



Lesson 5

Introduction – Water We Talking About?



Learning Standards & Assessment



Time



Resources



Activities



Handouts



Video





Science

Big Ideas

- ▶ Materials can be changed through physical and chemical processes.
- ▶ Water is essential to all living things, and it cycles through the environment.

Content

- ▶ The water cycle
- ▶ Physical ways of changing materials



50-75 minutes

Part 1: 30-45 minutes

Part 2: 20-30 minutes



Educator's Kits, including hardcopy lesson plans and support materials, are available for loan through the CRD. For pickup locations, print-friendly materials and multimedia tools see www.crd.bc.ca/teacher or contact the CRD at 250.360.3133.

Lesson 5b:

Forms of Water: Solid, Liquid and Vapour

Purpose

As part of the exploration of the physical properties of water, this lesson furthers student learning about the concept of the three states of matter (liquid, solid, and gas). The following experiments can be taught together or separately (Solid and Liquid Experiment; Water Vapour Experiment).

Note that some of the procedures in this lesson use teacher demonstration rather than group experiments for safety reasons (e.g., activities requiring hot or boiling water).

Preparation

You may wish to enlist the help of parent volunteers or older students in the school to help facilitate group experimentation work.

- ▶ Photocopy either Liquid and Solid Water OR Liquid, Solid Water and Vapour graphic organizer (1/student)

Procedure

PART A: SOLID AND LIQUID WATER

Warm Up- Magic Trick

Turn water into ice instantly.

1. Before you start, place a sponge in the bottom of a mug and place some ice cubes on top. Prepare a glass of water.
2. Pour some water into the cup, give it a swirl and turn upside down, making sure to empty the cup towards yourself, as not to expose the sponge.
3. Tadaaa- you have successfully turned water into ice.
Demonstration video here:
www.youtube.com/watch?v=dq93nAVSRnk&feature=related

Transition: Tell students that this lesson will be all about these two forms of water.



Teacher Resources

- ▶ Assessment Tool: *What is Water?* (provided with Lesson 5a)
- ▶ Assessment Tool: 'Solid, Liquid and Vapour: Answer Key' Demonstration video, search *Cloud in a bottle* online

Student Resources

- ▶ Handout options of:
 - Solid and Liquid Water OR
 - Solid, Liquid and Vapour Water (1/student)
 - My Conclusions
- ▶ Water Portfolio
- ▶ Optional- Water Word Map

Lesson Resources

- ▶ KWL chart
- ▶ Part A Magic Trick
 - Cup, sponge, glass of water and ice cube(s)
- ▶ Part A Experiments (1/group)
 - glass of water
 - same sized glass of ice cubes
 - two small bowls
 - Optional- piece of string (1/student/group) and salt (1/2 tsp in individual pots or share a shaker among class)
- ▶ Part B Demonstration (teacher only)
 - Two litre plastic bottle with lid and a bit of water in the bottom
 - Match or splint
- ▶ Part B Experiments
 - Spoon (1/student)
 - Kettle (teacher only)
 - Flashlight (teacher only)



Assessment Opportunity

Throughout the following activities, use the assessment tool, **What Is Water** (provided with Lesson 5a), to note students' abilities to make observations, form conclusions, and record details.



Experiment - Ice and glass of water (Solid/liquid)

1. Distribute the student handout, **Solid and Liquid Water Venn Diagram and Comparison** OR **Solid, Liquid and Vapour Water Comparison and Venn Diagram**. Explain that students will use this to record their observations during the experiment.
2. Distribute a glass of water and a glass of ice to each group.
3. Discuss, post or handout the instructions. Ask students to observe and discuss how these items are the same and how they are different. To prompt discussion, ask questions such as:
 - How do they look the same? Different?
 - How do they feel the same? Different?
 - Which is liquid?
 - Which is solid?
 - How does a liquid become a solid?
 - How does a solid become a liquid?
 - What will happen if you leave the ice out in a warm room?
 - What will happen if you put the glass of water in the freezer?
4. Have students pour the glass of water into one of the small dishes, and the ice cubes into the other dish. What do they notice? What happens to the shape of the water? What happens to the shape of the ice cubes? Can they use this information to help them define solid and liquid?
5. Ask students to brainstorm as many forms of solid water as they can, and as many forms of liquid water as they can. For example:
 - liquid: tap water, river, creek, ocean, lake, pond, marsh
 - solid: ice cubes, ice on a pond, glacier, iceberg, snow, hail, frost, skating rink
6. As a class, read the student handout questions **My Conclusions**. Have students complete and place in their Water Portfolios.
7. Optional- have students complete Word Maps for the words Solid and Liquid.

Experiment - Lift an ice cube without touching it (optional)

1. As students complete their handouts, challenge them to pick up an ice cube from their previous experiment without touching the ice or its container.
2. Provide them with a piece of string and some salt.
3. Discuss solution- Place the piece of string across one side of the ice cube. Sprinkle some salt on top of the string and ice cube. Wait 1-2 minutes. Gently lift the string.
4. What happened? The salt melted some of the ice into liquid water. Then the liquid water refroze forming ice on top of the string, holding it in place.
www.youtube.com/watch?v=u9slVq87czg&feature=relmfu
www.stevespanglerscience.com/experiment/ice-cube-rope-sick-science

Know-Wonder-Learn (KWL) Chart

As a class, revise the class KWL chart - answer questions, add new details and questions.

NOTE: If wanting to separate this lesson into two components, stop here and continue Water Vapour another day.

PART B: WATER VAPOUR

Warm Up - Picture this.

1. Talk students through a visualization exercise in which they imagine a cloud. You are in class. Everyone is busy cleaning up finished experiments. You put the last pencil away when you hear the recess bell ring. Do you need your coat to go outside and play today? You look out the window. In the sky you see a cloud. What colour is the cloud? Grey, white, pink, blue purple. Describe the cloud they imagined to a partner.
 - ▶ Alternately, display a picture of an interestingly shaped cloud. What do they see? What do they think it is made of?

Demonstration- Cloud in a Bottle (Vapour)

1. To illustrate the third form of water, water vapour, create a cloud in a plastic bottle.
2. Present the closed 2 L bottle with a bit of water inside; and squeeze it a few times.
3. Light a match or splint, blow it out and hold over the bottle nozzle and squeeze a few times, pulling the smoke into the bottle.
4. Seal the lid, shake the bottle and squeeze it. This represents the high pressure that forms clouds. A cloud will form inside the bottle as water molecules condense on the smoke particles.
5. Ask students if they recall what happened to Dylan and Dana when they became water vapour and joined the cloud in the video the *Down the Drain and Back Again*. (optional - can replay this section of the video).

Demonstration video, search Cloud in a bottle, to find a video like:

<https://www.youtube.com/watch?v=cXpuo3YH0n0>

www.youtube.com/watch?v=E8AvfXar9zs

Discourage students from attempting to replicate the activity themselves.

Transition: Explain that clouds are made of water vapour, the third form of water. Distribute student handout Vapour or have students continue to complete their Liquid, Solid Water and Vapour handouts.

Experiment- Breath (Vapour)

1. Distribute a spoon to each student. Ask them to breathe gently on the back of the spoon. Have them record their observations on their handout.
2. Where did this water come from? We give off water vapour every time we breathe out. On a cold day when they can see their breath, what they are seeing is actually water vapour condensing as it hits the cold air turning into tiny water droplets.

While students are engaged in this activity, prepare the next experiment.

Experiment- Kettle (Vapour)

1. Draw students' attention to your demonstration area.
2. Bring water to a boil until it is steaming. Darken the room and shine a flashlight on the steam to help students see it.
3. Ask students:
 - Is this water?
 - What form of water is it?
 - Where did it come from?
 - What are other examples of water vapour? Examples include clouds, fog, mist, steam from hot springs, steam from a shower, etc.
4. Read through the handouts for Part B: Solid, Liquid and Vapour Water with students for comprehension, then ask students to complete and add the handout to their Water Portfolios.
5. Optional- have students complete Word Maps for the word vapour.

Assessment Opportunity

Review students' completed handouts **My Conclusions; Part A: Solid and Liquid Water Venn Diagram; Part A: Solid and Liquid Water Comparison; Part B: Solid, Liquid and Vapour Water: Venn Diagram; Part B: Solid, Liquid and Vapour Water Comparison** collected in the Water Portfolios.

Curricular Competencies

Look for evidence that students are able to:

Science

- ▶ Questioning and predicting
 - Demonstrate curiosity and a sense of wonder about the world
 - Observe objects and events in familiar context
 - Ask questions about familiar objects and events
 - Make simple predictions about familiar objects and events
- ▶ Planning and conducting
 - Make and record observations
 - Safely manipulate materials to test ideas and predictions
- ▶ Processing and Analyzing
 - Compare observations with predictions through discussion
 - Identify simple patterns and connections

- ▶ Evaluating
 - Compare observations with those of others
- ▶ Communicating
 - Communicate observations and ideas using oral or written language, drawing, or role-play

Extensions and Adaptations

- ▶ Breakdown the Venn Diagram steps or create visual separation of ideas using the Comparison charts student handout.
- ▶ Adapt Experiment Instructions: Solid and Liquid questions to increase or decrease difficulty. Include temperature measurement and discussion of Fahrenheit and Celsius.
- ▶ Adjust reading requirement increasing or decreasing written instruction, supporting with verbal and visual demonstration.
- ▶ Extend the concept of solid, liquid, and gas for all matter by creating a game that requires students to categorize common objects - either the objects themselves or pictures of them (e.g., books, juice, the air we breathe). Students can categorize the objects by placing them in labelled boxes, or by labelling items in the classroom with removable sticky notes.
- ▶ On a cold day, take students outside to discover the water vapour from their breath. Explain to students that we give off water vapour every time we breathe out. On a cold day when they can see their breath, what they are seeing is actually water vapour condensing as it hits the cold air turning into tiny water droplets.

Online Resources

Online Game

- ▶ Water we doing- a conveyor belt bring objects that need water in one of three states. The player uses the up arrow to boil water, the down arrow to cool it and freeze it, and the space bar to release the water to water plants, steam rice or freeze ice for a glass of juice.
pbskids.org/fetch/games/water/game.html

Experiment

- ▶ Does water expand or contract as it cools? Fill one cup with water and lightly cover the top with tin foil. Repeat with an empty cup. Place both in the freezer. After 24 hours, carefully open the freezer and observe the foil lids. The lid on the water filled cup will have moved. Water expanded. Can also be completed with a plastic bottle- feel the difference in air pressure of the bottle before and after freezing. Connect this to why we turn off our outdoor water pipes in the winter - Bursting water pipes science video demonstration and explanation
www.youtube.com/watch?v=HFMjp2xaKck

Videos

- ▶ Flash frozen or super cooled water. Freezes when disturbed, shaken or poured on to a cold surface. Experiment by High School Students
www.youtube.com/watch?v=Fot3m7kyLn4&feature=related
- ▶ Anecdotal report and demonstration by Ontarian.
www.youtube.com/watch?v=047-QOWRTrk
- ▶ Hot water freezes faster. Mr. Herbert- a science teacher, explains and demonstrates why hot water freezes faster than cold water in freezing weather.
www.youtube.com/watch?v=xOVZV6DxaRs



Experiment Instructions

PART A: SOLID AND LIQUID WATER

The Experiment

Feel and look at the water in the glass.

Feel and look at the ice cube.

Write and Draw

- ▶ How do they **feel** the same? Different?
- ▶ How do they **look** the same? Different?
- ▶ Which one is a **liquid**?
- ▶ Which one is a **solid**?
- ▶ What are they **made of**?

Talk About & Write and Draw

- ▶ How does a **liquid** become a **solid**?
- ▶ How does a **solid** become a **liquid**?
- ▶ What will happen if you leave the ice out **in a warm room**?
- ▶ What will happen if you put the glass of water **in the freezer**?
- ▶ What else is **made of ice**?
- ▶ What else is **made of liquid water**?

PART B : WATER VAPOUR

Write and Draw

- ▶ Ask the teacher, how does it **feel**?
- ▶ How does it **look**?
- ▶ What is it **made of**?
- ▶ What **form** of water is it?
- ▶ How is it the **same or different** to a solid or liquid?

Talk About & Write and Draw

- ▶ How does a **liquid** become **vapour**?
- ▶ What will happen if you leave the touches a **cold surface**?
- ▶ What else is **made of vapour**



Part A: Solid and Liquid Water VENN DIAGRAM

Name: _____ Date: _____

My Observations



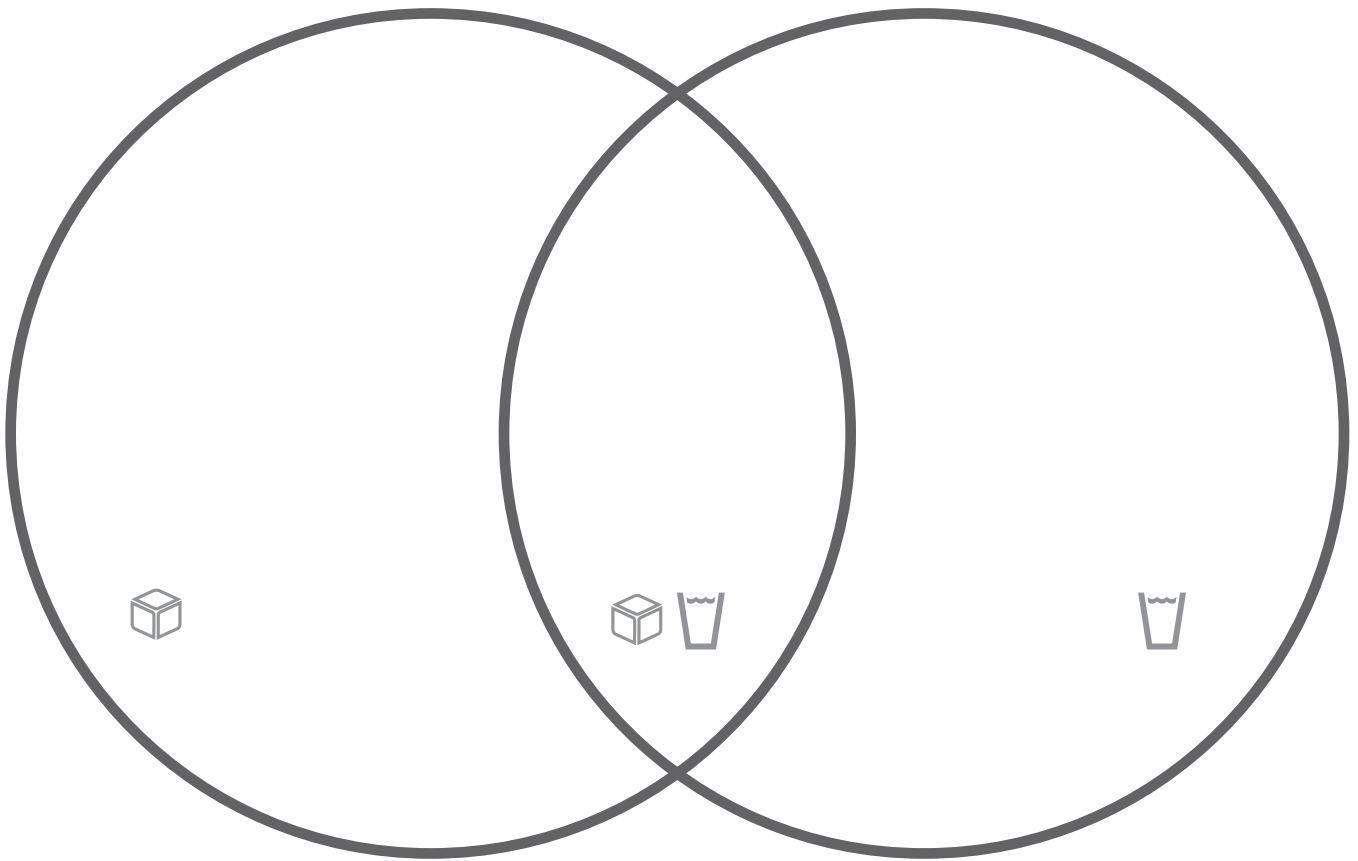
See



Hear



Feel





Part A: Solid and Liquid Water COMPARISON

Name: _____ Date: _____

My Observations:



See



Hear



Feel

- 1. Look, listen, feel.***
- 2. Write or draw what you see, hear and feel.***
- 3. Are any observations the same? Draw a line between them.***

Ice cube

Glass of water



My Conclusions

1. **An ice cube is a** _____.

(solid or liquid)

2. **When I drink a glass of water, it is** _____.

(solid or liquid)

3. **When I pour a liquid into a bowl, the shape** _____.

(stays the same, changes)

4. **If an ice cube is left in a warm room, it will** _____.

(melt, freeze)

5. **If a glass of water is left in a very cold place, the water will** _____.

(melt, freeze)

6. **Examples of liquid water are:**

▶ _____

▶ _____

▶ _____

7. **Examples of solid or frozen water are:**

▶ _____

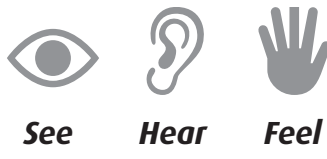
▶ _____

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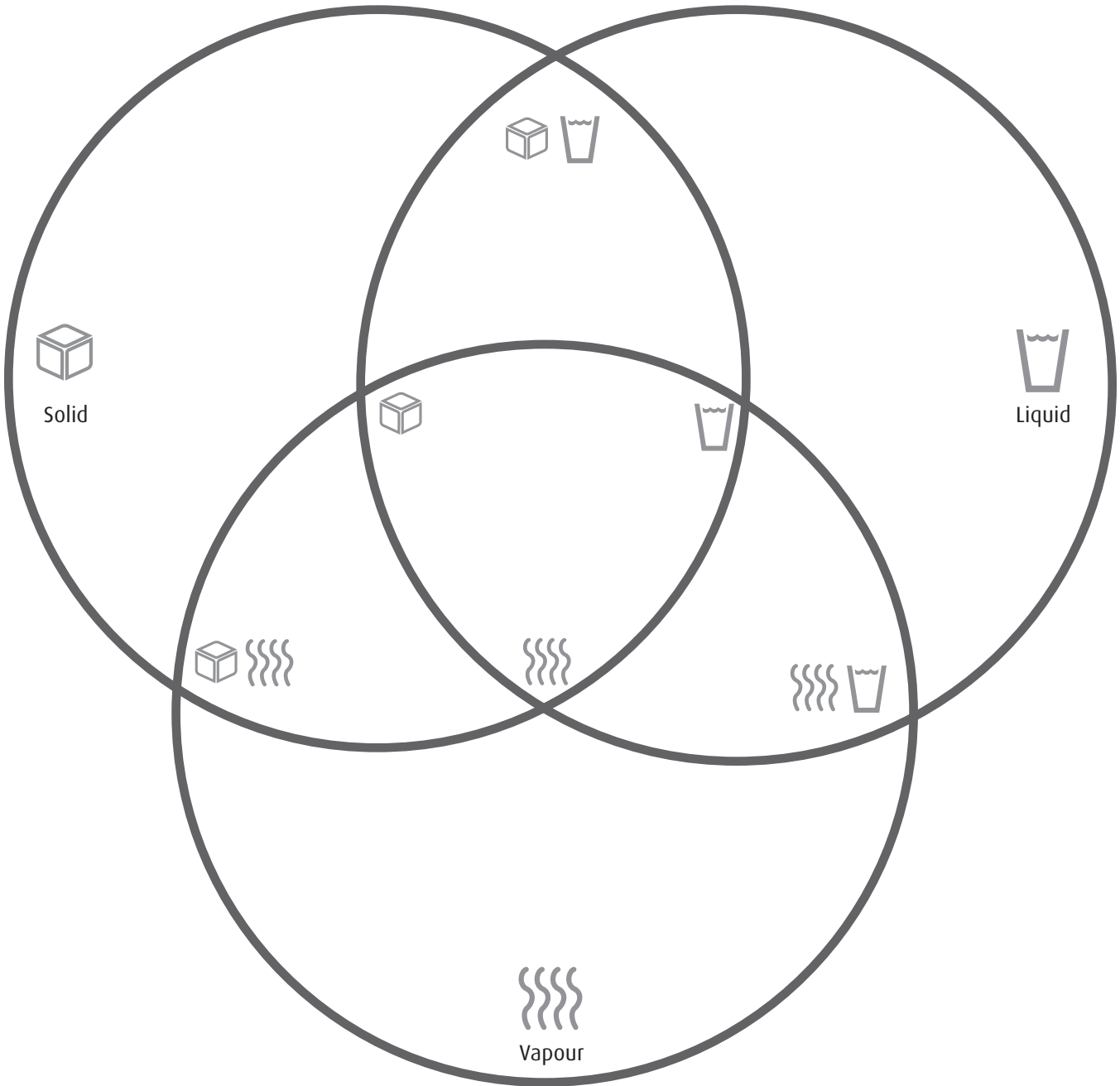


Part B: Solid, Liquid and Vapour Water: VENN DIAGRAM

Name: _____ Date: _____



My Observations





Part B: Solid, Liquid and Vapour Water COMPARISON

Name: _____ Date: _____



See



Hear



Feel

My Observations:

PART A- SOLID AND LIQUID

Ice cube

Glass of water

Part B- VAPOUR

Ice cube



My Conclusions

1. **An ice cube is a** _____.
(solid or liquid)
2. **When I drink a glass of water, it is** _____.
(solid or liquid)
3. **When I pour a liquid into a bowl, the shape** _____.
(stays the same, changes)
4. **If an ice cube is left in a warm room, it will** _____.
(melt, freeze)
5. **If a glass of water is left in a very cold place, the water will** _____.
(melt, freeze)
6. **If liquid water is heated, it becomes** _____.
(melt, freeze)
7. **Examples of liquid water are :**
 - ▶ _____
 - ▶ _____
 - ▶ _____
8. **Examples of solid or frozen water are:**
 - ▶ _____
 - ▶ _____
 - ▶ _____
9. **Examples of water vapour are:**
 - ▶ _____
 - ▶ _____
 - ▶ _____



Part A and Part B - Answer Key

My Observations

Answers could include:

Ice cube

- ▶ Solid
- ▶ Very cold
- ▶ Not see through (opaque)
- ▶ Objects stay on the surface
- ▶ Melts in at room temperature (over 0° Celsius)
- ▶ Made of water

Glass of water

- ▶ Hot, cold, warm
- ▶ Clear
- ▶ Objects go into the water
- ▶ Liquid
- ▶ Made of water

Vapour

- ▶ Very hot
- ▶ Goes around objects
- ▶ Evaporates (over 100°C)
- ▶ Made of water
- ▶ Gas

Same (ice cube and glass of water)

- ▶ Made of water

Same (ice cube, glass of water, vapour)

- ▶ Made of water

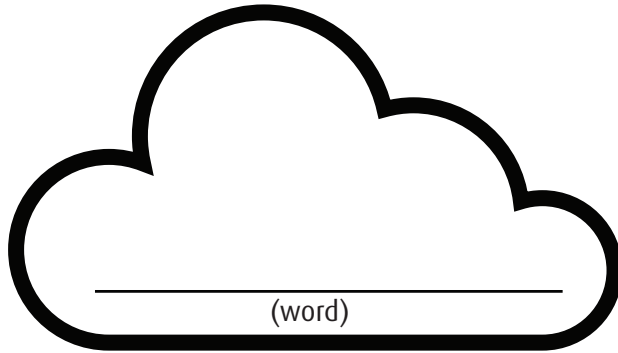
My Conclusions

1. An ice cube is a **solid**.
2. When I drink a glass of water, it is **liquid**.
3. When I pour a liquid into a bowl, the shape **changes**.
4. If an ice cube is left in a warm room, it will **melt**.
5. If a glass of water is left in a very cold place, the water will **freeze**.
6. If liquid water is heated, it becomes **vapour**.
7. Examples of liquid water are : **Rain, lake, river, tears, glass of water**
8. Examples of solid or frozen water are: **Snow, hail, icicle, ice cube**
9. Examples of water vapour are: **Breath, cloud, steam from shower**



Water Word Map

Name: _____ Date: _____



Draw it:

Define it:

Use it in
a sentence:

