

Newton's Cradle

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Guiding Questions

- What's the difference between motion caused by balanced forces and motion caused by unbalanced forces?
- How are balanced and unbalanced forces evident in your life and activities? (Science 6)
- How do Applied Design Skills and Technology (ADST) projects that embrace **Design Thinking** foster growth mindset, creativity, innovation and problem-solving?

<p>Know: (content)</p> <p>Applied Design Define: ID constraints & create Designs Test: & gather peer feedback</p> <p>Applied Skills Use materials, tools, and technologies in a safe manner, and with an awareness of the safety of others, in both physical and digital environments</p> <p>Applied Technologies Demonstrate a willingness to learn new technologies as needed</p>	<p>Understand : (Big Ideas)</p> <p>Skills are developed through practice, effort, and action. The choice of technology and tools depends on the task.</p>	<p>Do: (Core and Curricular Competencies) (Science 6 Competencies)</p> <ul style="list-style-type: none"> • Identify First Peoples perspectives and knowledge as sources of information • Demonstrate an openness to new ideas and consideration of alternatives • Identify some of the social, ethical, and environmental implications of the findings from their own and others' investigations • Co-operatively design projects • Transfer and apply learning to new situations • Communicate ideas, explanations and processes in a variety of ways. • Express and reflect on personal, shared or others' experiences of place
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INSTRUCTIONAL MODEL (5E)



Engage: (*interest piqued, prior knowledge assessed*)

► Watch the “**Newton's Cradle**” instructional video by Moneca Conway, [here!](#)

Teachers, if you need to brush up on Newton's Third Law, as applied to Newton's Cradle, [read this](#) article and watch [this TEDTalk!](#)

Tasks:

FIRST Use tools and technologies to create your own “Newton's Cradle”.

THEN use that experience as a springboard for the following conversation:

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Teacher Prompts:

1. "Newton's Third law states that 'for every action, there is an equal and opposite reaction.'"
2. (Use Newton's Cradle to show how this works.)
3. "What happens when you pull back on one ball and let go? The force of the first ball pushes the last ball in the other direction. What happens when you pull back on two balls and let go? The force of the first two balls pushes the last two balls in the other direction. What happens if you pull back on 3? 4? The ball(s) on the opposite end always swing up with an equal force to that of the first ball(s) because the force of the first ball causes an equal and opposite reaction in the ball at the other end."
 - a. There are loads of other fun science activities we can do to further demonstrate Newton's 3rd Law, such as the [balloon boat](#).

➤ What if we use Newton's Cradle as a metaphor for balance?

4. There are several traditional stories and adages promote balance and the notion that "For every action, there is an equal and opposite reaction".
 - a. Some old sayings are:
 - i. "Do unto others as you would have them do unto you."
 - ii. "Turnabout is fair play."
 - iii. "What goes around comes around."
5. Listen to [this Traditional story from Kenneth Little Hawk](#): "[The Boy Who Taught His People a Dance](#)," from *Wind, Sun and Stars: Two Native American Folk Tales* (1988).
 - a. What can we learn from each characters' actions & reactions?
 - i. Morning Star
 - ii. Feather Woman/Evening Star
 - iii. Grandfather Sun
 - iv. Grandmother Moon
 - b. Kenneth Little Hawk teaches that his people do the Sundance each summer to "give thanks for the scars of life that have been taken from them and the happiness that returns to their hearts".
 - i. How is this teaching like Newton's Third Law: "for every action, there is an equal and opposite reaction?"
 - c. When we contemplate Newton's Third Law and The Boy Who Taught His People a Dance", what can we learn regarding balance in our lives and activities?

➤ Constructivist/Connectivist Extension:

1. For "Indigenous cultures, storytelling is firmly grounded in oral tradition and history. Indigenous storytelling is a way to instill a knowledge of the mind, body, and soul in connection to the earth through experienced and trusted "knowledge keepers." In many Indigenous cultures, storytellers must be trained, apprenticed, and given the right to share knowledge through these stories. (Wheeler, Winona. Personal interview % U. Sask. 15 September 2018.). As well, "a common theme in Indigenous storytelling is the **importance of land and animal preservation. Indigenous culture and story hold the belief that the world is interconnected and should be preserved for future generations.**"
2. To encourage our students to blend traditional and contemporary storytelling, consider teaching them how to retell an existing story (with permission) like [these students did](#) (A stop-motion animation of the book [If Polar Bears Disappeared](#), by Lily Williams)
 - a. Conservationist Titles: [The Earth Book](#) (by Todd Parr), [Bee & Me](#) (by Alison Jay), [The Water Princess](#) (Susan Verde), and [many more!](#)

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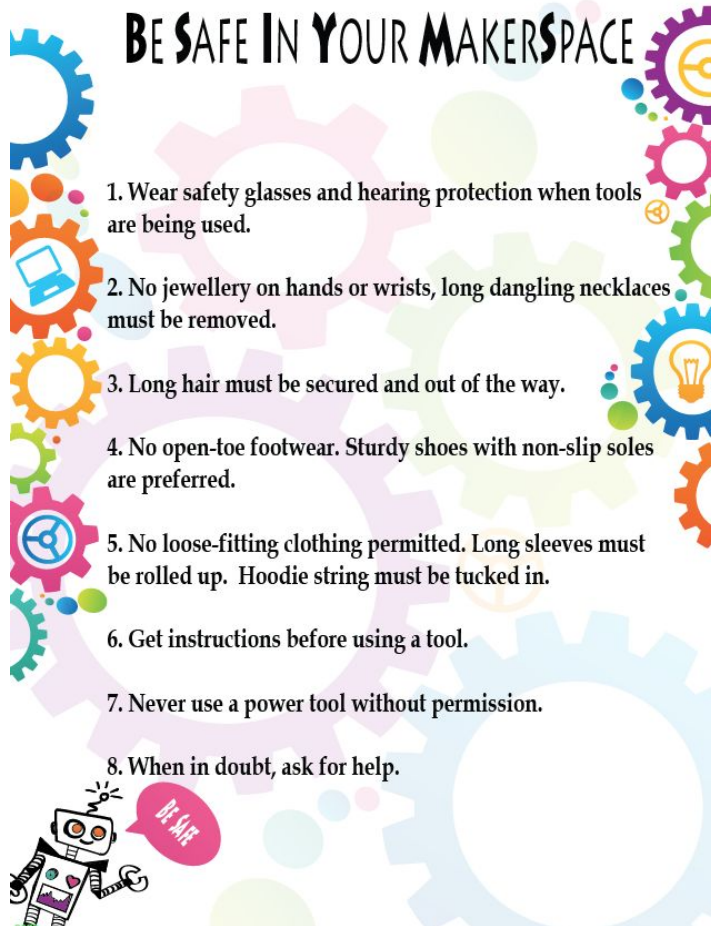
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Explore: (inquiry-based activity)

SAFETY

- **Introduce** expected behaviours poster for hand tools



- ➡ This is a fun [YouTube](#) about shop safety.

TOOLS

- Hammer, saw, screwdriver, ratchet-set, nails, bolts, screws

PROCEDURE

- **IN PAIRS**, Create Newton's Cradle as per **Moneca's video**.



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Explain: *(students communicate what they have learned).*

Core Competency reflections: *Assign one or more to individuals or groups. Reflections could take the form of a checklist, a recorded reflection, a written paragraph, etc.*



Creative Thinking Competency Discussion/Writing Prompt:

Tell me about a story you are interested in retelling & why.

I can get new ideas or build on or combine other people's ideas to create new things within the constraints of a form, a problem, or materials.

- I can get new ideas to create new things or solve straightforward problems.
- My ideas are fun, entertaining, or useful to me and my peers, and I have a sense of accomplishment.
- I can use my imagination to get new ideas of my own, or build on other's ideas, or combine other people's ideas in new ways.
- I can usually make my ideas work within the constraints of a given form, problem, or materials if I keep playing with them.

Profile 2 (curriculum.gov.bc.ca)



Critical Thinking Competency Discussion/Writing Prompt:

Tell me about any skills that made you S-T-R-E-T-C-H today. What was new/challenging?

I can ask questions and consider options. I can use my observations, experience, and imagination to draw conclusions and make judgments.

- I can ask open-ended questions, explore, and gather information.
- I experiment purposefully to develop options.
- I use observation, experience, and imagination to draw conclusions, make judgments, and ask new questions.
- I can describe my thinking and how it is changing.
- I can establish goals individually and with others.
- I can connect my learning with my experiences, efforts, and goals.

Profile 3 (curriculum.gov.bc.ca)

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Collaboration Competency Discussion/Writing Prompt:

Tell me about the way you and your partner shared resources, ideas and jobs.

I contribute during group activities with peers and share roles and responsibilities to achieve goals.

- I take on different roles & tasks. I work respectfully & safely in our shared space.
- I express my ideas & help others feel comfortable to share theirs so that all voices are included.
- I work with others to achieve a common goal & can evaluate group processes and results.

Profile 3 (curriculum.gov.bc.ca)



Communication Competency Discussion/Writing Prompt:

Tell me about the different ways you communicated with each other. Did you talk? Model? Draw? Listen? Question? Who did what?

I communicate purposefully, using forms and strategies I have practiced.

- I participate in conversations for a variety of purposes (e.g., to connect, help, be friendly, learn and share).
- I listen and respond to others.
- I can consider my purpose when I am choosing a form and content.
- I can communicate clearly about topics I know and understand well, using forms and strategies I have practiced.

Profile 3 (curriculum.gov.bc.ca)

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Personal Awareness Competency Discussion/Writing Prompt:

Tell me about how you find balance in your life.

I can make choices that help me meet my wants and needs and increase my feelings of well-being.

I take responsibility for my actions.

- I can take action toward meeting my own wants and needs and finding joy and satisfaction and work toward a goal or solving a problem.
- I can use strategies that increase my feeling of well-being and help me manage my feelings and emotions.
- I can connect my actions with both positive and negative consequences and try to make adjustments; I accept feedback.
- I make decisions about my activities and take some responsibility for my physical and emotional well-being.

Profile 3 (curriculum.gov.bc.ca)



Positive Personal & Cultural Identity Competency Discussion/Writing Prompt:

What personal connections did you make to the stories you heard today?

I understand that my identity is influenced by many aspects of my life.

I am aware that my values shape my choices and contribute to making me a unique individual.

- I understand that my characteristics, qualities, strengths, and challenges make me unique and are an important part of the communities I belong to (including people and places).
- I understand that what I value influences the choices I make and how I present myself in various contexts (including online).
- I can explain how I am able to use my strengths to contribute in my home and/or communities.

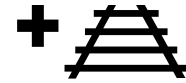
Profile 5 (curriculum.gov.bc.ca)

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Extend: *(transfer knowledge to other concepts)*



Cross-Curricular &/or Connectivist Extension Activities:

- For further thought: **Thrust** is an important result of Newton's Third Law. How does this work in a rocket? Read more about **rockets** and **rocketry**. [Try the Pop Bottle Rocket kit](#) with your class! Connect with Moneca Conway or Brian Campbell if you'd like to borrow the SD60 launchers!
- Share your data with other schools by leaving your top launch data and a picture of your winning design in the kit and with Moneca Conway (mconway@prn.bc.ca).

Evaluate: *(assess student understanding)*

[Share this link](#) with students if you wish to assess their ADST development.

Alternatively/additionally, students can self-assess their current state of being by highlighting any applicable statements on the **Core Competencies**, above.

Questions about this lesson? Connect with Elaine McEachern: emceachern@prn.bc.ca

Template Downloaded from curriculum.gov.bc.ca (Used with permission from Sarah McQuillan. Excerpted from Masters Thesis: Instructional Tools to Support the Implementation of BC's Redesigned Curriculum)
Lesson developed by Elaine McEachern.

Here is a visual that summarizes the lesson:



Question → connect to text → Youtube → make it → reflect on competencies → extend thinking.