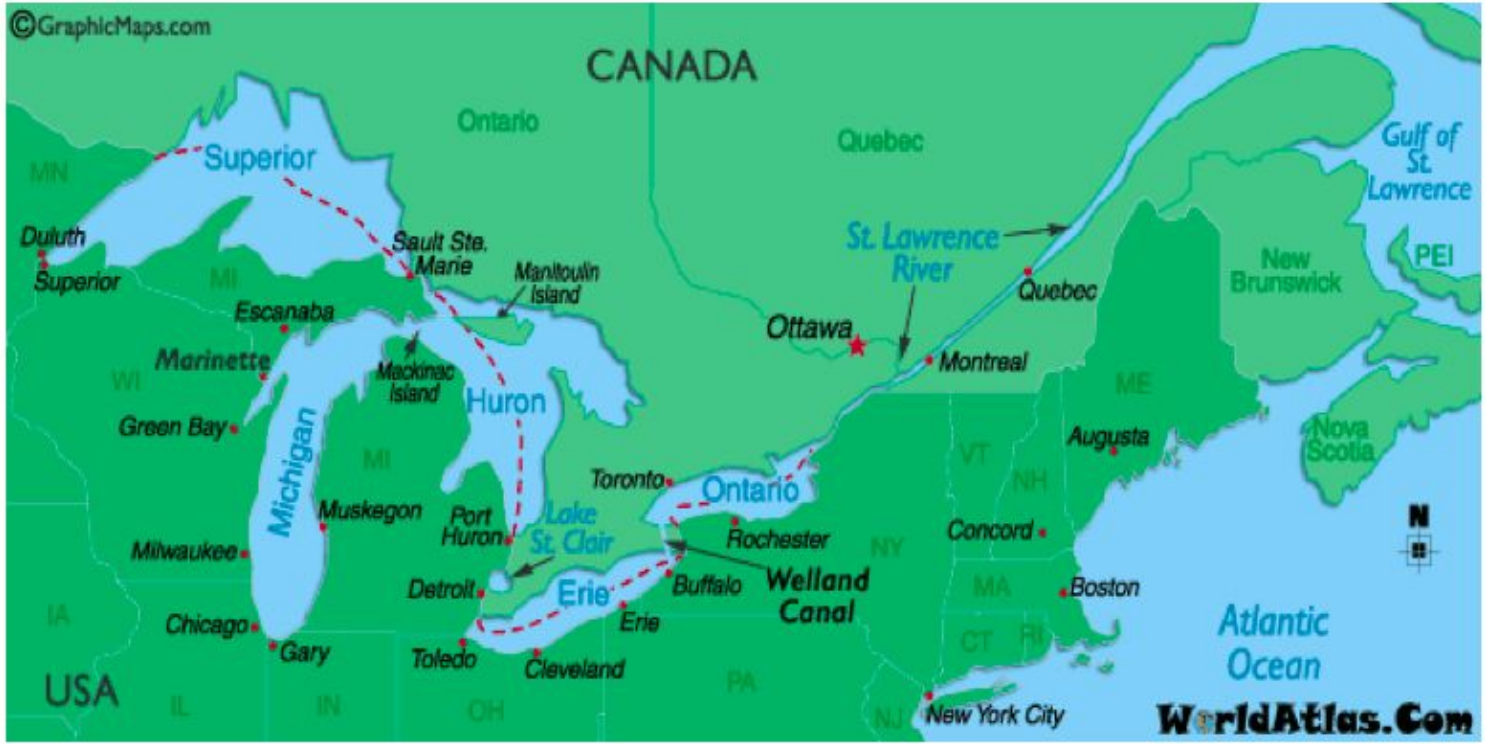
Students log on binogi and watch the following videos on https://app.binogi.ca/l/immiscible-liquids-and-emulsions . They can do it with their family members. The aim is to consolidate the student's learning further by engaging in math talks, as well as increasing parental involvement and raising awareness of what they are learning in school.

Some of the questions parents can ask as they watch the video together...

- Compare the density of the different liquids in the video? Why can't oil and vinegar mix? Why do they form two different layers in your salad dressing?

Students and their parents can answer the questions together after watching the video and discuss any other questions they may have.

The Water Story for the Great Lakes



The Story of the Great Lakes and St Lawrence River

Activity outline:
Through an interactive story, students experience the issues relating to the water quality of the Great Lakes and St Lawrence River basin, from Lake Nipigon downstream to the mouth of the Atlantic Ocean. Hence, students will explore the impacts that local and regional issues can have on the world. This activity aims to simulate the inter-connectedness between various human activities (industrial and commercial, agricultural, mining, and personal), and water pollution, both indirect and direct pollution, in order to illustrate that pollution is not always visible. It also introduces students to decision-making processes in order to manage and prevent water pollution at a personal, local and national level. Students propose ways in which people can help prevent and manage pollution now and into the future.

It is also possible to do some simple science tests/observations throughout the story. For example, salinity, turbidity or pH can be measured and the data analysed (tables, graphs). Students can also record their observations, describing what is happening and the resulting changes and discuss further in regards to the fluids and materials that are being introduced into the water system.

Materials:

- A map showing the Great Lakes and St Lawrence River basin.
- One clear container (4 to 5 litre capacity) filled half-way with clear water.
- One film canister or small container (not clear) per student.
- Ingredients (ensure they are safe for children) and label with land use or character for each canister:

Land use/character	**Ingredients**
Fishing	Fishing line or dental floss
Pulp and paper mills	Cloudy water and paper
Smelter (acid rain)	Vinegar
Mine	Muddy water
De-icing agent	Salt
Hazardous waste	Water and food colouring (red)
Washing the family car	Water and dishwashing liquid
Mysterious liquid	Water and food colouring (green)
Oil spill	Oil
Sewage	Lemon juice and floaties
Power plant	Vinegar
Fertilisers	Baking soda
Commuters	Vinegar
Tourists	Litter
Picnics	Litter
Dog	Mushed up chocolate
Demolishers	Vinegar
Pesticides	Baking soda

Activity instructions:

1. Prepare one labelled canister per student. There are 18 possible land uses/characters, therefore you will need to double up on some land uses/characters (e.g. Tourist) to ensure that every student has a role.
2. Place large clear container, half filled with water, where all the students can see it.
3. Introduce the topic of the importance of the Great Lakes and St Lawrence River basin as a home for many species of animal and plant, and our reliance on the water body. For example, illustrate that this basin is the largest freshwater ecosystem in the world (holding nearly 20% of the world's freshwater), approximately one third (over 30%) of Canada's population and 10% of the U.S. population live in the basin.
4. Distribute a canister to each student. Ensure that the canisters are not opened.
5. Explain to the students that they are each a character in "The Story of the Great Lakes and St Lawrence River" and that when their character is mentioned, to empty the contents of their canister into the large container.
6. Read the following story (p. 22 - 23). Ensure to emphasise the land uses/characters (in bold) and point to certain locations on the map. Whilst reading the story pose questions such as:
    i. How does the water look to you?
    ii. How do we determine water quality?
    iii. Do you think the water is safe to drink? swim in? eat fish from? boat on?
    iv. Is it safe for plants and animals? How do you determine if the water is safe for plants and animals?

Possible Discussion Questions/Activities:

Whole class:

1. What is pollution?
2. How do different types of fluids become pollution?
3. Are all fluids pollution? Why or why not?
4. Who's polluting the Great Lakes and St Lawrence River basin? Do you think this is a real situation? Do you see pollution in our local river or lake? Is pollution always visible?
5. What did you see happening in the story? What would be a better ending to the story?
6. How did you feel about the changes that were occurring along the stream flow? Did you want to swim, eat fish, boat, or drink the water along the stream flow?
7. How is the pollution on a local scale having an impact on water quality across the world? Use the globe to emphasise that all the water bodies in the world are connected by water currents. As well as mention the water cycle.

Individually/small group (ensure each student has a copy of the story):

1. How do certain fluids contribute to pollution? How does this affect you personally?
2. My/our ideas about:
    i. the impacts and significance of each pollutant.
    ii. removing any of the pollutants to clean up the water. Which pollutants are possible to remove? Why/why not? Who is responsible for cleaning up?
    iii. the possibility of preventing pollutants in the story. Can any of the pollutants be prevented? How?
    iv. whether it is easier to prevent pollution or clean up afterwards?
    v. those problems that could potentially cause water pollution in our area.
    vi. ways that people in the local area can improve the water quality.

3. How can each of us prevent pollution and improve the health of the Great Lakes and St Lawrence River basin?
4. Is there a relationship between the number of people and pollution? Why?
5. Investigate current strategies and action groups at the local, regional and national (Canada and America) levels that help manage and prevent pollution of the Great Lakes and St Lawrence River basin.
6. Investigate who uses the water and how pollution may affect the use.
7. What other challenges is the basin facing, now and in the future? For example, discuss the impact that invasive species have on the ecosystem.
8. How are the First Nation communities affected by the pollution? What actions have been taken and what resources do they have to prevent and/or resolve the issues on the water quality? (ON First Nations map, Indigenous communities in Quebec)

An important resource:

1. Environment Canada. *Great Lakes Kids.* Retrieved from http://www.on.ec.gc.ca/greatlakes/For_Kids-WS4DB7BBAD-1_En.htm
2. Government of Ontario. *First Nations map*. Retrieved from https://files.ontario.ca/pictures/firstnations_map.jpg
3. Government of Canada. *Indigenous communities in Quebec*. Retrieved from https://www.sac-isc.gc.ca/eng/1634312499368/1634312554965

Story: The Story of the Great Lakes and St Lawrence River

This is the story of the travels of a very special water basin — our Great Lakes and St Lawrence River, the world's largest freshwater ecosystem. It begins in a place far from here, in the hills surrounding Lake Nipigon where water runs off the slopes and begins its long journey to the ocean. We begin when Canada is covered with a heavy blanket of snow, when the evergreen trees wear hoods and coats of white and the animals put their extra warm fur on or sleep peacefully in the comfort of their den. As winter ends and spring returns, the animals and plants awaken and many animals return from far away. The air gets warmer as the sun bursts out bright and warm over the hills, and under its glare the snow blankets melt. The fresh water runs down hill into Lake Nipigon, adding to the deep cool water body.

With the warmth, more people arrive to test their skills to "catch the big one". On the shore a person **fishing**, unsuccessful in their attempts to cast a line, ends up with a tangled bundle of nylon fishing line. In frustration, the bundle is thrown into the lake.

The lake drains into the Nipigon River and then into Lake Superior, the most superior of them all. On the shore of Lake Superior sit many **pulp and paper mills**. The effluent discharge from the pulp and paper mills contain many harmful chemicals used in the process of bleaching and washing. This has an affect on the health and wellbeing of the plants and animals that live in the lake.

Water continues its journey from Lake Superior, down the St. Mary's River and into Lake Huron. In the valley north of Lake Huron lies the Sudbury area, the home to many copper-nickel **smelters.** The smelters releases sulphur which is a toxic chemical for plants and animals. This chemical combines with atmospheric water to produce acid rain. When the rain falls, these acids fall back to the Earth's surface and can pollute the lakes and rivers.

On the south-eastern shore of Lake Huron, there is a town by the name of Goderich, Canada, home of the largest salt **mine** in the world. The mine extends 5 kilometres under Lake Huron and pumps water out of the lake to help extract salt from the mine and to clean its equipment and flush out some of the waste. This includes various chemicals, which all drain back into the lake. During winter the salt from the mine has been used as a **de-icing agent** on roads across the region. As the snow melts, the water picks up the salt and flows into the lake.

The water continues to flow south towards Sarnia at the mouth of the St Clair River, an area better known as "Chemical Valley", home to one of Canada's largest **hazardous-waste** dumps. During a widespread power outage nearly 300 gallons of vinyl chloride is spilled into the river. Vinyl Chloride is a highly toxic, flammable and carcinogenic chemical.

Meanwhile, further downstream, in Marine City, USA, siblings **wash the family car**. The soapy water carries the grease and grime from the car, rubber particles from the tyres, asbestos from the brakes and other toxic metals down the driveway into the storm water drain; eventually ending in the river. If the car had been taken to the local car wash, the water would have been treated before it entered the river.

Next door, a family does some spring cleaning. Whilst they are sorting out the garage, they find an old rusty can with no label except a tattered skull and crossbones. It looks dangerous and they want to get rid of it before it hurts someone. So the **mysterious liquid** goes down the storm water drain. The poison is out of sight – but is headed for the river.

The river passes many other towns before reaching Lake St Clair and then continues its journey along the Detroit River. Here the water passes the first of many large cities, Detroit (USA). Detroit and the surrounding region has a major manufacturing centre, most notably as home to the major automobile

companies. By accident, **oil spills** into the river, causing many problems for the birds that live there. On the other side of the river, in Windsor, Canada, there's an overflow of **sewage** that escapes treatment so that billions of litres of untreated sewage and storm water finds its way to the Detroit River.

The river continues the journey to Lake Erie. On the western shore, there's Monroe (USA), home to one of the highest carbon dioxide emitting **power plant**s in the world. Water happily absorbs CO_2. When CO_2 levels are high and oxygen levels are low, fish have trouble breathing and their problems become worse as water temperatures rise. On the opposite shore of the lake, around Leamington (Canada), the **farmers** are busy fertilising their crops with nutrients such as phosphorus. Afterwards, the crops are watered and the water and fertiliser runs-off into the lake.

In Buffalo (USA), on the eastern shore of Lake Erie, traffic congestion is a big problem for the many **commuters** that drive to and from work. Car emissions, just like power plant and smelter fumes, contribute to acid rain. Also, if a car is not regularly serviced it might leak oil, which will be washed off the road and into the water with the next rain. Buffalo is also at the head of the Niagara River, the site of some of the most famous water falls in the world. At the Niagara Falls, many **tourists** meander along the shoreline, eating and drinking happily, but not everyone uses the bins that are provided.

Finally, the water reaches the last of the Great Lakes, Lake Ontario. In Canada's largest city, Toronto, people walk their **dogs** along the Harbourfront, especially as summer gets warmer. Not far along the path, an owner ignores their dog's poo, which will be washed away into the lake with the next rain. At a nearby park, a family sit enjoying their **picnic** overlooking the water but as they leave, litter is left behind. With a gust of wind, the litter ends up in the lake.

In the final stage of the journey the water goes Lake Ontario and into the St Lawrence River. Along the banks of the river there are many towns and cities, most notably, the large city of Montreal. On the outskirts of Montreal, on the bank of the river, redevelopment is occurring. The **demolishers** have discovered some mysterious liquids in metal drums. It's not possible to sell the drums for scrap metal so they throw them in the river. Further along the river, the crops are not growing well because they are being eaten by insects. The farmer decides to spray the crops with harmful **pesticides**, which eventually run-off into the river. The river continues bending through the landscape until it finally arrives at its mouth and flows into the Atlantic Ocean. But look at what flows out with it! Where will it end up?

(Adapted from "Who Polluted the Potomac?", Alice Ferguson Foundation, USA and "The Story of a River", Waterwatch, Queensland, Australia).