Anglophone School District - North

Grade 7 Science - Unit Lesson Guide

Mixtures and Solution

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The Aim of Science Education - Scientific Literacy

The aim of science education in the Atlantic Provinces is to develop scientific literacy.

Scientific Literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

The Three Processes of Scientific Literacy

An individual can be considered Scientifically Literate when he/she is familiar with, and able to engage in, three processes: Inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanation for phenomena. While there is a general agreement that there is no such sing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important to their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Assessment Overview

Science is a hybrid term that houses different disciplines such as: Physics, Chemistry, Biology, Environmental Studies, Engineering, Math, etc. Given this broad spectrum, it is not realistic that we can paint science assessment with a single brush in terms of probes that work for every science activity. However, regardless of school subject, let alone science, the frequency of assessment should be unbalanced with formative assessment occupying 80% of practise and summative with the remaining 20%.

80% Formative - 20% Summative

Formative Assessment
Formative assessment is a range of formal and informal assessment procedures employed by teachers during their learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both students and teacher that focuses on the detail of content and performance. Feedback is the central function of formative assessment. It typically involves a focus on the detailed content of what is being learnt.

Science Formative Assessment falls into 2 distinct categories, and they are divided about how feedback is given. Please be aware that an activity could be informal or formal, it is the purpose of the task that determines purpose.

Informal Formative
Informal Formative Science Assessment acts as a monitoring probe and is distinct because it is not graded.

Formal Formative
Formal Formative Science Assessment provides specific feedback to students, the teachers corresponds via anecdotal feedback, rubrics, and written responses to offer progress to student attainment.

Summative Assessment
Summative assessment seeks to monitor educational outcomes, often for the purposes of external accountability. Usually occurring at the end of a learning unit and determines if the content being taught was retained.

Mixtures and Solutions

Focus and Context

The focus in this unit is on inquiry, with an emphasis on making observations. Students should have opportunities to make and examine various types of solution (solid in a liquid, liquid in a solid, liquid in a liquid, for example) and devise activities for separating them according to their physical properties. The concept development of the particle model of matter with regard to pure substances and mixtures is one of the key components of the unit. Exploring common and easily made mixtures in the students' environment should be the focus of the unit. Students can use various common materials and technologies to help them separate the component parts of mixtures and solutions.

image source:http://studycasts.wikispaces.com/

Unit Instructional Overview

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* - EECD Grade 7 Inquiry package - available at https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx

Mixtures and Solutions - Curriculum Outcomes

Mixtures*	Solutions*	Concentration of Solutions	Mixtures, Solutions and the Environment
109-10 relate the formation and separation of everyday mixtures and solutions to disciplines such as chemistry and engineering	307-1 distinguish between pure substances and mixtures, using the particle theory of matter: pure substances vs mixtures; heterogeneous mixtures; homogeneous mixtures	307-4 describe the concentrations of solutions qualitatively, using the terms *dilute, concentrated, saturated, and unsaturated*	112-7 provide examples of how science and technology, related to mixtures and solutions, affect our lives
209-6, 307-2 safely using tools and apparatus, identify and separate the components of a variety of mixtures, using: - mechanical sorting - filtration - evaporation - distillation - paper chromatography	109-14, 307-3 describe the characteristics of solutions, using the particle model of matter and the terms: - solute - solvent - dissolving - soluble	109-7 identify different ways that concentrations can be demonstrated for various substances	113-1 identify some positive and negative effects intended and unintended consequences or a particular scientific or technological development related to mixtures and solutions
		210-9 calculate concentrations of solutions in g/L	
		208-1 rephrase questions related to solubility in a testable form and clearly define practical problems	109-4 provide examples showing the evolution of refining and separation techniques
	111-5 describe the science underlying a distillation apparatus	208-6, 209-1 design and cary out procedures to study the effects of temperature on solubility	
		210-7 identify and suggest explanations for discrepancies in data after carrying out procedures designed to study the effect of temperature on solubility	
210-16 identify new questions and problems about mixtures that arise from what was learned	209-7 demonstrate a knowledge of WHMIS standards by recognizing the following warning labels symbols	210-4 predict the solubility of a solute by interpolating or extrapolating from graphical data	
		307-5 describe qualitatively the factors that affect solubility: Temperature Pressure	
		209-3 use a commercial or student made hydrometer effectively and accurately for collecting data	

Mixtures and Solutions
Strand - Mixtures

General Curriculum Outcomes	Specific Curriculum Outcomes
109-10 relate personal activities in formal and informal settings to specific science disciplines	109-10 relate the formation and separation of everyday mixtures and solutions to disciplines such as chemistry and engineering
209-6 use tools and apparatus safely	209-6, 307-2 safely using tools and apparatus, identify and separate the components of a variety of mixtures, using: -Mechanical Sorting - Filtration - Evaporation - Distillation - Paper Chromatography
307-2 identify and separate the components of mixtures	
210-16 identify new questions and problems that arise from what was learned	210-16 identify new questions and problems about mixtures that arise from what is learned

Strand - Solutions

General Curriculum Outcomes	Specific Curriculum Outcomes
307-1 distinguish between pure substances and mixtures, using the particle theory of matter	307-1 distinguish between pure substances and mixtures, using the particle theory of matter: - Pure substances vs mixtures - Heterogeneous mixtures - Homogenous mixtures
109-14 explain the importance of using precise language in science and technology	109-14, 307-3 describe the characteristics of solutions, using the particle model of matter and the terms: - Solute - Solvent - Dissolving - Soluble
307-3 describe the characteristics of solutions, using the particle model of matter	
111-5 describe the science underlying particular technologies designed to explore natural phenomena, extend human capabilities, or solve practical problems	111-5 describe the science underlying a distillation apparatus
209-7 demonstrate a knowledge of WHMIS standards by using proper techniques for handling and disposing of lab materials	209-7 demonstrate a knowledge of WHMIS standards by recognizing and following warning labels symbols

Lab Safety

Outcomes:
209-7 demonstrate a knowledge of WHMIS standards by recognizing and following warning labels symbols

Lesson Activity Overview:
Before students begin to work with any type of chemical, there should be an introductory activity to lab safety. Specifically, an understanding of the WHMIS symbols that identify the potential dangers of certain chemicals. At the teachers discretion, based on the physical set up of the schools science lab, ensure that students have the knowledge of:
Responsibilities of the Student
Middle School Restrictions
WHMIS

From the NB Science Safety Guidelines Document
https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx - Related Documents
Responsibilities of Science Students - page 10
Science students have a responsibility to:
• listen and follow the instructions of the teacher in the science lab and behave safely and responsibly
• not perform any experimental activity in the lab without the expressed permission of the teacher or without the teacher's supervision
• report to the teacher immediately any dangerous situations or accidents

A student will be suspended from participating in current and future laboratory activities after refusal to follow acceptable laboratory practices or behaviours that create a dangerous situation for the student or other students.

Middle School (6-8) - page 16

By Middle School, although it is hoped that students have had experience in safe practices while doing science activities and experiments in school, this should not be assumed. Strict adherence to safety guidelines must be maintained. As students become older and gain experience they can be given more opportunities to work with more sophisticated apparatus and materials.

The same guidelines, cautions and recommendations apply as were given for the elementary students. In addition, the following guidelines are provided for middle school students.

Chemical Hazards

Chemical	Hazards and Precautions
Gases	☒ Flammable gases such as hydrogen, methane and propane may form explosive mixtures with air at relatively low concentrations. ☒ When H2 is collected for testing, ensure only small (e.g. test tube) quantities are ignited. ☒ When using H2, ensure adequate ventilation. ☒ Non-flammable gases such as nitrogen, when stored under pressure in steel containers, may explode when heated by an existing fire.
Any household chemical brought into the school should be treated with the same precautions as other chemicals. Hazardous effects of all chemicals used improperly should be known. The following household chemicals should **not be used** in middle school activities	
Chemical	**Hazards**
Bleach	• When mixed with acid, chlorine gas is produced •When mixed with another bleach and/or cleaner, harmful gas is produced
Drain Cleaner	•This substance is caustic (corrosive) •When mixed with water, extreme heat is produced •Mixing with another drain cleaner can cause a violent reaction
Gasoline and other Fuels	• There is a danger of this burning if near a flame
Products Containing Methanol	• There is a danger of burning
Asbestos	• There is a serious hazard of lung health
Fine Powdered Substances	• Aluminum, iron or zinc in the form of fine powders may present a fire hazard

If using any other chemicals, consult the Workplace Hazardous Materials Information System (WHMIS) Guidelines found later in this document.

Biological Hazards

Organism	Hazards and Precautions
Live Animals in the classroom	• strays or wild animals may carry mites, insects or diseases and are therefore **not allowed** in the classroom • Live animals cannot be released into the wild • All mammals must been inoculated against rabies • Even with the above precautions teachers should be aware of any hazards with an animal interaction. For Example: • animals obtained from an established supplier will reduce but not eliminate the risk of disease transmission - turtles and chickens can carry salmonella •Mammals, fish, and sea animals can cause wounds, infections, or allergic reactions. • To reduce the chance of scratches or bites, gloves should be worn when handling some animals • Hands must be washed well after any contact with animals • Medical treatment should be obtained if a student is injured, bitten or scratched by an animal.
Plants in the classroom	• Do not collect any rare or endangered plants from the wild. •Unless known to be safe, treat the plant as poisonous - even many common house plants are poisonous. •Do not allow students to put any part of a plant in or near their mouths. •Avoid contact with the juice or sap of plants; they can irritate the skin. •Wash hands well after handling plants
Handling Micro-Organisms	• Avoid bacteria, fungi, etc. known to be pathogenic • Clean and disinfect all work surfaces before and after handling micro-organisms • Do not culture anaerobic bacteria, soil bacteria, or swabs from any surface which may contain micro-organisms from a human source

Electrical Hazards

Item	Hazards and Precautions
Voltage	• A battery source of max 3V must be used to prevent shock hazards. • Use fuses or circuit breakers • Insulate live parts of circuits • Clearly identify high and low voltage connections of induction coils
Water	• Make sure hands are dry when working with circuits • Do not perform electrical experiments near water, wet floors, or wet benches • Stand on rubber mats or carpet when working with electricity • Outlets should be waterproof boxes on the top of benches of suspended from the ceiling.
Standards	•Equipment should be CSA or ULC approved. •Periodically check for frayed or broken cords, exposed live wires, and leakage of current. •Avoid use of extension cords. •If it is necessary to use electrical cords, do not run cords across walkways or aisles.
Safety	• Avoid touching a live circuit with both hands - flow of electric current through the body is a danger. •Use high voltage equipment properly. •Do not grasp an electrical device that has just been used. •Ensure that electrical equipment is properly grounded.

Mechanical Hazards

Item	Hazards and Precautions
Equipment with moving parts	•Tie long hair back. •Avoid loose clothing, hats with protruding brims, and jewellery. •Wear safety glasses or goggles. •Periodically check equipment to see that it is in good working order. •Simple machines and other moving objects can catch loose clothing or hair and pinch fingers •Belts pulleys, levers, hand mixers etc. should not be used by students without adult supervision.
Glassware	•Make sure glassware is safe for heating - use brands such as Pyrex ® or Kimax ®. •Be careful to identify if glassware is hot or cold before touching. •Have tongs or heat resistant gloves readily available to handle hot glassware. •Cool hot glassware on ceramic tiles or ring stand base. •Always clamp flasks and beakers when heating them on a ring stand

Fire Hazards

Item	Hazards and Precautions
Hot Plates	•Tie hair back. •Avoid loose clothing. •Ensure plates are cooled before storage.
Candles	•Tie hair back and avoid loose clothing. •Careful monitoring is required. •Candles can only be lit by the teacher. •Candles must not be moved by student.
Other Heat sources	•All other heat sources must be used by the teacher only. •Adequate ventilation must be provided.
Electrical Fires	•Follow guidelines listed to avoid electrical hazards. •Avoid having too large a current passed through electrical equipment or wiring which will cause overheating and a possible fire.

Other Hazards

Item	Hazards and Precautions
Earth and Space	Avoid all rock samples with toxic materials such as asbestos, uranium etc.
Light and Sound	View the sun during an eclipse only with approved apparatus. Otherwise as described for elementary school (previous section)

CLASS A: COMPRESSED GAS

This class includes compressed gases, dissolved gases, and gases liquefied by compression refrigeration

CLASS B: FLAMMABLE AND COMBUSTIBLE MATERIAL

This class includes solids, liquids, and gases capable of catching fire in the presence of a spark or open flame under normal working conditions

CLASS C: OXIDIZING MATERIAL

These materials increase the risk of fire if they come in contact with flammable or combustible materials

CLASS D: POISONOUS AND INFECTIOUS MATERIALS

Division 1: Materials Causing Immediate and Serious Toxic Effects

These materials can cause death or immediate injury when a person is exposed to small amounts

CLASS D: POISONOUS AND INFECTIOUS MATERIALS

Division 2: Materials Causing Other Toxic EFFECTS

These materials can cause life-threatening and serious long-term health problems as well as less severe but immediate reactions in a person who is repeatedly exposed to small amounts

CLASS D: POISONOUS AND INFECTIOUS MATERIALS

Division 3: Biohazardous Infectious MATERIAL

These materials contain harmful micro-organisms that have been classified into Risk Groups 2, 3,and 4 as determined by the World Health Organization (WHO) or the medical Research Council of Canada

CLASS E: CORROSIVE MATERIAL

This class includes caustic and acid materials that can destroy the skin or eat through metals (i.e. hydrochloric acid)

CLASS F: DANGEROUSLY REACTIVE MATERIAL

These products may self-react dangerously (for example, they may explode) upon standing or when exposed to physical shock or to increased pressure or temperature, or they emit toxic gases when exposed to water

New Nouveau Brunswick
Be...in this place • Être...ici on le peut

Science Resource Package: Grade 7

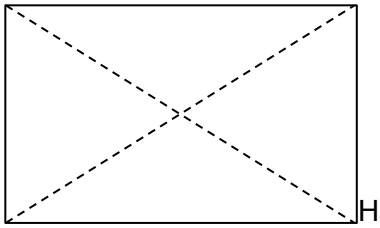
Mixtures and Solutions: Particle Theory of Matter

New Brunswick Department of Education

September 2009

🗁 *Access Prior Knowledge*

Ask: What are mixtures? What are not mixtures? List some mixtures. List substances that are not mixtures (pure substances).

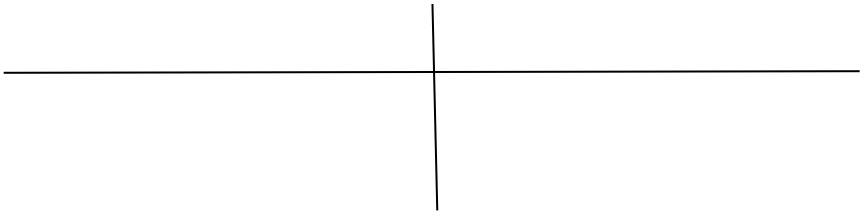


Have students discuss these questions in pairs or small groups using a placemat activity and record their ideas. To do a placemat activity, students fold a sheet of paper into halves or fourths (depending on number of students in the group). All at the same time, each student puts what they think and know in their section of the sheet. They can write in words and/or draw pictures. Students share their ideas with other members of their group.

Placemat: folds shown with dotted lines

Each student writes their ideas in
one section of the sheet.

Have students share their answers with the class. Make a large class T-chart so ideas may be revisited in other lessons. These ideas may include facts, characteristics and examples of mixtures and pure substances. (Accept misconceptions; do not attempt to correct students at this time. Students may, however, convince each other to change their minds. Look at the tips for facilitating class discussion on pages 19-20)



mixtures not mixtures

Provide labels for students to look at the ingredients of various products (for example: food, clothing). Items with more than one ingredient are mixtures; if there is only one ingredient then the item is a pure substance. These labels can be added to the T-chart.

Post student versions of curricular outcomes on chart paper (see page 22). Inform students that these outcomes will be addressed over the next portion of the unit. Point out to students which outcomes are being addressed in each activity.

1st Cycle

✪ Curriculum Outcomes

109-7 Identify different approaches taken to answer questions, solve problems, and make decisions.
112-7 Provide examples of how science and technology affect their lives and their community.
209-6 Use tools and apparatus safely.
210-16 Identify new questions and problems about mixtures that arise from what is learned.
307-2 Identify and separate the components of mixtures.

- Have a class discussion: Ask: *Why would people want to separate mixtures? What mixtures get separated in real life and how are they separated?*
- Have students write a journal entry about the separation of mixtures in real life

✓ Assessment:
Can students determine real life situations where it is useful to separate mixtures?

Some examples of separating mixtures in the real world include:
sorting change to roll coins
to obtain desired minerals from mined ore
filtering and treating water/sewage
cleaning up oil spills in the ocean
sorting recyclable materials
separating blood into plasma, red blood cells, and so on

Separating Mixtures Activity

The focus of this activity is different methods of separating mixtures and introducing the definitions of heterogeneous and homogeneous mixtures.

Materials:

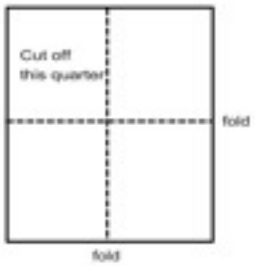
Different tools for separating each mixture such as tweezers, plastic cups, forks, magnets, filter paper, bowls, colanders, and spoons.
Different types of mixtures of two or three items

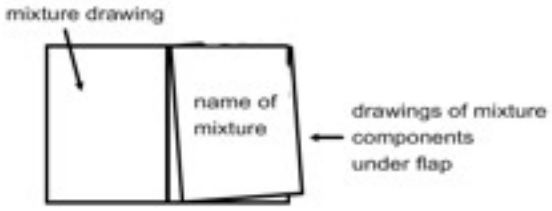
Possible separation methods and examples of mixtures:

Separation method	Example of mixture
Colander or containers with different sized holes	Rice and beans Marbles and tennis balls Cheerios® and Rice Krispies®
Scooping with slotted spoons or forks	Styrofoam peanuts and water
Magnetism	Metal nuts/washers and rubber bands Iron filings and water
Decanting (carefully pouring a solution from a container in order to leave the precipitate in the bottom of the original container)	Cooking oil and water
Evaporation	Salt and water
Floating, dissolving, static (using a balloon)	Salt and pepper
Filtration	Sand and water
Manually (by hand)	Different colour or size beads Different colour bread ties
Not easily separated	Salt and sugar Vinegar and water

- Students working in small groups are presented with three or four different mixtures from the list in the materials section. (Each group should have 1 or 2 different mixtures in common with other groups, and 1 or 2 mixtures which are unique to them. This will allow some comparison during the post activity discussion.)
- Students are first asked to examine the mixture, writing down their descriptions of the properties of the mixture – what do the constituents of the mixture looks like, what shape are they, what colour are they, are they hard or soft, etc.

- Using a three quarter foldable, each student will draw a picture and label the parts for one of their mixtures (with visible components). Make the foldable by folding a sheet of paper into fourths and cutting the top left quarter off. (see diagram)





- After cutting off the top left quarter, students will draw a picture and label the parts for this same mixture.
- Students should attempt to separate each mixture in turn, using whatever method they feel will be most successful. They can use some of the apparatus provided or devise their own method, although these should be discussed with a teacher prior to using them for safety reasons.

Students need to be made aware that inability to separate a mixture is not being unsuccessful. Negative results give important information to scientists and should not be considered a waste or failure.

- Students indicate their separation method and draw the different components of the separated mixture under the flap of the folded paper. Both the back of the flap and the bottom fourth may be used.
- For all their assigned mixtures, students should record what method(s) they used for separation and how successful their attempts were.
- Compared to the uses of the original mixture, what is different about the ways we can use the separated components of the mixture? Explain.

✓ **Assessment:**
During student activity, make notes on outcomes (or parts of outcomes) you observe being addressed. Process skill outcomes are part of the curriculum and should be assessed. Using the observation chart or the checklist (on page 25-27) on a clipboard may be helpful to you. This is sometimes called clipboard cruising. Develop your own code for quick notes.

A suggested code:
√ observed and appropriate,
WD with difficulty,
RTT refused to try,
A absent.

This chart may be used on multiple days, using a different coloured pen or pencil each day and putting the date in the corner. You may not have a symbol or note for every child every day. Some teachers like to focus on a group or two each time. However you choose to make note of your observations, you will always have a sense of who you need to take more notice of and who might need extra support. The information will also help you when it is reporting time.

Options for storing foldables:

- in a large zippered plastic bag. The bag can be hole-punched and put inside a duotang or binder. A strip of wide tape folded over the left edge of the bag before punching the holes will keep the bag from ripping.
- glue into notebooks or duotangs
- display them on bulletin boards

Reflection: Class Discussion

- Students will share which mixtures they had and the method used to separate their mixtures with the other groups. Taking the mixtures one at a time, ask questions like: *Did your group have this mixture? How did you separate it? Did anyone separate it a different way? Were any other mixtures separated using that method?*
- Revisit the T-chart on mixtures (see page 5). Ask: *Are there any items that should be added to or revised. Is there other information we could add?* Remind your class about respectful discussion. See the tips on page 19-20.
- Question for the class: Can everything be separated?
- This video clip made by NB grade 7 students describes distillation as a method of separating a mixture https://studycasts.wikispaces.com/Distillation

Reflection: Individual

After discussion, have individuals write a journal entry. Can everything be separated? Explain.

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Read journal entries to determine students' understanding of mixtures - consist of two or more components, components may be easy to distinguish or not, and the properties of the components may make them easy to separate or very difficult to separate.

Think like a scientist

Asking good questions is an important skill in science. Initially students will need support. Model the skill with the whole class and students will begin to have the confidence to contribute. After some practice, students will be able to generate questions successfully individually.

Present students with a situation and ask them to generate questions that could be investigated scientifically. (These situations and questions do not have to be limited to those that can be done in a classroom.)

Situation:

> Canadian Blood Services collects donations of blood from the public and makes blood products available to hospitals. In some cases whole blood is not needed and patients are given platelets, red blood cells, plasma, or another component found in blood.
>
> Write a question concerning the separation of blood into useful components that could be investigated scientifically.

For example:

> Would a coffee filter separate one or more components from the rest of blood?
> What is the ratio of the different components in blood?

Separating Mixtures

Examine each mixture and describe the properties (such as shape, colour, odour, hardness) of each material that makes up the mixture in the table.

Choose one of your mixtures that has 2 or 3 visible materials. On a separate piece of paper, draw the mixture and label the parts.

Using the available materials, devise and carry out a way to separate each mixture. Start with the mixture you drew a picture of. Once the mixture has been separated, draw a picture of the components.

Mixture	Properties of the mixture	Method of Separation

2nd Cycle

✪ Curriculum Outcomes

209-3 Use instruments effectively and accurately for collecting data.
209-6 Use tools and apparatus safely.
307-1 Distinguish between pure substances and mixtures, using the particle model of matter.
307-2 Identify and separate the components of mixtures.

- Introduce the idea of heterogeneous and homogeneous materials.

  Heterogeneous mixtures – more than one type of material observable in the mixture and not uniformly spread throughout.

  Homogenous– appears to be one substance spread uniformly throughout. One set of properties will describe all components of the mixture.

  This video created by Grade 7 students may be helpful https://studycasts.wikispaces.com/Homogeneous+Mixtures
- As a class, and using the drawings from the last activity, sort the mixtures from Cycle 1 into heterogeneous and homogeneous mixtures. (If students could observe the components and separate them, the mixtures would be heterogeneous.)
- Make a list of products used every day in the kitchen. (dish soap, hand soap, cooking oil, lemon juice, ketchup, salsa).
- Ask students to classify the items as homogeneous or heterogeneous.

Heterogeneous or Homogeneous Activity

In small groups:
Have students work in groups to explore and classify the following (or mixtures/solutions similar to these) as homogeneous or heterogeneous.

Materials:

At least 3 of: orange juice with pulp; chicken noodle soup; homogenized milk; salsa; relish; jam; soda water; chocolate chip cookie.

Plus at least 3 of: shampoo; toothpaste; mustard; Kool-Aid; ketchup; dish detergent.

Glass or clear plastic containers
Magnifying glasses
Microscopes or dissecting scopes
Dropper
Slides and cover slips if available
Flashlight

For each sample, the students:

- make observations without any optical aid and sort the containers into 2 groups
- make observations using a hand magnifier. Are there any samples they would reclassify?
- Using microscopes (if available), have the students decide if there are some samples in the solutions group that they should look at more closely. Are there any samples they would reclassify?

✓ **Assessment:**

On observation chart (or other record), note how students are performing on the skill outcomes.

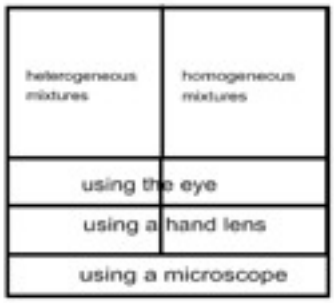
To record their results, students could use a layered book.

Layered book instructions:

Fold one sheet of paper unevenly so there is a flap

Fold a second sheet more unevenly

Place the folds inside each other to create 4 layers. Then cut up the middle of the top 3 layers to create flaps.



- The top flaps can be labelled: heterogeneous mixtures, homogeneous mixtures (solutions).
- The second layer would list the mixtures on the appropriate side using observations with the eye – drawings or reasons for classifying the mixture could be required
- The third layer would list the mixtures on the appropriate side using a hand lens - drawings or reasons for changing a classification could be required
- The fourth layer would list the mixtures on the appropriate side using the microscope - drawings or reasons for changing a classification could be required

Note: Remind students that reclassifying an item when seen under higher magnification doesn't mean they were wrong the first time. As technology improves and we are able to see smaller and smaller things, scientists' understanding changes. This sometimes results in changing models and theories.

Reflection: Class discussion

- Facilitate a discussion about what students observed and their reasoning for reclassification of mixtures as greater magnification was used.
- Here is a video clip made by grade 7 students about the differences between heterogeneous and homogeneous mixtures

https://studycasts.wikispaces.com/Beverage+Lab+-+Homogeneous+and+Heterogeneous

- Revisit the T-chart on mixtures (see page 5). Ask: *Are there any items that should be added to or revised. Is there other information we could add?* Remind your class about respectful discussion. The tips on pages 19-20 may be helpful.

✓ **Assessment:**
Mixtures foldable can be collected. Note classification of materials and whether observations with increased magnification resulted in changes.

Heterogeneous or Homogeneous Activities

Materials:

Mixtures provided by your teacher
Magnifying lens
Microscope
Slides and cover slips
Dropper
Flashlight
Table or foldable to record observations

Procedure:

For each sample:

1) Make observations without any optical aid and sort the containers into 2 groups – heterogeneous and homogeneous. Record the results on your table or foldable.

2) Make observations using a magnifier. Are there any samples that should be reclassified? Group the mixtures and record your results.

3) If available, decide if there are some samples in the homogeneous group that should be examined more closely. Take a drop of the mixture, drop it on a slide. Use another slide or a cover slip and examine under the microscope. Repeat this step 3 times, taking samples from different parts of the container. Are there any samples that should be reclassified? Group the mixtures and record the results.

4) Shine a flashlight through each mixture. Can you see the beam of light in the mixture? If you can, it means there are little bits floating in the mixture, causing the light to scatter inside the solution. The mixture is likely heterogeneous.

Remember: Reclassifying an item when seen under higher magnification doesn't mean you were wrong the first time. As technology improves and we are able to see smaller and smaller things, scientists' understanding changes and models and theories change too.

3rd Cycle

✪ Curriculum Outcomes

307-1 Distinguish between pure substances and mixtures, using the particle model of matter.
307-3 Describe the characteristics of solutions, using the particle model of matter.

Activity – Smaller than the eye can see

1. In small groups, have students brainstorm and record a list of the smallest things they can think of. Each group can organize their items from largest to smallest. You could have students print ideas on index cards or on pieces of paper with markers. (These can be tacked to a bulletin board as they are shared.)

2. Then as a whole class, share one item that is the “smallest item” from each group (round robin style) and record on the board or on chart paper. As each item is named, decide where the item fits in the list of largest to smallest. Those items that no other group has can earn that group a point.

Note: Even if students say atoms or molecules as their first item, work to elicit items of different sizes to try to help students conceptualize how small particles are. Parts of the atom, such as protons, electrons and/or neutrons may also be named, but not all students will be able to visualize these. This activity also provides an opportunity to discuss how the cell is the smallest unit of life and that it also is made of smaller particles.

Option: Powers of 10 video – famous video to help demonstrate size and scale. It can be found on YouTube at http://www.youtube.com/watch?v=A2cmlhfdxuY but if that link is removed at some point, the official website is www.powersof10.com where the video can be watched but it requires an e-mail address registration to be accessed. There is no charge at this time.

Activity – Matter's Particles

Revisit a variety of the heterogeneous and homogeneous mixtures (solutions) from the first two cycles.

To contrast mixtures and pure substances:

1) a) Refer to the diagram students drew in Cycle 1 of one of their mixtures and the separated components (page 8). Introduce students to the particle model of matter by having them imagine the particles (molecules). Choose one of the heterogeneous mixtures and ask students to re-draw and label the diagram of their "chosen" solution from Cycle 2 showing how the particles are distributed. This diagram should have different types of particles spread randomly and irregularly throughout.

   b) Now have them re-draw a diagram of their separated components showing how the particles are distributed. This diagram should have one type of particle.

   Students should use the terms heterogeneous, mixture and pure substance.

To contrast homogeneous and heterogeneous mixtures:

2) Choose one of the heterogeneous mixtures from Cycle 2. Draw and label a diagram of the heterogeneous mixture showing how the particles are distributed.

3) Choose one of the homogeneous mixtures (solutions) from Cycle 2. Draw and label a diagram of the solution showing how the particles are distributed.

✓ **Assessment:**
Student diagrams -
For heterogeneous mixtures, is there more than one type of particle identified and are the particles spread randomly throughout the mixture?
For homogeneous mixtures, is there more than one type of particle identified and are the particles spread evenly throughout?

Reflection: Class discussion

- Have a class discussion highlighting the types and distribution of particles in the pure substances and heterogeneous and homogeneous mixtures.
- Revisit the T-chart on mixtures (see page 5). Ask: *Are there any items that should be added to or revised. Is there other information we could add?* Remind your class about respectful discussion.

Reflection: Journal

1. What characteristics are necessary for a material to be considered a pure substance?
2. What characteristics are necessary for a mixture to be considered a heterogeneous mixture?
3. What characteristics are necessary for a mixture to be considered a homogeneous mixture (solution)?

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

When reading the journal entries, note which students are getting the idea of the differences between pure substances and mixtures and heterogeneous and homogeneous mixtures.

Possible Extensions:

Give students the choice of one of the following:

1) Draw a cartoon that demonstrates your understanding of what happens to particles during dissolving.

2) Create and act out a brief skit or interpretive dance that demonstrates your understanding of what happens to particles during dissolving.

This site shows a representation of salt dissolving:
http://www.chem.iastate.edu/group/Greenbowe/sections/projectfolder/flashfiles/thermochem/solutionSalt.html

This links to a clip of salt dissolving:
http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/molvie1.swf

Possible Next Steps:

Take an in-depth look at the differences between **soluble and insoluble** in terms of attraction between particles, and examples of **solutes and solvents**.

Introduce and use vocabulary and possibly reinforce with simple diagrams:

solution, solute, dissolving, solvent, soluble, insoluble

Have the students dissolve sugar in water.

Questions (Have the students work in small groups to discuss these questions):

What happens in terms of particles?

Imagine the particles. Where are the particles?

What are the particles doing?

What are the particles looking like?

Have students diagram dissolving, labelling solute, solvent, insoluble

This video clip made by NB grade 7 students may be helpful https://studycasts.wikispaces.com/Solute+and+Solvent+-+Dissolving

And

https://studycasts.wikispaces.com/Soluble+and+Insoluble

Understanding Distillation

Outcomes:
109-14 explain the importance of using precise language in science and technology
307-3 describe the characteristics of solutions, using the particle model of matter and terms: Solute, Solvent, Dissolving, Soluble
111-5 describe the science underlying a distillation apparatus

Lesson Activity Overview:
This lesson is a follow-up to ensure that students have a firm understanding of scientific terms.

Begin the lesson by working with scientific terms. In their journal, write and advice column about science projects in a school newspaper, explain the importance of knowing what the following words mean when doing a related science activity: (109-14)

- solute
- solvent
- dissolving
- soluble

Once students have a worked with the initial terms, expand the process to ensure they understand the process. Explain/illustrate what happens to both the solute and the solvent in a solution (307-3)

Now that the components of distillation are understood, it is now time to work with Distillation. Best practice would be for students to take a solutions, like salt and water and set up a distillation apparatus and separate the solution. Use the following links as guide. It is understood that most middle schools will not have all the same materials as described in the video, but ensure safety.

http://orgchem.colorado.edu/Technique/Procedures/Distillation/Setup.html
http://www.youtube.com/watch?v=SlDtBJ8Cb-w

After students have viewed the distillation of salt water. Draw a distillation apparatus and describe the function of each part from the point of view of the distillation process (111-5)

Assessment:Informal Formative
Ensure students view a live or virtual distillation process

Assessment:Formal Formative
Ensure students have created a journal entry that properly describe the terms: solute, solvent, dissolving, soluble - 109-14

Ensure students are able to describe what happens to both the solute and the solvent in a solution - 307-3

Ensure that students can appropriately illustrate a distillation apparatus - 111-5

Mixtures and Solutions
Strand - Concentration of Solutions

General Curriculum Outcomes	Specific Curriculum Outcomes
307-4 describe qualitatively and quantitatively the concentration of solutions	307-4 describe the concentrations of solutions qualitatively, using the terms, dilute, concentrated, saturated, and unsaturated
109-4 provide examples of how technologies used in the past were developed through trial and error	109-7 identify different ways that concentrations can be demonstrated for various substances
210-9 calculate theoretical values of a variable	210-9 calculate concentrations of solutions in g/L
208-1 rephrase questions in a testable form and clearly define practical problems	208-1 rephrase questions related to solubility in a testable form and clearly define practical problems
208-6 design an experiment and identify major variables	208-6, 209-1 design and carry out procedures to study the effect of temperature on solubility
209-1 carry out procedures controlling the major variables	
210-7 identify, and suggest explanations for, discrepancies in data	210-7 identify and suggest explanations for discrepancies in data after carrying out procedures designed to study the effect of temperature on solubility
210-4 predict the value of a variable by interpolating and extrapolating from graphical data	210-4 predict the solubility of a solute by interpolating or extrapolating from graphical data
307-5 describe qualitatively the factors that affect solubility	307-5 describe qualitatively the factors that affect solubility: - temperature - pressure
209-3 use instruments effectively and accurately for collecting data	209-3 use a commercial or student-made hydrometer effectively and accurately for collecting data

Measuring Solution Concentrations Qualitatively

Outcomes:
307-4 describe the concentrations of solutions qualitatively, using the terms, dilute, concentrated, saturated, and unsaturated
109-7 identify different ways that concentrations can be demonstrated for various substances

Lesson Activity Overview
The focus of this lesson is to have students create regular household solutions, like kool-aid to identify them as dilute or concentrated.

Discussion of common everyday experiences related to the terms dilute and concentrated such as “orange concentrate” and “weak coffee” can allow for a better appreciation of the students’ understanding of the terms before formal investigations and learning activities.

Coloured pinnies on students may be used to illustrate the terms dilute and concentrated. In dilute solutions, there will be very few “solute” students moving about the “solvent” students. This is a good opportunity to dispel a popular misconception that concentrated means more solute by keeping the same number of “solute” students and removing (evaporating) some “solvent” students. The terms saturated and unsaturated can be used and discussed after these experiences.

Students can create solutions of varying concentrations of food colouring and water and quantitatively and qualitatively describe the solutions they create. -307-4

Students should conclude with a discussion about the differences of qualitative and quantitative measurement. They should understand that terms that describe solutions are qualitative. Emphasis should be placed that scientists need to use numbers to justify their findings. Therefore, quantitative measurement should be introduced and students should understand that in future investigations they will be measuring this way. 109-7

Assessment: Informal Formative
Ensure that students participate lead up activities related to qualitative measurements of solutions - 307-4
Ensure that students participate in discussions that differentiate qualitative and quantitative measurement - 109-7

Assessment: Formal Formative
Ensure that students have correctly labeled solutions as either dilute or concentrated 307-4

Investigating Solutions Quantitatively

Outcomes:
210-9 calculate concentrations of solutions in g/L
208-1 rephrase questions related to solubility in a testable form and clearly define practical problems
208-6, 209-1 design and carry out procedures to study the effect of temperature on solubility
210-7 identify and suggest explanations for discrepancies in data after carrying out procedures designed to study the effect of temperature on solubility
210-4 predict the solubility of a solute by interpolating or extrapolating from graphical data
307-5 describe qualitatively the factors that affect solubility:
- temperature
- pressure
209-3 use a commercial or student-made hydrometer effectively and accurately for collecting data

Lesson Activity Overview
This lesson is designed to be an investigation about solubility. Specifically, the topic of solubility at differing temperatures is propose in the outcomes. Since the goal is to measure the solubility quantitatively, students must use a hydrometer, it can be one that is purchased commercially, or it can be one they they make. There are several scientific skills outcomes that are expected in the activity. Below is an overview of the expectations of the prescribed outcomes. Also, a work sheet has been created for students to follow to ensure they have completed all required skill outcomes.

Begin by introducing the concept of solubility and temperature. A volleyball discussion should follow so that students can work through any prior knowledge and misconceptions. There should be no intent that students make a prediction at this point, the discussion should only raise awareness of the subject.

Students will take the initial purpose of solubility and temperature and rephrase the concept into a testable form and clearly define the practical problem that they will be solving - 208-1

Next, students will design their own procedures related to their testable questions and they must ensure that they control the major variables. Make sure that a hydrometer is the device used to collect data - 208-6

Although it is not a specified outcome in this section, a major science skill is for students to create a hypothesis of what they expect to happen based on their prior knowledge. This would be an excellent time for students to work on this skill.

Once they have created their hypothesis, students should gather any materials needed based on their experimental design in 208-6 along with the Hydrometer - 209-3. Now they can carry out their procedures making sure that they control the major variables. 209-1

Use the data collected from the hydrometer based on the procedures to calculate the concentrations in solutions in g/L - 210-9. If students find a particular substance has a solubility of 60g/100mL, they should be able to devise and use a method to express the solubility in g/L.

Its now time to make sense of our raw data (concentration of solutions in g/L) by analyzing and interpreting our data. Two things will happen. First, students will plot their data into a graph. Then predict the solubility of a solute by interpolating or extrapolating from that graphical data. 210-4 Next, students should identify and suggest explanations for discrepancies in data after carrying out their investigation. 210-7

Based on their analysis, students should be able then to write a brief conclusion about what they have learned about the relationship between temperature and solubility - 307-5.

Assessment:Informal Formative:
Ensure that students use a hydrometer to collect data - 209-3

Assessment: Formal Formative
Ensure that students have completed the investigation worksheet. Evaluate each outcome that is listed individually.

Investigating Solutions Quantitatively - Investigation Worksheet

Name:_____

Concept: The Relationship between solubility and temperature.

Task 1

Outcome - 208-1	Rephrase the concept into a testable form and clearly define the practical problem that they will be solving

Task 2

Outcome - 208-6	Students will design their own procedures related to their testable questions and they must ensure that they control the major variables
Variable to Control _____ Procedure Step: (Make sure to include Hydrometer)	

Task 3

Outcome - 208-5	Sate a prediction and a hypothesis based on background information or an observed pattern of events

Task 4

Outcome - 209-1	Carry out their procedures making sure that they control the major variables - ***Record observations and rough data***

Task 5

Outcome - 210-9	Use the data collected from the hydrometer based on the procedures to calculate the concentrations in solutions in g/L

Task 6

Outcome - 210-4	predict the solubility of a solute by interpolating or extrapolating from graphical data
	

Task 7

Outcome - 210-7	Identify and suggest explanations for discrepancies in data after carrying out procedures designed to study the effect of temperature on solubility

Task 8

Outcome - 307-5	Based on their analysis, write a brief conclusion about what was learned about the relationship between temperature and solubility

Mixtures and Solutions

Strand - Mixtures, Solutions and the Environment

General Curriculum Outcomes	Specific Curriculum Outcomes
112-7 provide examples of how science and technology affect their lives and their community	112-7 provide examples of how science and technology, related to mixtures and solutions, affect our lives
113-1 identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development	113-1 identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development related to mixtures and solutions
109-4 provide examples of how technologies used in the past were developed through trial and error	109-4 provide examples showing the evolution of refining and separation techniques

Mix and Match - A Series of Task to Understand Mixtures and Solutions and the Environment

Outcomes:
112-7 Provide examples of how science and technology, related to mixtures and solutions, affect our lives
113-1 Identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development related to mixtures and solutions
109-4 provide examples showing the evolution of refining and separation techniques

Lesson Activity Overview
The outcomes for this section are all STSE, which in turn ask students to provide examples of their perceptions. This allows students to create actions that express their understanding. In the Universal Design for Learning, students should be provided options to express what they know.

Therefore, each of the outcomes for this section will require one of the listed options be completed. Granting this freedom will require that students identify the tasks they want to do, but conform to the timeline set by the teacher. Please have each student complete the Project Contract form.

It is also critical that expectations for each project are communicated to students (i.e., rubric) before they make their selection.

Task 1 - Provide examples of how science and technology, related to mixtures and solutions, affect our lives - 112-7
Options:
• Research a specific mixture/solution and report on its importance to people/society
• Create a mural that illustrates the mixtures and solutions you encounter in everyday life
• Create a “Day in the Life of...” in which the main character encounters and describes mixtures and solutions in a typical day

Task 2 - Identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development related to mixtures and solutions - 113-1
Options:
• Research and report on the positive and negative effects of applying salt to highways in the winter
• In a Series of illustrations, drawings, or pictures, show how a particular separation technique has changed and developed over time

Task 3 - provide examples showing the evolution of refining and separation techniques - 109-4

Options:

• Prepare a photo essay on the development of distillation apparatus

• Interview a construction worker or house builder about the differences between seepage beds as used by many rural people in the past, and modern septic tank systems

Assessment:Informal Formative

Monitor students to ensure that they are working on a day to day basis on their identified tasks from their project contract form

Assessment:Formal Formative

Ensure that students have completed their Project Contract Form

Ensure that students have completed and appropriately provided examples of how science and technology, related to mixtures and solutions, affect our lives 112-7

Ensure that students have completed and appropriately identified some positive and negative effects and intended and unintended consequences of a particular scientific or technological development related to mixtures and solutions 113-1

Ensure that students have completed and appropriately provided examples showing the evolution of refining and separation techniques - 109-4

Understanding Mixtures and Solutions and the Environment

Project Contract Form

Name:_____

For each of the three (3) categories, select one task that you will complete to appropriately complete the outcome

Task 1 -Provide examples of how science and technology, related to mixtures and solutions, affect our lives - 112-7	
Option 1 _____	Research a specific mixture/solution and report on its importance to people/society
Option 2 _____	Create a mural that illustrates the mixtures and solutions you encounter in everyday life
Option 3 _____	Create a “Day in the Life of...” in which the main character encounters and describes mixtures and solutions in a typical day
Task 2 - Identify some positive and negative effects and intended and unintended consequences of a particular scientific or technological development related to mixtures and solutions - 113-1	
Option 1 _____	Research and report on the positive and negative effects of applying salt to highways in the winter
Option 2 _____	In a Series of illustrations, drawings, or pictures, show how a particular separation technique has changed and developed over time
Task 3 - provide examples showing the evolution of refining and separation techniques - 109-4	
Option 1 _____	Prepare a photo essay on the development of distillation apparatus
Option 2 _____	Interview a construction worker or house builder about the differences between seepage beds as used by many rural people in the past, and modern septic tank systems

Signature:_____ Date:_____