

The Canada Science and Technology Museum
presents:

Astronomy: A Virtual Exploration Guide

Section 5

Astronomy and our Environment



Introduction

As we study the stars and planets, there is a tendency to view Astronomy as being ‘distant’ — without practical implications in our world. This is far from being the truth. By studying celestial phenomena, we learn more about many aspects of our environment, from why we have to dress differently for each season, to why the tides change. Through the course of this section, your students will investigate how events in space impact the environment on Earth. Older students will also examine how space research has led to technological innovations that can teach us more about our environment.

Section 5 Content

The following is an outline of this section’s structure and intended activity grade levels. For a comprehensive overview of the whole Exploration Guide, please see Section 1.

Primary (K-3)

5.1 Canada’s Seasonal Cycles: Dressing for the Weather

Junior (Grade 4 to 6)

5.2 The Seasonal Behaviour of Canada’s Animals

Transitional (Grade 4 and up)





5.3 All About Tides

Intermediate/Senior (Grade 7 and up)

5.4 Solar Winds and the Aurora Borealis

5.5 Satellites and their Environmental Applications

Distinctive icons throughout the Exploration Guide indicate its key features, helping you to find your way through the text quickly and efficiently.

| | |
|---|--|
|  Classroom Activity |  Discussion or Essay Topic |
|  Deeper Study |  Website to Visit |

Resources for the Activities

Many of the following activities require students to conduct research online. Worksheets for all activities are included at the end of this section. Teachers may request an answer package for the more detailed Activity Sheets by e-mailing virt_prog@technomuses.ca. Please allow about a week for us to reply.

Activities

Activity 5.1: Canada's Seasonal Cycles: Dressing for the Weather (Suitable for Kindergarten to Grade 3)



This activity reinforces the idea that Canada's four seasons result from the changing angles at which sunlight reaches the Earth over the course of the year. Before you begin this activity, review the relationship between the tilt of the Earth's axis, and the temperature on Earth. This relationship is explained in Activity 2.2 of the Exploration Guide (Tracing the Sun's Heat).

For this activity, you will need a suitcase filled with examples of seasonal outerwear, a wall-mounted map of Canada, a flashlight, old magazines and catalogues, safety scissors, glue, and the activity worksheet.

Part 1: Packing a Suitcase – Tell your students to imagine that you are going on a trip across Canada. This trip will take 365 days, so you have packed all of the clothes that you will need for a whole year. Take the articles of outerwear out of the suitcase one-by-one. As a class, have students identify each article of clothing, which season it should be worn in, and why. Have students use the flashlight to illustrate on the map the angle at which sunlight hits the earth during each season (as per Activity 2.2). For ideas about possible seasonal clothing items to include, see the chart below:

| TYPES OF CLOTHING | | | |
|--|---|--|--|
| Fall | Winter | Spring | Summer |
| cool, getting colder | cold, freezing | cool, getting warmer | warm, getting hotter |
| windbreaker jacket rain coat rubber boots light mittens toque wool or polar fleece sweater | parka scarf heavy socks winter boots wool or polar fleece toque mittens | windbreaker jacket rain coat rubber boots light mittens toque wool or polar fleece sweater | t-shirt shorts running shoes sandals sun hat sunglasses |

Part 2: Qualities of Seasonal Clothing – As a large group, brainstorm qualities that make articles of clothing suitable for a specific season. Organize your students' thoughts into a chart on the blackboard, as per the following example:

| SOME CHARACTERISTICS OF CLOTHING | | | |
|---|--|---|---|
| Fall | Winter | Spring | Summer |
| Fabrics need to: | Fabrics need to: | Fabrics need to: | Fabrics need to: |
| cover most of the body be windproof be waterproof be breathable be warm | cover the whole body be heavy to keep you warm insulate be windproof be waterproof be thick have many layers | cover most of the body be windproof be waterproof be breathable be warm | keep you cool be light be thin be breathable protect from the Sun |

Name: _____

Dressing for the Weather

| | |
|--------|--|
| SPRING | |
| SUMMER | |
| AUTUMN | |
| WINTER | |

CANADA SCIENCE TECHNOLOGY Canada

Part 3: “Dressing for the Weather” Chart – Distribute magazines and catalogues, scissors, glue, and the attached worksheet. Ask students to imagine that they are now going on a year-long trip across Canada. Have them plan what clothing they would need to pack, cutting out examples of seasonal clothing, and pasting them in the appropriate row on the worksheet.

You may wish to enlarge the worksheet, printing on tabloid-sized paper. This will allow students more area to paste their gathered images.

A variation of this activity would be to have students work in groups, pasting images onto a Bristol board.

Activity 5.2: The Seasonal Behaviour of Canada’s Animals

(Suitable for Grades 4 to 6)



One effect of Canada’s changing seasons is animal migration and hibernation. Many factors trigger migration and hibernation, including temperature changes and fluctuations in daylight hours. These factors are a direct result of the Earth’s revolution around the Sun. Indeed, it is thought that some animals are even guided by the position of the Sun and stars. Certainly, we can see that astronomy has a direct correlation with the actions of animals on Earth.

For more information about animal migration, visit the *Hinterland Who’s Who* website at www.hww.ca/hww2.asp?id=126



Have your students visit the *Hinterland Who’s Who* online media centre at www.hww.ca/media.asp. They will find a variety of video clips and factsheets pertaining to Canadian wildlife. Younger students can follow the ‘youth’ link to access video clips and factsheets that better suit their level of understanding and interest.

Working individually or in pairs, have students view a selection of the video clips. Ask students to select one of the featured animals, ensuring that they select an animal that migrates (most of the featured animals do). Using this resource, have students compile a small project explaining why the seasons change (as presented in earlier activities), and how seasonal changes affect the animal that they have selected. This project could take the form of a poster and/or an oral presentation.



Activity 5.4: Solar Winds and the Aurora Borealis

(Suitable for Grades 7 and up)



If your students have ever witnessed the Northern Lights (or Aurora Borealis), they were likely captivated by their mystery and beauty. How better to engage your students' interest in Astronomy than by relating it to such a fascinating phenomenon!

The Aurora Borealis (in the Northern hemisphere) and the Aurora Australis (in the Southern hemisphere) are caused by electrically charged particles that are ejected from the surface of the Sun. This phenomenon is called "solar wind." This solar wind is attracted to the Earth's two magnetic poles. When it enters the Earth's atmosphere at these locations, it creates a dazzling spectacle in the night sky.

For a brief technical description of what causes the Aurora Borealis, visit the National Research Council's website at:

www.nrc-cnrc.gc.ca/eng/education/astronomy/topics/solar_phenomenon.html.



For a more in-depth explanation, visit Natural Resources Canada's website at:

www.nrcan-rncan.gc.ca/com/elements/issues/13/auror-eng.php.

Name: _____

The Aurora Borealis

- Where does the Aurora take place?

- Describe how the Earth's magnetic field acts.

- At the southern magnetic pole, what is the Aurora called?

- What is solar wind, and how does it cause the Aurora?

- When and where was the first magnetic observatory established?

- Why did these scientists choose to study the upper atmosphere?

- What causes the different colours of the Aurora Borealis?

CANADA SCIENCE TECHNOLOGY MUSEUM Canada

Have your students visit the Canada Space Agency's website at:

www.asc-csa.gc.ca/eng/missions/sts-097/kid_aurora.asp.

Working individually or in pairs, have students read the Aurora Borealis factsheet online, finding answers to the included worksheet. **Please note that this worksheet must be printed on legal-sized paper.** The online factsheet explains why the Aurora Borealis exists. It also provides background information about how Canadian researchers have studied the Aurora, culminating with Canada's entry into the space age.

The online factsheet is also available in pdf format. You may wish to print the worksheet and have your students complete the activity offline.

Extension Activity: Based on what they learned in this activity, have older students conduct research to identify how the Aurora Borealis impacts our lives today. What current technologies are affected by solar winds? What do these technologies have in common?



Activity 5.5: Satellites and their Environmental Applications

(Suitable for Grades 7 and up)



Satellites have come a long way since Sputnik in 1957, and Canada’s Alouette project in 1962. Today, people use satellites for many applications. One major function of satellites is to monitor conditions as the Sun’s electromagnetic particles travel towards the earth. A variety of geomagnetic phenomena as associated with the journey of these particles, the study of which has been termed “space weather.”

To learn more about space weather and geomagnetic phenomena, visit the Space Weather Canada’s website at http://www.spaceweather.gc.ca/index_e.php.



Oral Presentation: Have your students visit the section of the website explaining the effects of space weather on consumer technologies (http://www.spaceweather.gc.ca/effects_e.php). Several technologies are discussed — power systems, satellite services, GPS positioning, pipelines, communication cables, etc. In pairs or small groups, have students learn about one way that space weather affects our everyday lives, and what hazards space weather can pose. Have students present their findings to the rest of the class.



Topics for Group Discussion: Encourage your students to make connections between astronomy and its relevance to their lives. The following topics are meant to help guide large and small-group discussions within your classroom:



- How many consumer technologies are reliant of satellite technologies?
- In what ways might our reliance on satellites make us vulnerable?
- Debate the merits and the problems surrounding satellite imaging.

Extension Activity: Using a computer and a projector, view NASA’s Earth Observatory page at <http://earthobservatory.nasa.gov>. Browse through a selection of images from NASA’s “Image of the Day” archive. Each image includes a detailed description of what you are seeing. Many images illustrate contemporary issues in Environmental Studies, such as coastal soil erosion, or rainforest deforestation.



Name: _____

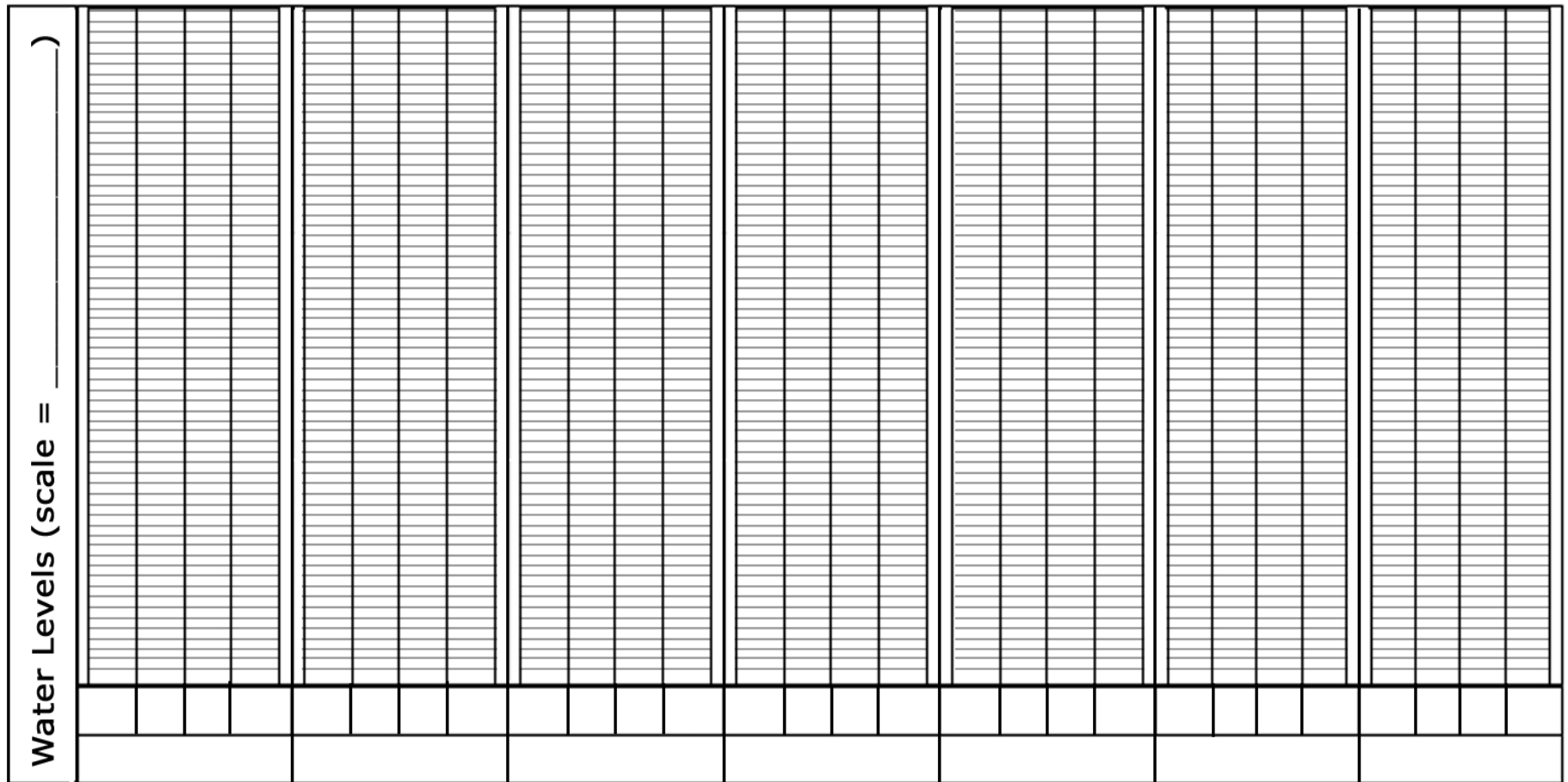
Dressing for the Weather

| | |
|--------|--|
| SPRING | |
| SUMMER | |
| AUTUMN | |
| WINTER | |

Name: _____

All About Tides

Tidal Chart for the City of _____



Dates and Times

Name: _____

The Aurora Borealis

1. Where does the Aurora take place?

2. Describe how the Earth's magnetic field acts.

3. At the southern magnetic pole, what is the Aurora called?

4. What is solar wind, and how does it cause the Aurora?

5. When and where was the first magnetic observatory established?

6. Why did these scientists choose to study the upper atmosphere?

7. What causes the different colours of the Aurora Borealis?

8. Is the Aurora always there? _____

9. What shape is it? _____

10. Where exactly is the Aurora Borealis located?

11. When is there the greatest chance of seeing the Aurora Borealis in southern Canada?

12. In the 1950s, what did the Aurora Borealis frequently interrupt?

13. How is the Aurora Borealis responsible for Canada entering the space age?
