Chemistry
Grade 3
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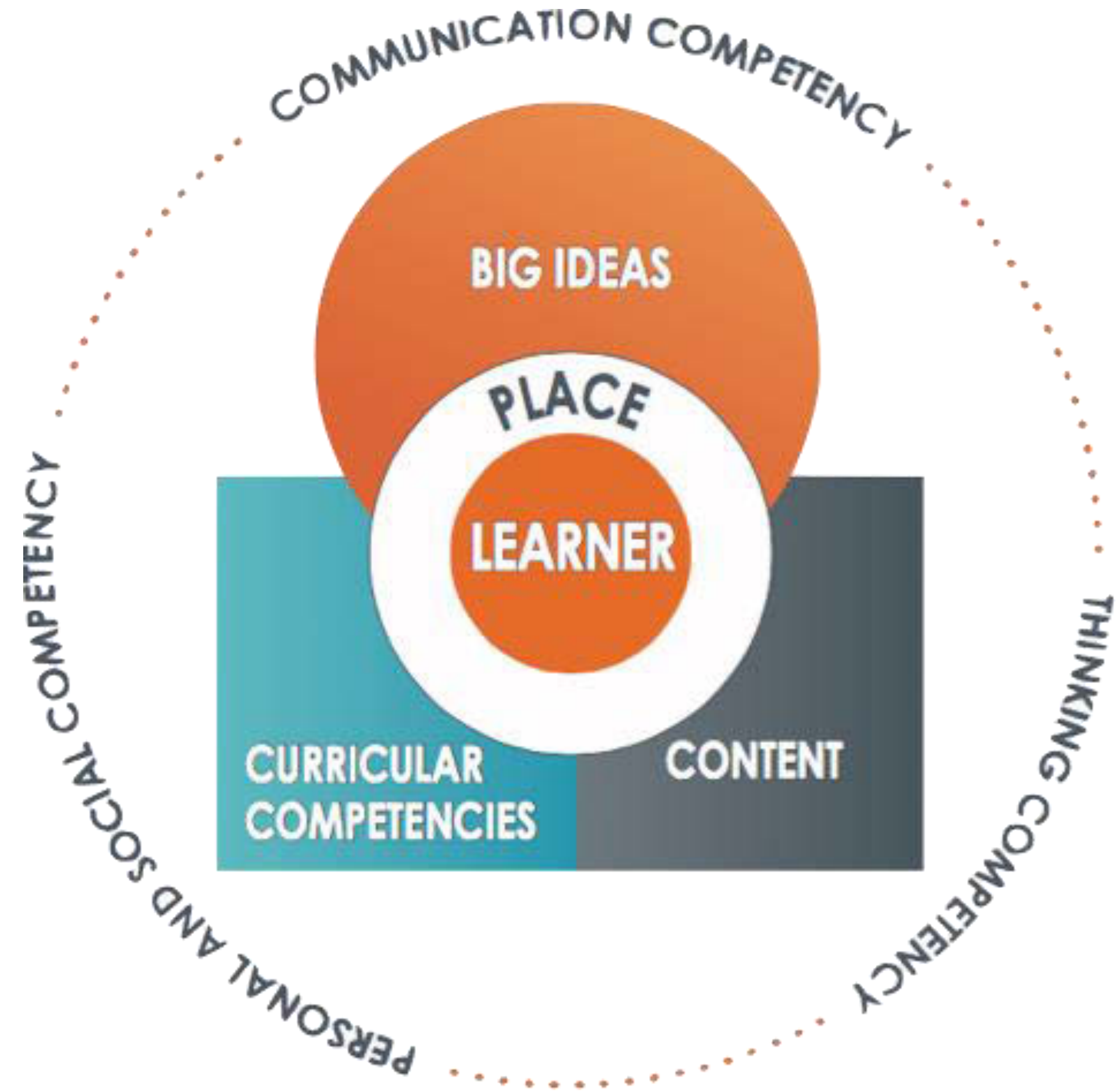
Grade 3 Science - Chemistry

Big Idea

All matter is made of particles.

Content

- atoms or molecules as particles of matter
- properties of materials - related to the particles they consist of


COMMUNICATION COMPETENCY
BIG IDEAS
PLACE
LEARNER
CURRICULAR COMPETENCIES
CONTENT
PERSONAL AND SOCIAL COMPETENCY
THINKING COMPETENCY

BIG IDEAS

Living things are diverse, can be grouped, and interact in their ecosystems (Questions to support inquiry with students: What is biodiversity? What is the relationship between observable characteristics of living things and biodiversity? How does Aboriginal knowledge of living things honour interconnectedness?)	All matter is made of particles. (Questions to support inquiry with students: Why is matter known as the material of the universe? What is an atom? What are its parts?)	Thermal energy can be produced and transferred. (Questions to support inquiry with students: What are the sources of thermal energy? How is thermal energy transferred between objects?)	Wind, water, and ice change the shape of the land. (Questions to support inquiry with students: How is the shape of the land changed by environmental factors? What are landforms? What landforms do you have in your local area?)

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Questioning and predicting** (*Cause and effect is the basic principle that an action will result in a consequence. In science, this concept is closely related to the concepts of pattern and change. However, cause and effect may or may not have a predictable outcome; Key questions about cause and effect: What are some causes of biodiversity in BC's wetlands? What is the effect of wind on mountains?)* • Demonstrate curiosity about the natural world • Observe objects and events in familiar contexts • Identify questions about familiar objects and events that can be investigated scientifically • Make predictions based on prior knowledge **Planning and conducting** • Suggest ways to plan and conduct an inquiry to find answers to their questions • Consider ethical responsibilities when deciding how to conduct an experiment • Safely use appropriate tools to make observations and measurements, using formal measurements and digital technology as appropriate • Make observations about living and non-living things in the local environment • Collect simple data **Processing and analyzing data and information** • Experience and interpret the local environment • Sort and classify data and information using drawings or provided tables • Use tables, simple bar graphs, or other formats to represent data and show simple patterns and trends • Compare results with predictions, suggesting possible reasons for findings	*Students are expected to know the following:* • **Biodiversity** (*biodiversity: the variety of different types of living things in an ecosystem; characteristics of local plants, animals and fungi)* in the local environment • **Aboriginal knowledge** (*the interconnection between living and non-living things in the local environment)* of **ecosystems** • **energy — needed for life** (*producers (plants), consumers (animals), and decomposers (bacteria and fungi) respond to their environment in energy pyramids (flow of energy in the community from the sun) food chains: the flow of food energy from one organism to another (e.g., grass to rabbit to lynx) food webs: interconnecting food chains (e.g., a rabbit may be eaten by a lynx or a wolf))* • **atoms** (the building blocks of matter) or molecules as particles of matter • **properties of materials** (*include density, viscosity, buoyancy, electrical conductivity)* — related to the particles they consist of • sources of **thermal energy** (*thermal energy can be*

Evaluating • Make simple inferences based on their results and prior knowledge • Reflect on whether an investigation was a fair test • Demonstrate an understanding and appreciation of evidence • Identify some simple environmental implications of their and others' actions	*produced by chemical reactions (e.g., hand warmers), friction between moving objects, and the sun.)* • **transfer of thermal energy (***conduction (touching – eg., hold an ice cube);convection (current – why do we hang mittens over a heat source?) radiation (through space by a wave – e.g., heat from the sun) thermal energy transfer- the cause of weather)* • major local **landforms *(****mountains, hills, plateaus, valleys, riverbeds, deltas, glaciers, etc.)* • observable changes in the local environment caused by erosion and deposition by wind, water, and ice

A framework for Inquiry

Significant Content: A focus on important knowledge and concepts derived from standards. Students should find the content to be significant in terms of their own lives and interests.

A need to Know: Activate learner curiosity. Engage student interest and initiate questioning with an entry event: this could be a story, a video clip, a photograph...

A Driving Question: A question that captures the heart of the inquiry in clear, compelling language, giving students a sense of purpose and challenge.

Authentic Purpose: Establishing an authentic purpose for the tasks we invite our learners to explore, enriches learning opportunities.

Voice and Choice: Guided by the teacher, learners have voice and choice in terms of design, what resources they will use and how they structure their time.

Revision and reflection: Learners go through a process of seeking feedback from their peers to think in-depth about their inquiry. Students learn that revision and reflection are frequent features of real-world work.

In-depth Inquiry: Learners follow a trail that begins with their own questions, leading to a search for resources and the discovery of answers and ultimately leads to generating new questions, testing ideas and drawing their own conclusions.

21st Century Competencies: Collaboration, communication, creativity, critical thinking, problem solving and social responsibility.

Adapted from: Larmer, J. & Mergendoller, J. (2010). 8 essentials for project-based learning.

Suggested Ways to Engage Students in Science Inquiry:

Authentic purpose: All matter is made of particles. Atoms, molecules as part of matter properties of matter related to the particles they consist of (density viscosity buoyancy electrical conductivity).

A driving question: Why is matter known as the material of the universe? What is an atom? What are its parts? If liquids, solids, and gases are all matter, why are these states of matter so different from one another?

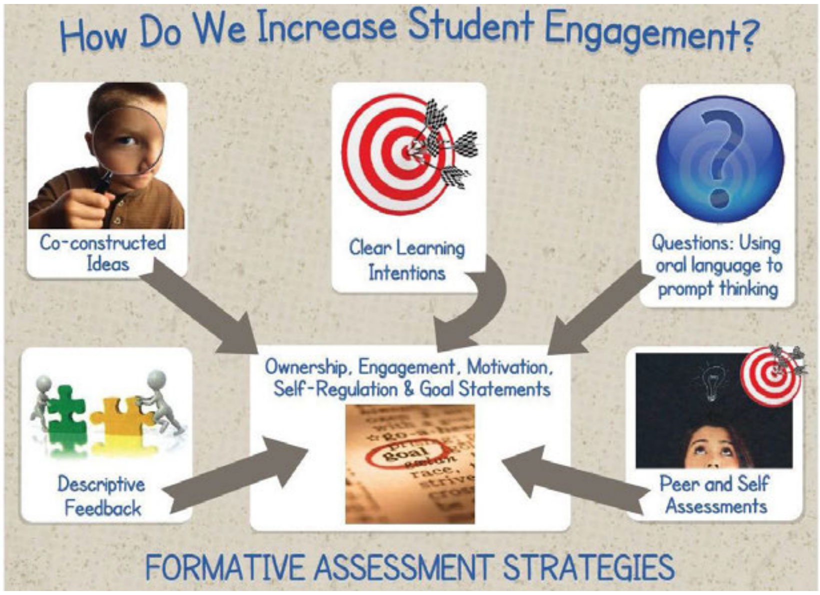
Significant content: Density movie ~ https://www.youtube.com/watch?v=A9LYLZLJV6A
Kit contains density cubes for experimental demonstrations in water

Core competency : Question and Investigate ~ uncovering the mystery of viscosity through everyday science
Slow as molasses ~ 'Racing liquids' activity with eye dropper (please invite parent/buddy volunteers to help with this activity) We suggest you use Styrofoam trays that will not be recycled anyway as ramps for measuring flow **or** plastic cups to pour and conduct this race of liquids. Use prediction mat to proceed the investigation.

Recommended liquids for testing: oil, shampoo & golden syrup. (not provided in kit)

Other options: water, honey, molasses, vinegar, liquid soap, milk or ketchup.

It is so annoying when get to the end of a ketchup bottle and you have to keep banging to get that last bit out. Why is this? Because ketchup is thick and does not flow as easily as other fluids. We call this resistance to flowing ***viscosity***.



Suggested Ways to Embed Assessment *for* Learning Strategies:

Co-construct background knowledge: To pique interest and assess prior knowledge invite questions and wonderings about floating/sinking, sticky/non-sticky.

Prediction map: Students chart their thinking as they compare their predictions to experiment outcomes.

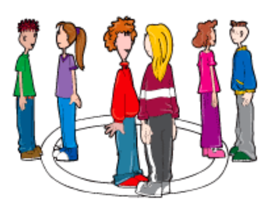
Ownership, engagement: Explore peer presentation through ***Inside/Outside Circle*** format to have students communicate what they have learned throughout their science inquiry. *Inside/Outside circle* can also be used before experiments to share predictions in advance of the experiment. Inside/outside cooperative learning structure addresses both information sharing and communication competency. See attached summary description.

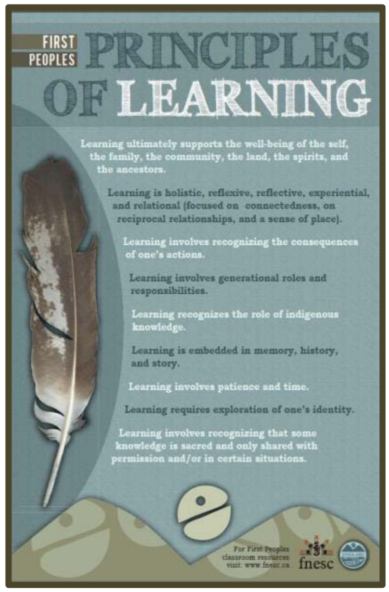
Questioning: "The general public has long preferred answers to questions; certainty to uncertainty. But should they? *After all* questions are the 'kindling for curiosity'……without questions there could be no answer."

Source - Real Clear Science

Why do we get down low in a fire? ~ hot air rises and the air is hot (convection)
Density of gas ~ -density of hot air is less than normal air so gravitation pull is less on hot air so it goes up and normal air comes down.

Self-assessment: "The most productive strategy is to develop our students' ability to give themselves feedback. To start with, a simple approach, sometimes called "plus, minus, interesting" is all that is needed." At the end of a task, ask students to identify something they found easy about the task, something they found challenging and something they found interesting. Such reflections develop language skills and help students become clear about what areas they need to work on. **In science,** for instance, students might be prompted to think about what they would change to improve a science experiment they conducted. Dylan Wiliam (April, 2016 *Education Leadership*).





Suggested Ways to Weave Aboriginal Ways of Knowing within this unit:

Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

Respect for the well-being of the land: Trip to Cathedral Grove, Seal Bay, Nymph Falls (close to the fish ladder there are cedar trees where you can see evidence of cedar stripping). Nature detectives - paying special attention people's private land.

Exploring Buoyancy in this science strand leads quite nicely to place – based learning. Why choose cedar?
Test out different local woods (bag of wood rounds in kit & nearby forest pieces). Travelling along the steep rocky shore or in the dense rainforest was next to impossible, coastal Natives had to travel from place to place by water. They needed boats that could be paddled far out to sea in order to catch the fish which was their major food source and also to travel up and down the coast to trade and attend potlaches. The **canoes** that coastal First Nations built were made from tall cedar trees without the tree felling and woodworking tools, such as the saw and axe which we use today. The cedar was felled and hollowed by lighting a small fire at the base with the fire being fed with cedar bark until a large hole was hollowed. When the tree was on the ground it was slowly shaped with a small D-shaped hand held tool called an "adze". The wood was shaped using hot water and cross pieces of wood in order to make the canoe wider in the middle and narrow at the ends. In order to make the canoe as smooth as possible, the rough skin of the dogfish (which acted like sandpaper) was used. Finally the canoe was greased with whale oil to preserve it and ensure it a long life. Source: web.uvic.ca

Maple syrup in Canada **Health benefits of maple sap and syrup:**

- Maple syrup is high in minerals such as potassium, calcium, magnesium, manganese, iron and zinc.
- Maple sap or water can boost energy without spiking your blood sugar level.
- First Nations people used to drink maple sap at the end of every winter to help rejuvenate the body and regain vitamins and minerals that were lost due to an unvaried winter diet of dehydrated food.
  - Maple syrup industry growing in the Comox Valley http://www.comoxvalleyrecord.com/news/161509765.html
  - Also see BIG LEAF maple syrup website for additional information

C T PS

Resources Page

Videos

Buoyancy: What makes something float or sing? ~ https://www.youtube.com/watch?v=nMlXU97E-uQ

Sink or Float? ~ https://www.youtube.com/watch?v=eQuW8G2QV_Q

Density movie ~ https://www.youtube.com/watch?v=A9LYLZLJV6A

Electrical Conductivity ~ https://www.youtube.com/watch?v=QZPURSF5iH4

Heat (particles of matter)~ http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/heat.htm

Symphony of Science – the Quantum World 3:28 (a bit advanced/great tune!)
https://www.youtube.com/watch?v=DZGINaRUEkU&feature=related

Bill Nye the Science Guy Atoms & Molecules 18:03 https://www.youtube.com/watch?v=JcZNWVtUqDU

Bill Nye the Science Guy on Heat 2:05 https://www.youtube.com/watch?v=f1eAOygDP5s

Fun way to explore Viscosity with Kids: http://www.mykidsy.com/blog/2014/05/fun-way-to-explain-viscosity-to-children/

Teacher resources

http://www.mykidsy.com/blog/2014/05/fun-way-to-explain-viscosity-to-children/

Chemistry for Kids: http://www.chem4kids.com/files/atom_structure.html

Adventures in learning: Electric Playdough and Circuits for kids ~ lots of prep required
https://www.youtube.com/watch?v=I3EwE5ILSVQ

http://intheplayroom.co.uk/2015/04/14/electric-play-dough/

Explanation of Inside/Outside Collaborative Learning Structure:
http://eworkshop.on.ca/edu/pdf/Mod36_coop_inside-outside.pdf

Properties of Materials Science background:

Vocabulary:

Words to describe properties ~ hard, soft, strong, weak, touch, brittle, stiff, rigid-flexible, absorbent, waterproof, magnetic, non-magnetic, wear and tear, smooth, rough, transparent, opaque, translucent

Names of a variety of materials ~ wood, metals, copper, tin, steel, gold, silver, aluminum, chrome, plastic (polythene, polystyrene, PVC, fabrics), cotton, silk, polyester, wool, acrylic, foam, glass, rubber

Precise Scientific vocabulary for testing the properties of materials:

Hardness: Resistance to scratching and pressure. Hardwood does not mark as easily as softwood.

Strength: Amount of force needed to break a material usually by pushing or pulling down. Toughness: Resistance to breaking by cracking, opposite to 'brittle'.

Stiffness: Amount of force needed to change the shape of a material, opposite to flexible. Elasticity: Ability to return its original shape when a force is removed eg rubber band.

Plasticity: Ability to retain the new shape when a force is removed eg plasticene.

Absorbency: Ability of a material to soak up a liquid.

Waterproof: Resistance to liquids, repels water.

The property of a material can change according to how the material is treated; clay is very different once it has been fired, rolled up newspaper is very different to a sheet of newspaper.

Source :primaryresources.co.uk

Atom: The Building Blocks of Everything

Atoms (tiny particles that make up everything around us)

Molecules: 2 or more atoms joined together; Atoms are the smallest pieces of matter; they are made of particles (protons and electrons). When atoms are grouped together, these groups are called molecules (the smallest pieces of compounds).

-**use tinfoil** and rip it up demonstration; each student rips foil in half and in half again until his/her individual piece cannot be ripped any smaller; encourage students to imagine what would happen if they kept ripping the pieces – the pieces would be so small that you would have to look at it under a microscope and it would no longer be aluminum. When you get to that smallest piece it is called an atom

-**dramatize the molecules in solids, liquids and gases**. Have students model molecules in three states of matter. In a solid the molecules are packed tight. Ask students to model a solid by linking arms so they are packed tightly in a group. They can wiggle a little but the group maintains its shape. Students may model a liquid by spreading apart and moving around more but they must be touching at least another student with an outstretched arm. To model a gas students break all bonds spreading to fill out the room.

Viscosity – the resistance to flow, often in liquids but also in gases. How fast a liquid flows depends on its viscosity and the slower the flow the higher the viscosity of the liquid (or gas). A fluid with higher viscosity resists motion because of the molecular structure which creates a lot of internal friction within the liquid. Low viscosity flows easily because its molecular structure results in very little friction when it is in motion. (Source: http://anordinary-life.blogspot.ca/) Water flows quickly (low viscosity) and syrup flows slowly (high viscosity).

-Racing Liquids: pouring, testing, timing liquids as they flow down a ramp or chart stand

-Oobleck BEAM Lesson plan included in kit : http://beam.ucla.edu/sites/default/files/docs/Oobleck.pdf

-Viscosity Bottles Lesson plan included in kit (liquids not provided):

http://anordinary-life.blogspot.ca/2014/03/science-viscosity-bottles.html

Density – our senses tell us when an object is larger and heavier. "Density, however, is a *relational* concept. It depends upon relating many other concepts –weight, mass, volume, material, measurement, proportionality – that themselves are all under development by a young child. A concept of density emerges as children puzzle about and seek deeper explanations for why objects weigh what they do or why some things might sink or float in a given liquid."

Source: Carol L. Smith '*Why is density so hard for students to learn and for teachers to teach?*'

-Examining **density cubes** from the kit

-"Three-Layer Float" lesson from Science World included in kit (Source: bagofscience)

-"Floating Rock/Sinking Wood" lesson from Science World included in kit

Materials: piece of ironwood, pumice stone, playground rock and stick

Many density lessons available through a search of Steve Spangler Science: Density divers, Sinking soda surprise, Liquid layers, Magic Spheres , Marbled mystery; Seven Layer Destiny Column

Explanation of Density: http://anordinary-life.blogspot.ca/2013/05/what-is-density.html

C T PS

Buoyancy – the force exerted on an object immersed in fluid. It is usually directed up.

Why did Aboriginal people choose cedar for their canoes? Test various rounds of wood to see which floats the best. Discuss also properties of cedar (carves easily, pliable, light softwood, low density etc.)

Build boats from various materials to see which is most buoyant. Investigate life jackets.

Experiments:

- "Up or Down" Science World Experiment in kit
  Kit materials for small groups: corks, Styrofoam, popsicle sticks, candles
  Other classroom objects: coin, grape, apple, lego piece
- "Demo Magic Ketchup" experiment:
  Materials 1 litre plastic bottle, ketchup pack, Kosher salt www.sciencebob.com

Electrical Conductivity : What things conduct electricity?

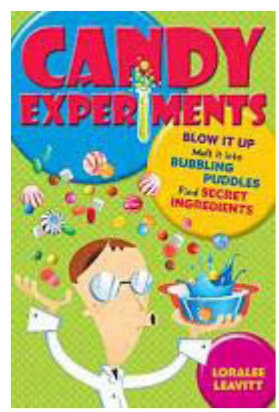
- try putting electrodes on glass, wood, ebonite rods, salt, plastic straw, cut up acetate strips, lemons, potato clock (kit materials ; food items not included)

Materials: batteries/leads (two wires)/lights, banana clips or alligator clips; potato clocks

- experiment with what conducts electricity and what doesn't using a simple circuit and explore play dough's conductivity & insulating properties with *squishy circuit activities* (will be in a supplemental kit available from the LRC; order kit separately)

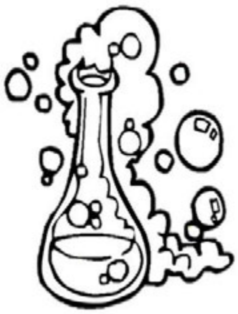
Books found in Kit:

<u>What Floats in a Moat?</u> Lynne Berry
<u>Who Sank the Boat?</u> Pamela Allen
<u>Captain Kidd's Crew Experiments with Sinking and Floating</u> Mark Weakland
<u>Things That Float and Things That Don't</u> David A. Adler
<u>What Floats? What Sinks? A Look at Density:</u>Jennifer Boothroyd (Lightning Bolt Books)
<u>First Science Density</u> Kay Manolis



<u>Experiments recommended from Candy Experiments #1:</u> Digital Version available through Destiny (materials not included in kit)

Pg. 46 The Light Candy Bar with a Muskateers Bar (would an Aero Bar work?)
Pg. 48 Float the Boat – materials taffy or starburst candies
Pg. 50 Float the Unfloatable – materials soda & candy show pictures of folks reading newspaper in the dead sea, 'it is like a bubble lifejacket) Soda also contains sugar making it denser than water
Pg. 53 Sink the Unsinkable - materials mini Twix bars and vegetable oil; the bars float in water because they are less dense but oil is less than water making it less dense



Comparing results with my predictions

- Yellow: I can do this **independently**.
- Blue: I can do this **with guided support.**
- Orange: I can do this **with direct support.**

Learning Target	I can predict and suggest possible reasons for my findings.	
I can predict what might happen in an experiment.		When I compared my results to my predictions, I found ____ ____ ____ Diagram with labels
I can compare my predictions to what the results were.		
I get ideas when I use my senses to explore.		
I can share what I learned from the experiment. (inside/outside circle)		
I am an active listener. I support and encourage the person speaking. (inside/outside circle)		

Science: Viscosity Bottles

This last week I have been thinking of the next science group and I want to make it even more hands on for the kids...

The next science session is about **volcanoes** and one of the things I want to do is to show the children about viscosity without them getting messy like it can be in The Lava Viscosity Test.

It is a great little experiment but it can get very messy with a lot of people around. That is when I remembered something I had seen at The Science Museum last year. I can't afford any specialist equipment but it did inspire me to start thinking about how it could be done using the things I have in the house and I came up with viscosity bottles!

It worked out great with my four girls; my girls could 'play' with science safely while I got dinner on and the three year old was thrilled that she could do science ***all by herself***; learning more independently.

This is how I made ours and some ideas of how to turn it into a science experiment...

You will need:

- 8 small clear empty plastic bottles - we used water bottles
- Treacle
- Golden syrup
- Washing up liquid
- oil
- Electrical tape
- Scissors
- A funnel

STEP ONE
Put about 2cm high of oil in one bottle

STEP TWO

Put the second bottle on top and secure so nothing can leak out with electrical tape.

It's that simple. You have made a viscosity bottle!

To make your other three viscosity bottles repeat **STEP ONE** and **STEP TWO** except using the treacle instead of oil.

Repeat again with golden syrup as your liquid for the last viscosity bottle use the washing up liquid. This way you have four viscosity bottles ready to explore!

TIP: With the treacle and golden syrup I used a funnel to reduce the amount of mess.

You can just use them to observe how different liquids have different amounts of viscosity.

- The thicker the liquid the slower it runs and the higher the viscosity
- The thinner the liquid the faster it runs and the lower the viscosity.

Other things you can try...

EXPERIMENT

- Turn all the viscosity bottles at the same time and see which liquid gets to the other bottle first and which one gets there last.
- Ask which has more/less viscosity to get children used to scientific terms.
- Also get a timer out and time how long it takes each one to empty from one bottle to the other.
- You could make graphs to show your findings if you like.

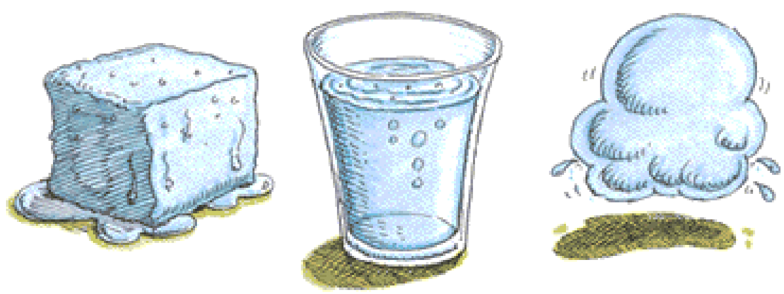
DEFINITION OF VICOSITY: ***The state of being thick, sticky and semi-fluid in consistency, due to internal friction.***

Lesson Plan for Oobleck

Written by Liz Roth-Johnson

Introduction/Background Info

The everyday materials around us generally fit into one of three categories: solid, liquid, and gas. Along with plasma, these three categories represent the different possible states of matter. A table is solid, while the air we breathe is a gas. Some materials can even transition between the different states. For example, water can exist as a solid (ice), a liquid (water), or a gas (steam or vapor) as shown here.



Water can exist in different states of matter (from wateronthemove.wikispaces.com)

In this lesson, we will explore the properties of "oobleck" – a simple mixture of cornstarch and water. Oobleck is unique because it can behave as both a solid *and* a liquid. Many centuries ago, Sir Isaac Newton proposed that fluids should flow at a predictable, constant rate. Many fluids do indeed behave this way and are called "Newtonian" fluids. Water is a perfect example of a Newtonian fluid: when you are in a swimming pool, water flows around you whether you are moving around quickly or slowly.

However, as you will soon discover for yourself, oobleck does not behave as a typical Newtonian fluid. Oobleck belongs to a class of materials known as "non-Newtonian" fluids. Unlike water and other Newtonian fluids, non-Newtonian fluids respond differently depending on how quickly you try to move them around (the "strain rate"). If you could go swimming in a pool of oobleck, the oobleck would feel like a liquid when you moved slowly, but would act like a solid if you tried to swim around quickly.

There are many examples of non-Newtonian fluids, and understanding the behavior of non-Newtonian fluids is important for many areas of scientific research. For example, the food industry deals with many non-Newtonian fluids including ketchup, mayonnaise, jelly, and cranberry sauce. Understanding how these materials behave helps food scientists make more tasty food products. Biologists studying cells are also interested in non-Newtonian fluids because the goopy insides of cells behave as non-Newtonian fluids and this influences many cellular processes. Engineers are even finding ways of putting non-Newtonian fluids to good use in our everyday lives by using them to fill potholes!

Student Objectives

- Understand qualitatively what distinguishes solids and liquids
- Observe the non-Newtonian characteristics of oobleck first-hand
- Be able to make simple predictions about the behavior of non-Newtonian fluids

Overview of Lesson Process

- Introduce the states of matter and brainstorm properties of liquids and solids (10 min)
- Break into smaller groups and make oobleck. Determine whether it behaves more like a solid, a liquid, or a combination of the two (15 min)
- Continue playing with the oobleck to establish how its behavior relates to strain rate (15 min)
- Review and discuss the findings of your oobleck experiments. Brainstorm other non-Newtonian fluids in everyday life and discuss potential uses for non-Newtonian fluids (10-15 min)
- Clean up any oobleck messes you might have made (5-10 min)
- If there is extra time at the end, show students fun oobleck videos (5-10 min)

Materials

Water	½ cup per group		$0.00
Cornstarch	1 cup per group	Smart&Final	$10.00
Bowls	1 per group	OfficeMax (20142757) 125 bowls	$31.99
Spoons	1 per group	Smart&Final	$10.00
Ziploc bags	1 per group	OfficeMax (23076234) 500 bags	$30.49
Food coloring	A couple drops per group	Smart&Final	$5.00
			Total **$87.48**

Procedures

Part 1: Liquids & Solids

1. As a group, brainstorm the different properties of liquids and solids. Write down your ideas. *Some examples: liquids flow, splash, take the shape of the container they are in; solids hold their shape, resist forces like pushing or hitting.*
2. In small groups, make a bowl of oobleck:
    a. Put 1 cup of cornstarch in a bowl and add 1-2 drops of food coloring (optional).
    b. Slowly add up to ¾ cup water while mixing, until all the cornstarch is wet.
    c. Keep adding water until the oobleck feels like a liquid when mixed slowly.
    d. Oobleck is done when it is no longer powdery (needs more water) but doesn't splash when hit with a spoon (needs more corn starch).
3. Use the list you made in step one to systematically test whether oobleck behaves like a solid or a liquid. It may be helpful to also test a bowl of pure water for comparison with a "true" liquid. *Does the oobleck flow? What happens when you squeeze it in your hand? Hit it with a spoon? What happens to the water when you do the same?*

Part 2: Understanding Oobleck and Non-Newtonian Fluids

4. After establishing that oobleck can act like a solid *and* a liquid, explore how these behaviors relate to the "strain rate" – how fast you try to move or perturb the oobleck.
    a. Try stirring the oobleck with your finger. If you stir quickly, the oobleck should resist. If you stir slowly, the oobleck should give way.
    b. Try modeling quicksand (another non-Newtonian fluid) by letting your fingers sink to the bottom of the bowl and trying to remove them quickly. What happens?
    c. Try your hand at levitation! Put the oobleck into a lightweight bowl or cup. Dip your fingers or a spoon into the oobleck and then quickly lift upward. You should be able to momentarily bring the entire container up in the air before it starts falling down.

Part 3: Wrap-Up Discussion

5. Review your findings from playing with the oobleck. Was it solid, liquid, or both? How did it's liquid-like and solid-like properties correspond to how quickly or slowly you moved the oobleck? *Sir Isaac Newton proposed that fluids should flow at a predictable, constant rate. While this is true for many fluids, like water, some fluids like our oobleck behave differently when different rates of forces are applied to them. These types of fluids are called "non-Newtonian" fluids.*
6. Brainstorm some everyday examples of "non-Newtonian" fluids. *Some examples: ketchup, jelly, mayonnaise, cranberry sauce, blood, quicksand, and silly putty.*
    a. Note that there are different types of non-Newtonian fluids. Some (like oobleck and quicksand) become more solid as you try to move them, while others (like ketchup and mayonnaise) actually become more liquid as you try to move them!
7. Try to think of some useful applications for a non-Newtonian fluids like oobleck. Some college students recently came up with the idea to fill potholes with bags of non-Newtonian fluid. The oobleck flows slowly to fill the pothole but responds like a solid when a car drives over it.
8. If there is more time at the end, show the students some fun videos.
    a. Non-Newtonian pothole fillers (1 min): http://youtu.be/XrvzZewPUJA
    b. Oobleck on speakers (1.5 min): http://youtu.be/3zoTKXXNQIU
    c. Walking on oobleck (20 sec): http://youtu.be/bIOGL4eZnjs
    d. Sinking in oobleck (40 sec): http://youtu.be/Lb9kt1z3jAA
    e. Time Warp high-speed (6 min): http://youtu.be/S5SGiwS5L6I

Resources

Here are a few good websites with instructions and ideas for playing with oobleck:

Kidzone: http://www.kidzone.ws/science/cornstarch.htm
Exploratorium: http://www.exploratorium.edu/science_explorer/ooze.html
Science Bob: http://www.sciencebob.com/blog/?p=608

Worksheet for Oobleck

We usually think of the materials around us being a solid, a liquid, or a gas. In this activity, you will investigate a strange material called *oobleck*.

With your class, create a list of the different properties of liquids and solids:

Properties of Liquids	**Properties of Solids**

With your group, test all of the solid and liquid properties from the two lists you just made. Circle the properties that describe how oobleck behaves.

Does oobleck behave like a liquid, a solid, or both?

Can you think of any other materials that behave like oobleck?

What is one way engineers have used a material like oobleck to help people?

The 3 Layer Float

Have you ever wondered why wood floats and rocks sink? The answer is density. Density is simply the measurement of how solid something is. This experiment will show the different density of 3 substances and 3 objects.

Gather Your Materials:

Oil
Water
Honey
Coin
Cork
Grape
Tall Clear Cup

Begin the Science Experiment Procedure:

1. Fill 1/3 of the tall clear cup with honey.
2. Fill the next third with oil.
3. Fill the last third with water.
4. Wait a minute and let all three substances settle.
5. Carefully drop in the coin, then the grape and then the cork.

Results and Observations:

Answer these questions as you make your observations:

1. What layer is the water?
2. What substance settled on top?
3. What happened to the coin?
4. What happened to the grape?
5. What happened to the cork?

Now that you have made your observations it's time to determine the results. Discuss these questions to reach a conclusion:

1. What substance has the highest density? (bottom liquid)
2. What substance has the lowest density? (top liquid)
3. What object has a higher density than honey?
4. What objects have a higher density than water?
5. What object has the lowest density?

For a little extra fun, stir the contents of the glass and watch what happens!

Floating Rock/Sinking Wood

Go Back
Print

Activity Length:

10 mins.

Introduction

This demonstration introduces the students to the idea that large objects do not necessarily have a higher density than small objects

Just because something has more mass (or is bigger) does not mean it is has a higher density. Density depends on how much mass is packed into a given volume (i.e., if you had the same volume of two things, the one with more mass would have a higher density). A quick way of describing density is to describe an object as heavy or light for its size.

Pumice stone, unlike regular rock, does not sink in water because it has a low density. Pumice stone is igneous rock formed when lava cools quickly above ground (lava froth). You can clearly see where little pockets of air have formed.

Ironwood is a common name for a large number of species of wood that are very hard. Our “local” species, the American Hop Hornbeam (*Ostrya virginiana*), is found in central and southern Ontario. This very hard wood is resistant to compression and is valued for making tool handles and fence posts. The ironwood branch is very dense and sinks in water.

What To Do

1. Show the students the two sticks and two rocks.

2. Ask them to predict what will happen when each object is placed in the water. Ask them what they base their predictions on.
3. Put the objects in the water individually or as pairs. (The regular rock and piece of ironwood will sink; the pumice stone and regular stick will float.)
4. Let the students handle the objects to feel the weight (mass) of each.

Objectives:

- Demonstrate how the distribution of particles in a substance determines its density.

Materials:

- 1 large, clear container of water
- 1 large piece of pumice stone (can be ordered through Teacher Source or Boreal or purchased at a drugstore)
- 1 smaller “regular” rock
- 1 small branch of ironwood (from Teacher Source search for 'wood')
- 1 larger “regular” branch

Key Questions:

- How does the ironwood compare to the regular stick?
- How does the pumice stone compare to the regular rock?
- How could you measure the relative densities of unknown objects?

Extensions:

- Explain that the density of a substance or an object remains regardless of its size. Cut or break off a small piece of wood from the larger piece. Show that they both float, despite the small piece being “light” and the big piece being “heavy.”
- Try this activity with different brands of soap bars. Predict which brands (if any) will sink and which brands (if any) will float. Why do some kinds of soap float and some kinds sink? (Dove soap contains air bubbles.)

Other Resources

Science World Resources | Full Unit | Floaters and Sinkers

Up or Down?

Go Back
Print

Activity Length:

15-25 mins.

Introduction

Students learn how to make predictions about an object's density and how to test their predictions by seeing if it sinks or floats.

Objects that are more dense (heavier for their size) than water will sink, and objects that are less dense than water will float. Density is measured as mass/volume and because a litre of pure water has a mass of 1 kilogram, water has a density of 1.0 kilogram per litre. Objects with a density less than 1 kg/L will float, and objects with a density higher than 1kg/L will sink.

What To Do

Preparation

1. Fill 4 or 5 buckets with water and set them up at stations around the room.
2. Place at least 6 different objects by each bucket.

Instructions

1. Divide the students into 4 or 5 groups, each assigned to one bucket station.
2. Ask students to study the objects at their station and to predict which will sink and which will float in the bucket of water. Ask them to write down their predictions.
3. Students then test each object individually and note down their observations.

4. Once all the objects have been tested, ask the groups to discuss their results and come up with an explanation of why some objects float and some sink.

Objectives:

- Predict, test and explain the relative densities of everyday objects through investigating their interaction with water

Materials:

- 1 Bucket or large container full of water
- 1 “Up or Down” prediction card
- 6 or more various objects such as the following: coin, grape, apple, LEGO piece, cork, styrofoam, popsicle stick, candle

Key Questions:

- Why do some objects float and others sink?
- Does shape matter? How do you know?
- Does weight matter? How do you know?
- Does size matter? How do you know?
- How could we test out hypotheses about what makes something float or sink?
- Which objects are denser than water? Which objects are less dense than water?

Extensions:

- Can we change a sinker to a floater and vice versa? What kinds of changes will cause this?
- Challenge students to find or create a “flinker,” something that doesn’t quite sink and doesn’t quite float.

Other Resources

Science World Resources | Full Lesson & other activities | Floaters and Sinkers

THE MAGIC KETCHUP EXPERIMENT!

YOU WILL NEED:

- A 1 liter plastic bottle
- Ketchup pack from a fast food restaurant
- Salt (using Kosher salt helps keep the water from becoming foggy)

WHAT TO DO

1. Remove any labels from the bottle and fill it all the way to the top with water.
2. Add a ketchup pack to the bottle.
If the ketchup floats, you're all set – go to step 3. If the ketchup sinks in the bottle, go to step 4.
3. For the floating ketchup pack simply screw the cap on the bottle and squeeze the sides of the bottle hard. If the ketchup sinks when you squeeze it, and floats when you release it, congratulations, you're ready to show it off. If it does not sink when you squeeze it, try a different kind of ketchup pack or try a mustard or soy sauce pack.
4. If the ketchup pack sinks, add about 3 tablespoons (45 ml) of salt to the bottle. Cap it and shake it up until the salt dissolves. (Kosher salt will keep the water from getting too cloudy, although it will usually clear up over time if using regular table salt.)
Continue adding salt, a few tablespoons at a time until the ketchup is just barely floating to the top of the bottle.
Once it is consistently floating, make sure the bottle is filled to the top with water, and then cap it tightly.
Now squeeze the bottle. The magic ketchup should sink when you squeeze the bottle and float up when you release it. With some practice you can get it to stop in the middle of the bottle.

HOW DOES IT WORK?

This experiment is all about buoyancy and density. Buoyancy describes whether objects float or sink. This usually describes how things float in liquids, but it can also describe how things float or sink in and various gasses.

Density deals with the amount of mass an object has. Adding salt to the water adjusted the water's density to get the ketchup to float. Sound complicated? It is, but here's the basics on the ketchup demo…there is a little bubble inside of the ketchup packet. As we know bubbles float, and the bubble in the ketchup sometimes keeps the heavy packet from sinking. When you squeeze the bottle hard enough, you put pressure on the packet. That causes the bubble to get smaller and the entire packet to become MORE DENSE than the water around it and the packet sinks. When you release the pressure, the bubble expands, making the packet less dense (and more buoyant) and, alas, it floats back up. This demonstration is sometimes known as a CARTESIAN DIVER.

MAKE IT AN EXPERIMENT:

The project above is a DEMONSTRATION. To make it a true experiment, you can try to answer these questions:

1. Do different food packs (ketchup, mustard, soy sauce) have the same density?

2. Does the temperature of the water affect the density of the ketchup packet?

3. Does the size of the bottle affect how much you have to squeeze to get the packet to sink?

Prediction Map

Scientists make predictions about what will happen before they do an experiment. Think like a scientist and share your thinking with pictures and words!

Predict what will happen:	Experiment results:	Compare your predictions to your results:

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STEM Process Tool

Look Around
(What observations can you make?)

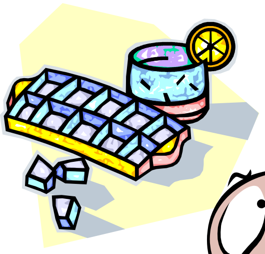
Ask Questions
(What questions come to mind?)

Get an Idea
(What would happen if…What is your hypothesis?)

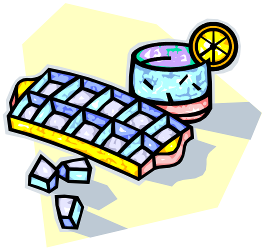
Try It Out
(Test it! Experiment!)

Think Again
(Analyze your findings…What did you discover?)

Make Sense of It All
(Explain your findings…What did you learn?)



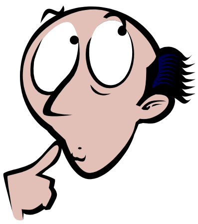
Will an ice cube float?



Yes ☐ No ☐

Why?	What actually happened?

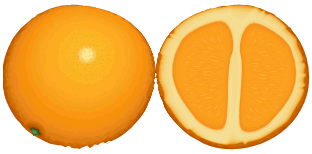
If the water had salt in it, would it have an effect on the ice cube?



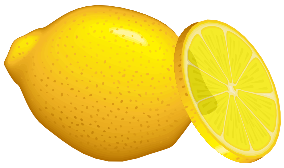
Yes ☐ No ☐

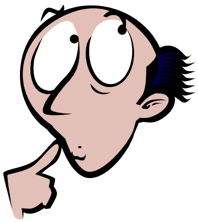
Why?	What actually happened?

Why do you think that happened?



Will the orange/lemon float if you put it in water?



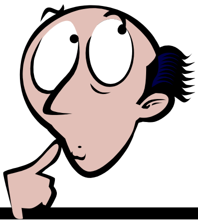


Yes ☐ No ☐

Why?

What actually happened?

Will it float if you take the peel off?



Yes ☐ No ☐

Why?

What actually happened?

Why do you think that happened?

floats	sinks

Which of these objects sinks or floats? Test them out using the water tank to find out. Tick the box; **yes** or **no**!

Object	Yes	No
 Pebbles		
 Sponge		
 Corks		
 Paper Clips		
 Pennies		
 Lego Bricks		
 Marbles		
 Plastic Spoon		

Can you test some other objects to find out if they sink or float?

An electronic copy of this teacher guide can be found on Learn71 at
https://portal.sd71.bc.ca/group/wyhzgr4/Pages/default.aspx

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