Activity Ideas:
Air and Water in the Environment
Properties of Solids and Liquids

Supplementary Resource for Video 3: A Playful Classroom Environment
This document is a companion guide to the Ontario Science Centre’s video series on Play Based Learning, produced in partnership with the Ontario Ministry of Education.

To see the learning opportunities in action, look for the videos on the Science Centre’s YouTube channel: 
https://www.youtube.com/user/OntarioScienceCentre

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LEARNING OPPORTUNITY: ICE BALLOONS

What it’s about:
- Students experiment with frozen water balloons using a variety of materials.
- This idea was originally taken from the Exploratorium’s website. For detailed instructions, see https://www.exploratorium.edu/snacks/ice-balloons

Connections/Extensions:
- What happens if students sprinkle sugar on the balloon, instead of salt?
- Lift an ice cube using some string and a bit of salt: https://www.stevespanglerscience.com/lab/experiments/ice-cube-rope-sick-science/
- Students notice that it’s easier to chip away at the ice with a paper clip, compared to a toothpick. For older students, this would be a good link to conductors and insulators.
- For older students: how can you measure the volume of water in the balloon before and after freezing? (E.g. measure diameter of sphere, displacement of water, etc.)

Try it outside:
- This experiment has potential for mess; bring materials outdoors on a mild day.
- If you are low on freezer space, freeze balloons outside over a couple of cold winter days.
- Use a small amount of salt and nontoxic pigments (tempera paint, food colouring) to paint on ice outside. The salt creates interesting melting patterns, but avoid using large quantities.
- For older students: on a cold winter day, work in groups to build a protective shelter for your water balloon. Does the design of the shelter influence how quickly it freezes? Check periodically and see if some freeze at a higher rate than others (the freezing will likely take a day at the very least). When all of the balloons have frozen, progress to the ice balloon experiment.
Materials:
- Large bin of water or individual bowls and water bottle
- For each student/group:
  * Frozen balloons, *not pictured below* (see Exploratorium article on how to fill them carefully)
  * Salt in shaker
  * Toothpicks and paper clips
  * Food colouring (we diluted it with younger participants)
  * Trays to contain mess
  * Magnifying glass
  * Flashlight
  * Towel to wipe hands

Observations from Prototyping:
- We diluted the food colouring, and had few issues with mess.
- Because of our own constraints, we provided all the materials at once, but likely passing them out one by one (as described in the Exploratorium instructions) would encourage more detailed observation.
- We distributed a small amount of salt, because students used all of the salt in the shakers.

See next page for sample instructions/prompts (we placed it in a T-stand)
Ice Balloons

Safety notes:

✓ Never eat or drink your science experiments.
✓ The food colouring will stain. Use only one drop at a time.
✓ Make sure anything wet stays in the bowl.
✓ Tidy up your spot when you finish.

Look closely at the ice:
Use the flashlight and the magnifying glass.

Things to notice and try:
Look for air trapped in the ice. Where do you think it came from?

Use the paper clip and toothpick to chip at the ice. Which tool works better?

Carefully sprinkle salt on the ice. What happens?
Carefully add one drop of food colouring to the ice. What happens?
LEARNING OPPORTUNITY:
SNOWFLAKES AND SYMMETRY

What it’s about:
• Students explore rotational symmetry with mirrors and simple building materials.

Connections/Extensions:
• Take photos of interesting shapes created.
• Cut snowflake shapes from paper (can use inexpensive coffee filters or better quality origami paper), and change the snowflakes’ appearance with the mirrors.
• Use other materials with the mirrors (beads, cut coloured paper, sequins) for a kaleidoscopic effect.
• Use a MIRA tool to contrast rotational symmetry with bilateral symmetry.

Try it outside:
• Catch snowflakes on a snowy day, and photograph them to sketch later.
• Look for examples of rotational vs bilateral symmetry in nature.
• Make small versions of the hinged mirrors to take outside, or bring small single mirrors (compact mirror or locker mirror) outdoors to experiment with reflection and symmetry.
Materials:
• Microscopic images of snowflakes
• Placemats to mark work area (optional)
• Interesting building materials (we used toothpicks, foam pieces, Styrofoam spheres, and plastic “gems”)
• Angled mirrors (2 acrylic mirrors joined on the outside with fiberglass tape). We purchased custom cut mirrors. It’s important that the mirrors are plastic and not glass, so that they are light and durable. Two locker mirrors (with no border) taped together would be a smaller, cheaper alternative.

Observations from Prototyping:
• This activity was easy to set up and take down.
• It can be hard for groups larger than two to share mirrors, because of the limited range of view.
• The mirrors work well with a variety of objects (hands, faces, loose parts, building materials, etc.).

See next page for sample instructions/prompts (we placed it in a T-stand)
Snowflakes and Symmetry

Use the mirrors to make one toothpick look like six!

Use the materials and the mirrors to make something that reminds you of a snowflake.

Can you count how many sides it has?

Don’t forget to put everything away when you’re done!
LEARNING OPPORTUNITY: WATER BEADS

What it’s about:
• Students experiment with super-absorbent polymer beads.
• Things to notice and try:
  • Clear beads “disappear” in water (because they are made of mostly water, light passes through them in the same way as it does water).
  • Compare the beads in salty vs fresh water.

Connections/Extensions:
• Soak clear beads in red cabbage juice for a fun twist on chemistry (pH) experiments. Provide a labelled ice cube tray with different materials (vinegar, lemon slices, baking soda, soap, etc.) for testing (make red cabbage juice by soaking cut leaves in boiling water, or by blending cabbage and water).
• It’s fun to watch the beads expand over time (it takes about a day). If possible, involve students in this process (and with making cabbage juice if you choose to).
• Good connections to colour mixing for younger participants.
• Disposable diapers contain a similar absorbent polymer, for related or at-home experiments.
• Math opportunities: representing growing or shrinking patterns, partitioning whole numbers with concrete materials, creating a repeating pattern by combining two attributes, counting by 1’s, 2’s, 5’s and 10’s etc.

Try it outside:
• This activity can get messy, so would be great to take outdoors on a warm day.
Materials:
- Plastic table covering
- Each student/group gets:
  * Polyacrylamide beads, not pictured below (we found ours in the floral section of Canadian Tire)
  * Large tray to contain wetness
  * Measuring spoons and dropper
  * Ice cube tray (each slot can be an individual science experiment)
  * Tray to hold water beads, and small beaker for clear beads (to avoid colour bleeding)

Observations from Prototyping:
- Students were fascinated by the texture of the beads, and enjoyed mixing them with water.
- We tried the cabbage juice experiments with rotating stations, but it was hectic to replenish consumables. Perhaps try it as a whole group activity, or empower older students to replenish consumables themselves.
- We created a “slosh bucket” for students to discard beads after chemistry experiments.
- Hydrate beads the day before you need them, so that they have enough time to soak up water.
- The beads will take on a musty smell if you store them in a closed container. Consider storing them in the fridge if you need them for several days.

See next page for sample instructions/prompts (we placed it in a T-stand)
Water Beads

Safety notes:
✓ Never eat or drink your science experiments.
✓ Keep all beads and water on the tray.
✓ Beads are slippery. If one falls on the floor, pick it up.
✓ Tidy up your spot when you finish, so the next person can have fun too.

Things to notice and try:
Use the spoon to put beads into the ice cube tray.
Use the magnifying glass to look closely at the beads.
Can you make a clear bead disappear?
Can you make a bead float?

Math Challenge:
Try counting your beads by 1’s, 2’s, 5’s and 10’s.
Use the ice cube tray to create a growing pattern of beads.
LEARNING OPPORTUNITY: MAKE IT FLOAT

What it’s about:
• Students use materials to construct a structure that floats.
• Students test their structure in the big bin of water, and add glass beads to test it to the breaking/sinking point.

Connections/Extensions:
• Predict how many beads your structure will hold. How close was your prediction?
• Ask each group to report the number of beads their boats held (either best number, or from multiple trials), and graph the results.
• Record how many beads each structure supported. Work as a class to try for the largest possible number of beads (add everybody’s together, so that everyone is contributing, and it isn’t a contest between individual students or groups).
• Older students could also record the ratio of number of parts to number of beads held.
• Look at connections to buoyant structures (boats, diving gear, swim bladders in fish, aquatic plants, etc.).

Try it outside:
• This can get messy. Bring the experiment outside on a warm day!
• If you are close to a lake or ocean, visit a marina and observe the structure of different boats.
• Visit a wetland, and observe/investigate the structure of floating aquatic plants (e.g. duckweed, pond lilies, etc.).
Materials:
- Large bin of water for testing
- Each student/group gets:
  * Container of glass beads, metal nuts, or coins for testing
  * Building materials (foam spheres, corks, toothpicks, aluminum foil, cut pool noodles, etc.)
  * Towel for spills
  * Large bin of water for testing

Observations from Prototyping:
- It would be interesting if students could photograph their results.
- Near the end of the activity, some students put all materials into the water bin (they did keep the water inside the bin, though).
- When we prototyped this with adults, we found that very large pieces of foil were easy to form into a boat shape, and the activity lacked challenge. Small pieces of foil encouraged creative solutions.

See next page for sample instructions/prompts (we placed it in a T-stand)
Make it Float

Safety notes:

✓ Make sure the water stays in the tub.
✓ Always work carefully with the water in the tub.
✓ Tidy up your spot when you finish, so the next person can have fun too.

Use the materials to build something that floats.

Test your object!

How many glass pebbles will your object hold? Make a guess, and then try it out!