As a part of science curriculum standards, students across the nation are being asked to develop skills such as scientific inquiry, technological problem solving, experimentation, and research. Not only is student understanding of basic science concepts a goal of the curriculum, but students are being asked to develop an appreciation for the roles scientists play in society. By continuously assessing and judging the soundness of scientific claims, scientists help shape our understanding of the world by providing compelling evidence and rethinking existing frames of thought. The books in *Scientists in Action* help fulfill many of these curriculum objectives by exploring the fascinating world of today’s working scientists. Each book examines the great variety of scientific work within a particular field, and describes how scientific questions are answered. Processes and practices are explored, with an emphasis on the creative and collaborative aspects of work.

The Scientists in Action Teacher’s Guide contains lessons that showcase various fields of science, explore contributions scientists make, and offer hands-on investigations that create authentic learning experiences. The lesson plans in this guide are tailored to grades 5 and 6, but can be extended further. Students will participate in diverse activities that maintain the same overarching goal: to understand the fundamental concepts of science and technology and recognize scientists as contributors and informers. Students will learn how to gather and organize information, and decipher what information is pertinent to their understanding and what is not.

The lessons in this guide are designed to be taught in sequential order as they work to scaffold student understanding from lesson to lesson. Reproducible worksheets and assessment tools accompany each lesson plan. The titles in *Scientists in Action* include:

- Archaeologists in Action
- Astrologists in Action
- Biologists in Action
- Chemists in Action
- Entomologists in Action
- Environmental Scientists in Action
- Food Scientists in Action
- Geologists in Action
<table>
<thead>
<tr>
<th>Lesson Plan Title</th>
<th>Pacing</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Scientific Process</td>
<td></td>
<td>biologist, chemist, environmental scientist, food scientist, hypothesis, scientific method, scientific practices, scientist</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Becoming an Astronomer</td>
<td></td>
<td>astronomer, gravity, gravitational pull, mass, matter, model, solar system</td>
</tr>
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<td></td>
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<tr>
<td>That’s Debatable!</td>
<td></td>
<td>archaeologist, arguments, debate, defend, entomologist, explore, form, gather, geologist, rebuttal</td>
</tr>
</tbody>
</table>

* 1 class period = 40-60 minutes
ACCOMMODATION STRATEGIES

Accommodations provide equal access to learning and equal opportunity to demonstrate what is learned. Accommodations allow a student access to the subject or course without any changes to the knowledge and skills the student is expected to demonstrate.

Educators are encouraged to adapt the instructional approach, activities, and assessments included in this guide to best meet the diverse interests, needs, and abilities of their students. Possible accommodations may include:

**Instructional Strategies**

- Break tasks into parts with accompanying time lines
- Provide extra time for processing of oral information
- Pair oral instructions with visual ones (writing or symbols)
- Pre-teach new vocabulary and regularly review previously taught vocabulary
- Provided model of completed work
- Frequently check with the student to get him/her started
- Provide oral and visual instructions and examples
- Provide a checklist of tasks for the student

**Environmental Strategies**

- Proximity to teacher
- Strategic seating
- Flexible or mixed-ability grouping
- Provide an alternative setting for learning that is free from visual and auditory distractions

**Assessment Strategies**

- Build in extra time to allow student to process questions asked and answers given
- Provide written instructions and rubrics for assignments
- Offer a choice of assessment activities so that the student can choose one suited to their strength
- Space out or extend assignments to prevent student feeling overwhelmed
- Reduce the number of tasks used to assess skill or concept
- Allow students to use assistive devices or technology
Lesson 1
The Scientific Process

Objectives

Students will:
- Identify and explain the parts of the scientific process.
- Participate in scientific experiments across multiple fields and complete scientific practices for each.

Curriculum Correlations

Ontario Science and Technology
Grade 5. Understanding Matter and Energy, 2; 2.3, 2.5. 3; 3.7, 3.8
Understanding Earth and Space Systems, 2; 2.3, 2.4. 3; 3.1, 3.3
Grade 6. Understanding Matter and Energy 2; 2.4, 2.5

Next Generation Science Standards
MS-PS3-2, MS-PS3-3, MS-PS3-5, MS-PS1-2
MS-LS1-7

Common Core State Standards
CCSS.ELA-LITERACY.R1.5.3
CCSS.ELA-LITERACY.R1.5.4
CCSS.ELA-LITERACY.RST.6-8.3

Materials
- Scientists in Action series
- Whiteboard or Chalkboard
- Whiteboard Makers or Chalk
- Anchor Chart
- Markers, Pens, or Pencils
- Materials for chemistry experiment (liquid starch, white glue, iron oxide powder, magnets, craft stick, tablespoon, disposable cups, gloves)
- Materials for biology experiment (3 slices of bread per group, 3 resealable sandwich bags per group, wipes)
- Materials for environmental experiment (liquid soap, water, corn oil, toothbrush, vegetable oil, feathers, grid paper)
- Materials for food science experiment (lemons, small dishes, strips of paper towels, pennies, dimes)
- Scientific Method Identification Worksheet
- My Scientific Practice Worksheet (4 for each student)
- Scientific Practices Assessment Checklist

Setting the Stage

Begin lesson by posing the question, “What is a scientist’s role?” Write down student answers on the whiteboard. Use the following questions to continue class discussion:
- How do scientists know what to study?
- What process(es) do scientists follow when investigating a phenomena?
- How do scientists gather information?

Take away concept:
- The role of a scientist is to study phenomena in various fields of science in order to educate and provide information to the general public
- The process scientists follow is the scientific method or scientific practice.

Review scientific process with students:
1. Asking a question and/or defining a problem,
2. Making a hypothesis
3. Developing methods of investigation
4. Carrying out investigation
5. Analyzing and interpreting the collected data
6. Communicating findings

Teacher will write the scientific method on an anchor chart so students may refer to it when needed.

Students will complete Scientific Method Identification Worksheet. Students will choose one of the books in the Scientists in Action series and provide a description and example of each step that scientists practice when conducting an investigation.

Teacher may discuss answers and examples upon completion and answer any questions pertaining to the lesson. On the anchor chart, write a definition of each of the steps (definitions should be defined as a class). Example definitions could include:
- Hypothesis – A prediction based on the information you already know; an educated guess.
- Carrying out Investigation – The use of experiments and/or observation to gather evidence and information.
- Communicate Findings – The publishing of work in books, newspapers, magazines, or scientific journals. Scientists may also explain their research online or give speeches/presentations at conferences.
Activity

Set up four separate group stations. Each station will have a specific scientific focus (i.e. food science, chemistry, biology, and environmental science). Students will attend each station and read an explanation of what each type of scientist does, take part in an investigation, and complete a My Scientific Practice Worksheet for each experiment.

Each station will conduct the following experiments:
* Each experiment should take no longer than 30 minutes to complete

- **Chemistry** – Students will explore the affects of a chemical reaction by combining small molecules into one large molecule (polymers). Students will make slime that is able to move with the use of magnets.
- **Biology** – Students will explore the rate in which mould develops using three different methods.*
- **Environmental Science** – Students will chart the effects of applying water, oil, and soap to a feather in order to examine how oil spills harm wildlife.
- **Food Science** – Students will examine lemon juice and it’s influence over provided materials.

*The biology experiment will take a couple days of observation.

Extensions

- Invite students to research an experiment that they would like to partake in that would complement one of the books in the Scientists in Action series.
- Students may write a personal piece detailing which experiment they liked the most and why.

Wrap-Up

Students will complete experiments and hand in My Scientific Practice Worksheet for the four experiments conducted.

Conclude lesson by asking students about their findings for each of the experiments. Use prompting questions such as the following:
- Were any of your hypotheses correct? If so, which one(s)?
- Which experiments, if any, helped you to understand the scientific field in which it was based?
- What step in the scientific method do you feel is most important? Why?

Assessment

Assess Scientific Method Identification Worksheet for understanding and for completion. Teacher will grade My Scientific Practice Worksheet using Scientific Practices Assessment Checklist.
### Scientific Method Identification Worksheet

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the Problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write a Hypothesis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop Methods of Investigations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carry out Investigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpret Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conclusion and Communicate Findings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Moldy Sandwich Experiment
(Biology)

What do you need?

- 3 slices of bread
- 3 resealable sandwich bags
- disinfectant wipes

Instructions

1. Investigate the question, “How is food affected by different interactions with people?”

2. Label each of the bags: “control”, “clean hands” and “dirty hands”.

3. Pass a slice of bread around your group. Make sure each person touches it!
   Place the piece of bread in the “dirty hands” bag. Seal the bag.

4. Each person washes their hands using the disinfectant wipes. Don’t touch anything new!
   Now pass around another slice of bread. Place this piece of bread in the “clean hands” bag. Seal the bag.

5. Place the last piece of bread, that no one has touched, in the “control bag”. Seal the bag.

6. Place the bags in a dark place and watch how quickly the mold begins to appear.

7. After a few days, record the results. Compare the mold in each bag.
How do Oil Spills Harm Wildlife?
(Environmental Science)

What do you need?

- Liquid Soap
- Water
- Corn Oil
- Toothbrush
- Vegetable Oil
- Feather

Instructions

1. Investigate the question, “what happens to birds’ feathers when they are caught in an oil spill?”

2. Use grid paper and write “Absorbed”, “Repelled” and “Changes” across the top.

3. Write “Water”, “Oil” and “Liquid Soap” along the left side.

4. Dip the feather in water and record whether the feather “absorbed” or “repelled” the water. Describe the “changes” you see.

5. Dip the feather in the oil and record whether the feather “absorbed” or “repelled” the oil. Describe the “changes” you see.

6. Sprinkle water on the oil-soaked feather. Record whether the feather “absorbed” or “repelled” the water this time. Describe the changes you see.

7. Mix water and soap together and try to remove oil from feather. Did the feather “absorb” or “repel” the soap? Describe the changes you see.
Magnetic Slime
(Chemistry)

What do you need?

- Liquid Starch
- White Glue
- Iron Oxide Powder
- Magnets
- Craft Stick
- Tablespoon
- Disposable Cups
- Gloves

Instructions

1. Investigate the question, “what kind of reaction happens with iron oxide is mixed with liquid starch and white glue?”

2. Add a tablespoon of iron oxide powder into your disposable cup.

3. Add 2 tablespoons of liquid starch. Use a craft stick to mix the ingredients until the liquid has a smooth consistency.

4. Add 2 tablespoons of white glue and stir mixture. Stir until the mixture is even. You may need to scrape the mixture off of the craft stick periodically to keep mixing.

5. Put on gloves and scoop out the black slime and knead it with your hands. Keep kneading the slime until it is smooth and dry.

6. Once completely dry (you will know this because the black dye will not transfer to anything), take off your gloves and have some fun! Take the magnets and see how they interact with the slime. Try stretching out the slime as long as you can.
The Electric Lemon
(Food Science)

What do you need?

- Lemon
- Small Dish
- Strips of Paper Towel
- 5 Pennies
- 5 Dimes

Instructions

1. Investigate the question “what happens when paper towel and coins are dipped in lemon juice?”

2. Squeeze half a lemon and pour its juice in a small dish.

3. Soak approximately 9 strips of paper towel in the lemon juice.

4. Make a tower out of the coins. Alternate between the dimes and the pennies and separate the coins by placing a lemon soaked piece of paper towel in between each coin.

5. Place each of your index fingers on either side of the tower so that the tower is being held horizontally. Don’t let your hands touch each other!
Name: ___________________________________________ Date: __________________________

My Scientific Practice Worksheet

Experiment being Conducted: _______________________________________________________

1. Question being explored
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

2. Hypothesis
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

3. How will you investigate the problem? (i.e. materials, steps, etc.)
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

4. Explain the investigation
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

5. Analyze the results (what are they telling you?)
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

6. Conclude your findings (answer to the question).
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
# Scientific Practices Assessment Checklist

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Met</th>
<th>Somewhat Met</th>
<th>Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student correctly and clearly identifies the question being explored.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student makes a hypothesis based in fact and reasonable prior knowledge.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student identifies planning requirements, such as materials needed, to conduct investigation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student explains how the investigation will be carried out.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student shows understanding of scientific concepts in their analysis of the results.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student clearly concludes their findings.</td>
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</tbody>
</table>

Additional comments: ____________________________________________________
_______________________________________________________________________
_______________________________________________________________________
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_______________________________________________________________________
LESSON 2
Becoming an Astronomer

Curriculum Correlations

Ontario Science and Technology
Grade 6, Understanding Earth and Space Systems, 2; 2.2, 2.4, 2.5, 3.1, 3.5
Next Generation Science Standards
5-PS2-1, 5-ESS1-1
MS-ESS1-1, MS-ESS1-2, MS-ESS1-3
Common Core State Standards
CCSS.ELA-LITERACY.R1.5.2
CCSS.ELA-LITERACY.R1.5.3
CCSS.ELA-LITERACY.R1.5.4
CCSS.ELA-LITERACY.RST.6-8.1

Setting the Stage

Write the word “scientist” on the whiteboard at the front of the classroom. Facilitate class discussion by posing the question, “When you think of the word scientist, what are some fields of study that come to mind?” (i.e. biologist, chemist, etc.)

Write student responses on the whiteboard. Continue discussion using the following prompts:

- Do you believe the field of astronomy is a science? Why or why not?
  (If students are unfamiliar with astronomy pose the question, “what is astronomy? What is an astronomer’s field of expertise?”)
- What type of contributions do you think astronomers make to the field of science?
  Why do you think their contributions are important to us?
- How do you think astronomers are able to test their hypothesis? Are you familiar with any tools or equipment they rely on to make their observations?

Remind students that scientists, in their search for answers, start out their investigations with a question. Tell students that the question you would like to explore is: “What causes Earth and other planets to rotate around the Sun?”

- Have students hold a pencil and drop it from about shoulder height. Ask students, “why didn’t the pencil float in the air? What caused it to fall to the ground?”

- Take away concept:
  - All objects are made up of matter; the amount of matter an object has is called its mass. In space, objects with a greater mass have the ability to pull other objects towards them. That pull is a force we call gravity. Weight is measured in newtons (N) and mass is measured in grams (g) and kilograms (kg).
  - Because Earth’s mass is great, its gravitational pull is also great. Earth’s gravity pulls the pencil to its center, keeping it from floating in the air.

Show students a model of the solar system (model may be conceptual or physical). Pose the question: “Knowing what we do about mass, matter, and gravity, what do you think a good explanation would be as to why Earth, planets, and other debris orbit the Sun? Why is this important to study?”

Have students write a brief explanation to the question in their journals.

Students will watch brief video (https://bit.ly/2O1FjRj)

Materials

- Astronomers in Action
- Whiteboard or Chalkboard
- Whiteboard Markers or Chalk
- Pens, Pencils, or Pencil Crayons
- Journals
- Blank Paper
- Paint
- Styrofoam balls
- Sticks
- Scissors
- Glue
- Tape
- Additional art supplies as required
- Computers (Research)
- NASA Project Guidelines
- Astronomers in Action Rubric
- Gravitational Pull Worksheet

Objectives

Students will:
- Explain that the solar system is comprised of the Sun and a collection of objects (i.e. planets, asteroids, moons, etc.) and are held in orbit around the Sun by its gravitational pull on them.
- Develop and use a model to explain a particular phenomena.
- Demonstrate and understanding of components that make up Earth.
Activity

Students will read *Astronomers in Action*.

Introduce project:

- Working in small groups of 3-4, students will choose a concept from *Astronomers in Action* and create a model to describe the phenomena.
- Students will explain how the topic they chose is important to the field of science.
- Students will participate in a gallery walk of the various models.

Teacher will discuss project expectations and requirements prior to the projects being started. Provide students with *NASA Project Guidelines*. Criteria for the project may include:

- Topic chosen is reflected in text and has contributed to the field of astronomy
- Includes a question that has guided their research on the topic
- Model is detailed and demonstrates a thorough understanding of topic (model may be physical or conceptual)
- Includes a write up that explains various components of the model
- Explain how the chosen topic has led to the development of industries and engineering systems

Extensions

- Invite students to write an opinion piece and/or reflection about what they have learned during this assignment. Students may discuss how their opinions of astronomy has changed or developed over the course of the lesson.

Wrap-Up

Students will complete assignment requirements and hand-in write-ups.

Students may complete *Gravitational Pull Worksheet* depending on available time.

Participate in a gallery walk of the models. Ask students to reflect on the project and some of the strengths and challenges of their work. Consider the importance of model-making when it comes to science. Ask students:

- Why are models useful in science?
- Why do you think real scientists use models in their work?
- What is one thing you learned from another group's model?

Assessment

Journals will be collected and assessed for comprehension and understanding. Students will submit their projects (models and written components) and teacher will use *Astronomers in Action Rubric* to assess. Collect *Gravitational Pull Worksheet* (time dependent). Observational notes should be taken where permitted.
NASA Wants YOU!

Calling all Astrologists! NASA has lost all their information on Space and they need you to help inform them about some important topics.

Here is some of the topics they need information on:

- The Milky Way
- How We Study Space (Different Complex Equipments)
- The Solar System (Planets, Moons, Asteroids, Etc.)
- Eclipses of the Sun and Moon
- Kepler Mission (Exoplanets)
- Constellations
- Future Missions to Space (Enceladus, Europa, Mars)
- Phases of the Moon

In groups of 3 – 4, research one of the topics listed above (Each topic can only be chosen once).

NASA is requesting the following information for each subject:

1. A question to help shape their research
2. Detailed information about the phenomena
3. A model to represent the topic (conceptual or physical)
4. How the topic has contributed to the field of astronomy
5. How topic has led to development of industries and engineering systems

NASA will hold a large conference in a couple days so that you can show your information to your fellow astrologists!

* EACH INDIVIDUAL WILL PROVIDE THEIR OWN REPORT*
Weight is the ______________________________ of gravity pulling down on you. Mass is the amount of matter that makes up an object or thing. Mass is measured in ___________ (g) and/or kilograms (__________). You can figure out an object’s weight using the following equation:

\[ \text{Weight (N)} = \text{mass (kg)} \times \text{gravitational pull (N/kg)} \]

Let’s explore how much you would weigh on other planets!

My mass is ___________________ kg (you may make up a number)

<table>
<thead>
<tr>
<th>Place</th>
<th>Gravitational Pull (N/kg)</th>
<th>My Mass (kg)</th>
<th>My Weight (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td>11.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td>26.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neptune</td>
<td>12.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Moon</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>3.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td>8.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uranus</td>
<td>10.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. What happens to your mass when you move from one planet to another? __________________________________________________________

2. Which planet did you weight the most? ______________________________________

3. Which planet did you weigh the least? ______________________________________

4. Imagine you went to Mars. Write a brief story about a day in your life there. How did your new weight affect what you were able to do there? ____________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### Astronomers in Action Rubric

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model of Phenomenon</strong></td>
<td>Model is incomplete and/or missing entirely.</td>
<td>Model does not accurately portray phenomenon chosen.</td>
<td>Model is complete and offers an accurate portrayal of the phenomenon chosen.</td>
<td>Model is detailed and thorough. Information provided demonstrates an excellent understanding of chosen topic.</td>
</tr>
<tr>
<td>(Physical or Conceptual)</td>
<td>Detail of model is limited. Model appears to be unfinished or is missing important information.</td>
<td>Detail is sufficient and demonstrates understanding of the topic.</td>
<td>All components are detailed and offer insights into the phenomenon.</td>
<td></td>
</tr>
<tr>
<td><strong>Research and Guiding Question</strong></td>
<td>Report is incomplete and research has not been conducted on the topic. It does not support any model. Question is not provided or does not offer any guidance</td>
<td>Report is included in the project but it lacks detail. Information provided is somewhat limited making it difficult to understand. Some research has been done on the topic. Question that guides research it too vague</td>
<td>Write up offers insight into the phenomenon chosen. Reader is able to understand information provided. Research on the topic is evident. Question is included in report but could be more specific</td>
<td>Write up provided is extremely detailed and demonstrates that research was thoroughly completed on the phenomenon. Question is well constructed and has a specific focus. It helped guide research</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>Information provided in report is very limited and does not offer insight into how the topic has made any contributions to the field of astronomy or the development of industries. Reader has a difficult time following train of thought.</td>
<td>Content of the project offers some information on the topic. Report offers limited information on how the topic has contributed to the field of astronomy and led to the development of industries and engineering systems. More detail is encouraged</td>
<td>Content of the project is thorough and meets requirements. Report offers an adequate explanation as to how the topic has contributed to the field of astronomy and led to the development of industries and engineering systems</td>
<td>Content of the project is detailed and exceeds the requirements. Report includes thorough explanations as to how the topic contributes to the field of astronomy and had led to developments of industries and engineering systems</td>
</tr>
<tr>
<td><strong>Spelling and Grammar (Mechanics)</strong></td>
<td>There are 5 or more mechanical errors throughout the report</td>
<td>There are 3-4 mechanical errors throughout the report</td>
<td>There are 1-2 mechanical errors throughout the report</td>
<td>There are no mechanical errors throughout the report</td>
</tr>
</tbody>
</table>

**Additional comments:**

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________
LESSON 3
That’s Debatable!

Curriculum Correlations

Ontario Science and Technology
Note for teachers: Expectations will be dependant on which debate topics are chosen

Ontario Language Arts Standards
Grade 5 Oral Communication
2; 2.2, 2.3
Grade 6 Oral Communication
2; 2.2, 2.3

Next Generation Science Standards
Note for teachers: Expectations will be dependant on which debate topics are chosen

Common Core State Standards
CCSS.ELA-LITERACY.RST.6-8.1
CCSS.ELA-LITERACY.RTS.6-8.8
CCSS.ELA-LITERACY.SL.6.3
CCSS.ELA-LITERACY.SL.6.4
CCSS.ELA-LITERACY.SL.6.6

Materials
• Scientists in Action series
• Whiteboard or Chalkboard
• Whiteboard Makers or Chalk
• Projector or Computer (Movie)
• Anchor Chart
• Pens, Pencils, or Markers
• Computers (Research)
• Paper
• That’s Debatable Handout
• Scientific Debate Rubric
• Here’s Some Feedback cards

Objectives
Students will:
• Identify the importance of debating and explain the 4 steps to the debating process.
• Research information about a given topic in order to defend stance on the issue.
• Participate in a classroom debate.

Setting the Stage


Ask students:
• What was happening in this scene?
• What is the process called in which two or more people are discussing differing views on the same topic?”

Lead students to identify that the video is showing a debate. Use the following prompting questions to facilitate a class discussion. Write down answers on the whiteboard:
• Why do we debate? Why is it important?
• What is a rebuttal?
• Is the topic “computers have many practical uses” a good topic to debate? Why or why not?

Take away concepts:

• Debates help us learn more about important topics. When we listen and participate in debates, we are able to gather enough information to examine and frame our own informed opinions.
• A rebuttal occurs when participants on one side of the debate provide evidence, information, or facts that disprove an argument made by the other side.
• The topic computers have many practical uses would not be a strong topic to debate because the vast majority of people would agree with this statement and its not a controversial subject.

As a class, discuss the 4 steps to the debating process. Write steps on an anchor chart paper so students may refer to it as needed. Teacher may reinforce and model the steps to ensure student understanding.
1. Gather information
2. Explore all sides of the issue
3. Form an opinion about the topic
4. Defend position in a debate by providing evidence, supporting information and/or facts.
Activity

Students will participate in a classroom debate. As a class, brainstorm possible debate topics from each of the books in the Scientists in Action series (one topic per book is sufficient). Possible topics include, but are not limited to:

- Should Pluto be considered a Planet? (Astronomers in Action)

- Should the government should ban the use of Genetically Modified Organisms (GMOs) (Food Scientists in Action)

- Should scientists be allowed to use animals for scientific testing? (Biologists in Action)

- Does the role anthropods play in spreading diseases makes them more harmful than helpful to our ecosystems? (Entomologists in Action)

- Should cultural treasures should remain in the country in which they were found, or should archaeologists who make cultural discoveries be allowed to determine where they are displayed? (Archeologists in Action)

* All books in the series should be read by this point. Ensure enough debate topics are available so that there is not too much overlap between pairs of students.

Students will be placed in pairs. Two pairs will be assigned each debate topic—one pair argues one side, and one pair argues the other.

Teacher will give students That’s Debatable Handout. Students will use the information included on the handout to prepare for the debate.

Ensure that classroom debate etiquette is discussed and write the rules on anchor chart paper. Class may decide what etiquette should be included. Rules should be reflected in assessment. Rules may include:

- Listen to your opponents and do not interrupt them when they are debating
- Challenge the claim, not the person
- Everyone must speak at least once
- Speak loud and clear but control your tone

Discuss rubric requirements as a class. Teacher may choose to share rubric with students prior to getting started.

Extensions

- Students will write a short paper detailing the arguments used in their debate.

- Invite students to write a reflection on the debate process and examine their opinions on the assigned issue following the debate (Would they change their side? Why or why not?)

Wrap-Up

Students will debate each topic in front of the class. Debates should take the following structure. Ensure students know the structure before the debate so that the activity does not get unmanageable.

1. Pair 1 Introduction
2. Pair 2 Introduction
3. Pair 1 Preview
4. Pair 2 Preview
5. Pair 1 Point 1
6. Pair 2 Point 1
7. Pair 1 Point 2
8. Pair 2 Point 2
9. (finish rest of points)
10. Pair 1 Rebuttal
11. Pair 2 Rebuttal
12. Pair 1 Conclusion
13. Pair 2 Conclusion.

When each debate is finished, invite students to ask questions to the pairs presenting. Pairs should be able to answer questions about their topics and point of view.

Each student will complete Here’s Some Feedback cards and hand them to the teacher upon completion.

Assessment

Teacher will assess the debates using Scientific Debate Rubric. Teacher will also collect Here’s Some Feedback cards. Observational notes should be taken when possible.
That’s Debatable!

WELCOME TO OUR CLASSROOM SCIENCE DEBATE!
You and your partner will be assigned an issue that is currently up for debate in science.
You will also be assigned a “side.”

With your partner, complete the following steps to prepare for the big debate.
Remember, you will be debating in front of your peers against the opposing side!

GOOD LUCK

**STEP 1: RESEARCH**

- With your partner, research your science topic and explore the various stances on the issue. Remember to record where you are getting your information from. You are looking for FACTS, EVIDENCE, and INFORMATION that supports your arguments.

**STEP 2: ARGUMENTS**

- Decide on 3 really strong arguments that support your side of the argument.
  HINT: Your argument will be stronger if you can provide statistics and evidence!!!

- Write down each of your arguments and make sure you are comfortable enough to explain them in detail.

**STEP 3: STRUCTURE**

**INTRODUCTION** — Introduce yourselves and state what you stand for. Engage the audience and get them interested!

**PREVIEW** — What points you are going to cover? These should be no longer than 3 words and provide a look or preview on what your arguments will be.

**POINT ONE** — Discuss your first point
  - Name that you provided in preview
  - Explanation (why is your point true and what does it mean for your overall argument?)
  - Evidence (Facts, statistics, examples, or authority (scientists))

**POINT TWO** — Name, Explanation, Evidence

**POINT THREE** — Name, Explanation, Evidence

**REBUTTAL** — Begin with “I would like to thank my opponents for their argument, but we would like to formally disagree with their stance because . . .” (very briefly discuss why you disagree).

**CONCLUSION** — Each group will provide concluding statements briefly summarizing why their position is correct. In your closing statement, reflect the argument you made in your introduction.
Here's Some Feedback

Your Name: ____________________________________________________________

Pair You are Reviewing: _________________________________________________

Something I really liked is...

A piece of advice I have for you is...

One thing I learned from your arguments is...
**Scientific Debate Rubric**

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparedness</strong></td>
<td>• Arguments are incomplete, disorganized or completely lacking.</td>
<td>• Somewhat organized presentation of arguments and evidence.</td>
<td>• Organized and generally complete presentation of arguments and evidence.</td>
<td>• Extremely thorough, well organized presentation of arguments and evidence.</td>
</tr>
<tr>
<td></td>
<td>• Opening and closing statements do little more than state the stance of the team members.</td>
<td>• Listeners have difficulty distinguishing points in opening statement and closing does not reflect what was stated in opening.</td>
<td>• Opening statements lists arguments/points but it does not engage listeners. Closing statements mostly reflect arguments.</td>
<td>• Opening statements engage the audience and closing statements leave no unanswered questions.</td>
</tr>
<tr>
<td><strong>Performance &amp; Etiquette</strong></td>
<td>• Demonstrates no preparedness.</td>
<td>• Lacks confidence.</td>
<td>• Is confident on topic at hand the majority of the debate.</td>
<td>• Exhibits confidence, energy, and passion in the course of the debate.</td>
</tr>
<tr>
<td></td>
<td>• Tone in debate does not reflect etiquette discussed in class.</td>
<td>• Respectful of partners and opposing team members.</td>
<td>• Maintains a positive attitude and respectful demeanour.</td>
<td>• Maintains a respectful tone.</td>
</tr>
<tr>
<td></td>
<td>• Does not provide any supporting preparation materials.</td>
<td>• Supporting materials can become distractive.</td>
<td>• Uses preparation material effectively.</td>
<td>• Exudes professionalism and courtesy to partner and opposing team.</td>
</tr>
<tr>
<td><strong>Content/ Knowledge</strong></td>
<td>• Demonstrates and inadequate understanding of topic.</td>
<td>• Demonstrates a generally accurate understanding of issues, facts, and evidence but can exhibit minor confusion or misunderstand material.</td>
<td>• Demonstrates a basic but accurate understanding of issues, facts, and evidence relating to the topic.</td>
<td>• Demonstrates superb understanding of material, issues, facts, and information relating to the topic.</td>
</tr>
<tr>
<td></td>
<td>• Statements are unsupported by little or no information at all.</td>
<td>• Has some difficulty connecting facts with arguments.</td>
<td>• Adequate understanding of facts provided and can make some connections.</td>
<td>• Demonstrates accurate understanding of details and makes connections.</td>
</tr>
<tr>
<td></td>
<td>• Cannot connect evidence with arguments.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evidence &amp; Research</strong></td>
<td>• None of the arguments have been supported with evidence, facts, or statistics.</td>
<td>• 1 argument is supported with evidence, facts, and/or statistics. Resource was cited in debate and recorded.</td>
<td>• 2 arguments are supported with evidence, facts, and/or statistics. Resources are cited and recorded.</td>
<td>• All arguments are supported with evidence, facts, and/or statistics. Resources are cited and recorded.</td>
</tr>
</tbody>
</table>

**Additional comments:**

_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________