Written by:
Andrea Schultz-Allison,
Department of Earth Sciences,
The University of Western Ontario

Designation: Ontario Curriculum: Science and Technology

Earth and Space Systems: Grade 1 – Daily and Seasonal Cycles

Specific Expectations Addressed:

Understanding Basic Concepts – describe, using their observations, changes in heat and light from the sun over a period of time (e.g. measure and describe outdoor temperatures at different times of the day; observe and describe how the position of the sun influences the length and shape of the shadows)

Developing Skills of Inquiry, Design, and Communication – ask questions about and identify needs or problems arising from observable events in the environment, and explore possible answers and solutions (e.g. chart observations of a sunflower over several days and identify a pattern in the movement of the head of the flower; record sunrise times and sunset times and observe a pattern)

Relating Science and Technology to the World Outside the School – describe ways in which humans modify their behaviour to adapt to changes in temperature and sunlight during the day

Background:

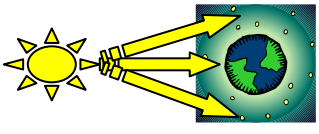
Our Seasons are as different as Day and Night

What goes around comes around! A common saying regarding human sociology that also speaks volumes regarding the Earth Sciences. When teaching primary children about daily and seasonal cycles remember they're all *a-round*! From the shape of our earth and sun and the shape of the earth's orbit, to the rotation of the earth around its axis, and to the perpetual cycle of our seasons the emphasis is on the infinity of the circle.

For concrete examples of, or other teacher resources, set out moveable 3D solar system models or household blue boxes depicting the Mobius loop of recycling. Students may explore the movements of the 3D models or discuss the life cycle of recyclable items (e.g. from paper product to recycled as a boxboard or cardboard product and possibly back to paper product). These also emphasize the concept of continuous change and cyclical motion. Finally, kinesthetic activities such as circle games, songs, and activities also help young minds develop the notion of circuitous movement all around them.

The earth's daily cycle of day and night is entirely due to its rotational movement. The earth rotates counterclockwise around itself – around its own north-south axis, an imaginary line running between the Poles. Since it takes about 24 hours for the earth to make this spin once, this creates night and day. Half of the earth is facing the sun in daylight hours, and the other half is in darkness. The earth also rotates around the sun in a not-quite-perfect circle (an elliptical / oval shaped path) on a not-quite-straight tilt of 23.5º (on its axis) and thus we have seasons. Imagine the earth leaning in towards the sun during our summer solstice, and then gradually tilting away from the sun as it continues to orbit creating the autumnal equinox and then winter solstice. If not for the earth's slant we would not have the earth's seasons.

While envisioning these daily and seasonal cycles continuing on and on, around and around, picture also the round, spherical earth shape. The sun's light and heat energies cannot fall evenly upon the earth because the planet is round. Sun rays strike the equatorial regions in a more concentrated, direct beam and therefore product more heat. While the Polar regions are receiving sunlight in a less direct, more angled path and are the least heated.



Procedure:
Part 1

Understanding Basic Concepts – describe, using their observations, changes in heat and light from the sun over a period of time (e.g. measure and describe outdoor temperatures at different times of the day; observe and describe how the position of the sun influences the length and shape of the shadows)

Materials Needed For Activity:

- Globe or plastic ball / beach ball / balloon decorated as such
- Cord capable of holding globe weight
- Flashlight
- Sticker of a person

1) Suspend an actual globe, or preferably a lightweight plastic ball/beach ball painted or printed as a globe, on a cord from the classroom ceiling, at the front of the room.

2) Stick a sticker "person" on one of the continents.

3) Prop up a flashlight so that it rests at the same "latitude" as the Equator and turn it on to represent the sun.

4) Turn off classroom lights, close curtains.

5) Turn the "Earth" slowly counterclockwise so that the "person" is in direct "sunlight". Ask students:
    - what time of day is the (sticker) person experiencing?
    - what time of day is everyone on the other side of the world experiencing?

6) Turn the Earth slowly counterclockwise again, explaining that it would really take 12 hours for this process, until the person is completely out of view. The "sun" is still shining, but the person has disappeared into darkness. Ask students:
    - what time of day is the person experiencing now?
    - is this person experiencing warmer or cooler temperatures right now?

Procedure:
Part 2

Understanding Basic Concepts – describe, using their observations, changes in heat and light from the sun over a period of time (e.g. measure and describe outdoor temperatures at different times of the day; observe and describe how the position of the sun influences the length and shape of the shadows)

Materials Needed For Activity:

- lamp
- CD / tape player (optional) with "sounds" of sunset, night, sunrise, daytime

1) Plug lamp in, place in centre of classroom.

2) Have students stand in circle, centered around lamp.

3) Turn on "sun" lamp; turn off classroom lights, close curtains.

4) Each student is now playing the part of the Earth. Ask students to face the "sun" and play appropriate music / sound effects for daytime, i.e. students laughing/playing in school yard; busy traffic sounds; dogs barking, etc. This is daytime!

5) Turn sounds effects off and have students make one quarter turn left / counterclockwise. Play the sound effects for sunset / dusk such as quiet waves at the beach; slower, quieter traffic, etc. Ask the students based on the amount of "sunlight" they see and feel, and based on the sounds they're hearing, what time of day they believe it to be.

6) Turn sound effects off and have students make another one quarter turn to their left. They now have their backs to the "sun" and should see no light. (Turn lamp off if it helps) Play the sound effects for nighttime, i.e. crickets chirping, owls hooting, etc. Again, ask the students to identify the time of day and describe why they know it is such.

7) Turn sound effects off and have students make another one quarter turn to their left. Play the sound effects for sunrise, as the students see and feel the return of light. (Sound effects such as birds chirping, squirrels stirring/chattering, etc.) Ask students to identify the time of day and describe how much sun they "see" while looking straight ahead. How is this similar to sunset? How do the sounds match this time of day?

8) Finally, turn sound effects off and have student make one last quarter turn to face the lamp again. Ask what time of day it is and how they (the Earth) feel to be fully facing the sun. (Warmer, brighter)

When students return to their desks, they may begin Handout #1, together, as a class.

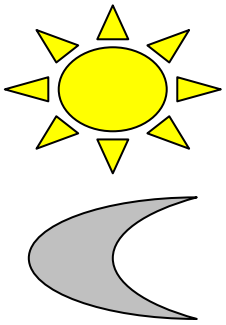
HANDOUT #1: Observations Chart **Name:** _____

When my part of the EARTH faces the SUN it is:

_____
(What time of day?)
I see: _____
I feel: _____
I hear: _____

When the EARTH has ROTATED almost around in a whole circle it is:

_____
(What time of day?)
I see: _____
I feel: _____
I hear:



When the EARTH begins to ROTATE it is:

_____
(What time of day?)
I see: _____
I feel: _____
I hear: _____

When the EARTH has ROTATED halfway around from where day began it is:

_____
(What time of day?)
I see: _____
I feel: _____
I hear:

Fill in the Blanks:

The Earth is _____ (round / flat / square).

The Earth spins around to the left, which is _____ (clockwise / counterclockwise).

The Earth also orbits around the _____ (stars / moon / sun) and we get heat and light.

Does the Earth turn more than once in a complete circle? Yes or No? We know this is true because it creates _____ and _____.
Day is 12 hours long and night is 12 hours long. 12 + 12 = _____.
Therefore, a full day is _____ hours long.

Procedure:
Part 3

Developing Skills of Inquiry, Design, and Communication – ask questions about and identify needs or problems arising from observable events in the environment, and explore possible answers and solutions (e.g. chart observations of a sunflower over several days and identify a pattern in the movement of the head of the flower; record sunrise times and sunset times and observe a pattern)

Developing Skills of Inquiry, Design, and Communication – record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g. measure and record changes in temperature)

Relating Science and Technology to the World Outside the School – describe ways in which humans modify their behaviour to adapt to changes in temperature and sunlight during the day

Homemade Thermometer

Materials Needed For Activity:

- Cold water
- Small plastic jug / bottle
- Dark food colouring
- Clear straw
- "Tacky" or reusable adhesive
- Heavyweight paper / white cardboard
- Scissors
- Felt-tipped pens (Red, Yellow, Blue)
- Access to a refrigerator

Make the Thermometer

Procedures: *Note: Teachers may delegate any or all of these instructions to students as they see fit, i.e. students may be presented with the completed thermometers or just the full bottles with sealed straws

1) Pour cold water in the bottle until it is approximately ¾ full. Add enough food colouring that the water will be clearly visible. Place the clear straw into the water. Seal the straw into place by surrounding it with tacky around the neck of the bottle.

2) Carefully blow into the straw for approximately 2 or 3 seconds to force extra air into your bottle. You will notice that this extra air pressure in the bottle will force some water up the straw. You should now see the level of the coloured water above the neck of the bottle.

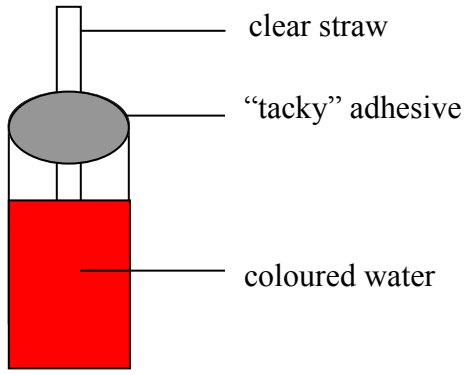
3) Cut your paper / cardboard at the top and bottom and slide it over the straw like a boat sail.

4) Let the thermometer stand at room temperature until another science class / another day. Draw a line on your card beside the water line in RED for Room temperature.

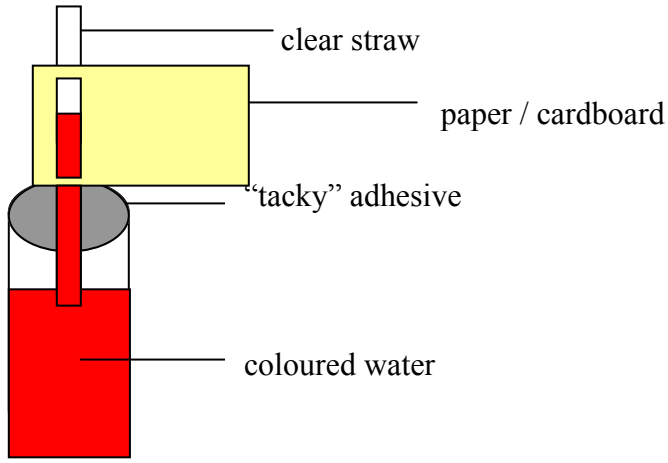
5) Take your thermometer outside. If it is winter, mark the water level in BLUE for cold weather. If it is summer, mark the water level in YELLOW for hot, sunny weather.

*See attached illustrated instructions for further assistance

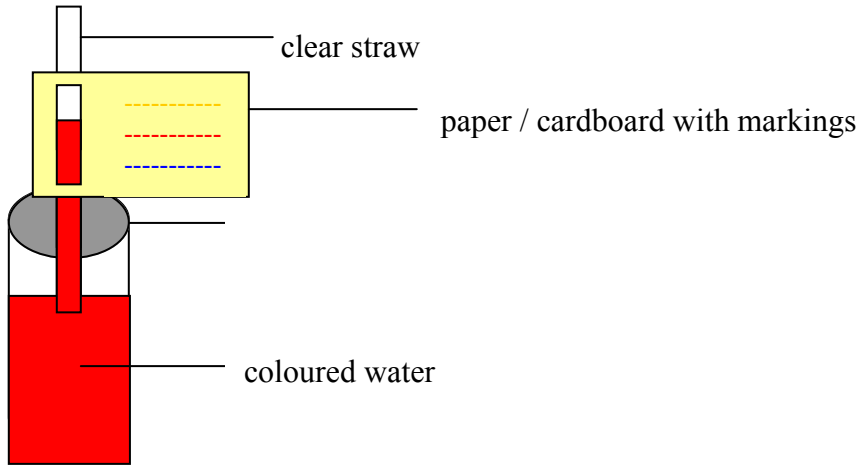
1)


clear straw
“tacky” adhesive
coloured water

3)


clear straw
paper / cardboard
“tacky” adhesive
coloured water

5)


clear straw
paper / cardboard with markings
coloured water

Homemade Thermometer

Questions / Problems / Observations in classroom discussion:
(Teachers may wish to incorporate these answers into worksheets or journal entries with simple captions under sketches of student thermometers)

- Why did extra air pressure force the water up the straw?

(The air expanded, or grew larger, and took up more room in the bottle, pushing water out of its way and "up" the straw)

- How did the warmer temperature affect the water level?

(Heat makes the air and water expand, forcing the water level in the straw above the room temperature mark)

- How did exposing the thermometer to winter weather or the refrigerator affect the water level?

(Cold temperatures make the air and water contract, or take up less room, and the water level seems to "drop")

- What problems would we experience if the weather outside wasn't very hot or very cold? What would we observe on our thermometer?

(Not much range in temperature and very close, difficult to distinguish markings on our thermometer card)

- How could we solve these problems?

(Use of a refrigerator or heat lamp)

- What information do we get from store-bought thermometers? What do we do with this information?

(Temperature readings in degrees Celsius / Fahrenheit which tell us how to dress; or if we should go outside; or what temperature our food has cooked to; or tell us if we have a fever and need to see a doctor, etc.)

- What information do we get about the day or season simply by looking out the window? What do we do with this information?

(We learn if it is day or night, or if it is spring/summer/fall/winter; we see if it is sunny or raining or snowing or windy; we see things like green buds and spring flowers; we see leaves change colour and fall off; we see gray snow clouds and dark skies; we see clear blue skies and bright sunshine, etc. We can use this information to decide if we should use our furnace and close our windows, or if we should turn on an air conditioner and close the blinds to the hot sun. We can also use this information to "guess" the temperature outside and choose our clothing, shoes, and hats. Finally, this information will tell us what kinds of activities we will do outside: shoveling and ice skating or gardening and tree-climbing)

- What do you do in the summer that you cannot do in the winter?

- What do you do when the sun shines brightly? Or not at all?

Distribute Handout #2 to students for recording the results of the experiment.

HANDOUT #2: Homemade Thermometer Experiment Sheet! **Name: _____**

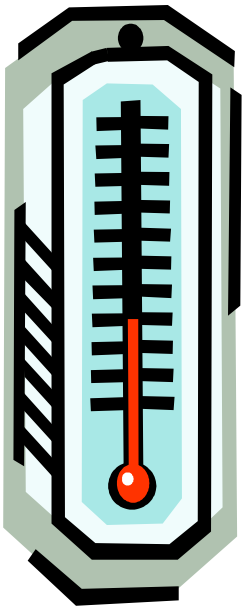
Purpose: To create thermometers and to measure and record temperatures, using our skills of inquiry, design and communication.

Materials:

- · Cold water
- ·Dark food colouring
- ·"Tacky" or reusable adhesive
- ·Scissors
- ·Access to a refrigerator
- ·Small plastic jug / bottle
- ·Clear straw
- ·Heavy paper / white cardboard
- ·Felt-tipped pens (Red, Yellow, Blue)

Procedures:
Design and construct thermometers according to teacher's instructions.

Observations:



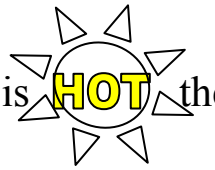
→ The temperatures HIGH on the thermometer are H_ _

→ The temperature that feels "just right" is R_ _ _ temperature

→ When the MERCURY is low, the temperature is C_ _ _

A thermometer that you buy in a store is also used to measure TEMPERATURE. It is made of a sealed glass tube containing a liquid called MERCURY. The mercury expands and rises in the glass tube as the temperature increases, just like our homemade (water) thermometers. There are numbers printed on the side to tell you the temperature in DEGREES. Never touch a broken thermometer because of the sharp glass and because mercury is poisonous.

Conclusions:



When the temperature outside is HOT the liquid in the thermometer goes _____ (up / down).
People should wear sunglasses to protect their _____ (eyes / ears) and sun block to protect their _____ (shoes / skin) from the strong sun.

When the temperature outside is COLD the liquid in the thermometer goes _____ (up / down).
People wear _____ (more / less) clothing to stay warm and wear _____ (hats / umbrellas) to keep heat from escaping the head.