**Heat in the Atmosphere Station Activity:**

**Name: Date: Period:**

**Name: Name:**

**Objective:**

**Goal 2: The student will demonstrate the ability to analyze the major components, thermal structure, and chemical composition of the atmosphere.**

Objectives – The student will be able to:

1. Analyze and compare the heat transfer systems (radiation, convection, conduction) affecting atmospheric circulation patterns
2. Describe the Earth’s energy budge using the radiative properties (absorption, relection/albedo, and scattering) of the land, water and atmosphere (cloud cover)
3. Describe the cause of local and global air and wind patterns, including pressure gradients, density, land and sea breezes, Coriolis effect, and energy exchange

**Procedure:**

1. Students will be assigned into 10-14 groups/pair in which they will work together to finish 15 activities based on the above objectives.
2. There will be demonstrations to analyze, computer animations, and analysis questions to complete.
3. Students will be given \_\_\_\_\_\_\_\_\_\_\_\_\_\_ minutes per station before they need to rotate numerically upon the teacher’s signal. Each group/pair will be assigned an initial station from which to begin.

**Station 1: Conduction Demonstration**

1. Record the original temperature of Container A and Container B in the chart below.
2. Record the current temperature of Container A and Container B in the chart below.

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| Container | A | B |
| Original Temperature |  |  |
| Current Temperature |  |  |

1. Record the current temperature of Container A and Container B on the chart on the lab station.
2. What is conduction?

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1. Based on the list of current temperatures on the table, describe what is occurring. If not enough data is available, predict what will happen?

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1. In what direction is the heat flowing?

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1. Over the course of the rest of the day, predict what will happen to the temperatures in both cups and why?

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**Station 2: Greenhouse Effect Animation**

Use the computer to go to the following link: <http://ccl.northwestern.edu/netlogo/models/ClimateChange>

1. Read the sections: What is it?, How it Works, and How to Use it.
2. Define albedo:

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1. What happens to temperature if you increase sun brightness?

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1. What happens to the temperature if you increase and decrease the albedo?

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1. What happens to the temperature if you increase the CO2 concentration?

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1. What happens to the temperature if you increase the cloud cover?

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1. Try to increase the global temperature to as high as you can. What characteristics did you set up?

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**Station 3: Analysis Questions**

Make a concept map of the following terms: *Radiation, Convection, Conduction, Absorption, Reflection, Scattering, Albedo, Electromagnetic Spectrum, Infrared rays, Visible Light, UV rays, Greenhouse Effect, Global Warming*

**Station 4: Coriolis Effect Demonstration**

1. What is the Coriolis Effect?

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1. Follow the instructions on the lab station.
2. When the turntable was turning counter clockwise, simulating the motion of the Northern Hemisphere, how did the ball appear to curve in relation to its directed path of motion?

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1. When the turntable was turning clockwise, simulating the motion of the Southern Hemisphere, how did the ball appear to curve?

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1. Why does the apparent deflection (curve) occur?

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1. Did the sphere itself actually curve as it rolled across the surface? Why or why not?

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Procedure 5 Procedure 7 Procedure 10 Procedure 13 Procedure 15

**Station 5: Carbon Cycle Animation**

Use the computer to go to the following link:

<http://www.kidsnewsroom.org/climatechange/animations.html>

1. Follow the instructions on the lab table.
2. Draw the carbon cycle in the space below. Include the land, air, and water. Include the labeled red arrows as well.
3. What is the relationship between respiration and photosynthesis?

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1. How do fossil fuels such as oil and coal form?

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1. Through what process do plants release carbon back into the atmosphere?

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1. What is combustion?

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**Station 6: Analysis Questions**

Insolation is a measure of the amount or intensity of solar radiation that an area is receiving. The more direct the sunlight that comes in, the higher the amount of insolation. In the space below, draw a diagram of the Earth and the sun. Include the position and tilt of the Earth at both summer and winter. In the spaces below it, explain how the seasons are created using the concept of insolation.

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**Station 7: Convection Demonstration**

1. Your teacher is going to run the set up. In the space below, sketch what you are seeing and included captions that explain what is going on.
2. In convection, why is it that the warm air rises and the cold air sinks?

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1. In our atmosphere, what is causing the air to heat up and cool down?

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1. What aspect of weather do you think occurs as a results of this warming and cooling cycle?

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**Station 8: Global Warming Animation**

Go to the following link: <http://earthguide.ucsd.edu/earthguide/diagrams/greenhouse/>

1. Click through the animation one time in its entirety, then go back through and answer the questions:
2. Where does the Earth receive most of its energy from? What is this process called?

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1. What form is this energy in?

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1. Why is visible light able to pass through the atmosphere?

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1. What happens to the visible light after it reaches Earth?

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1. What gases contribute to the greenhouse effect and how do they contribute?

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1. If you increase the amount of carbon dioxide, what would be the effect and why?

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1. Why do you believe that only the waves with the shortest wavelengths reach the Earth’s surface?

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**Station 9: Analysis Questions**

Read the reading on the table (Earth Science: The Physical Setting, page 564) and answer the following:

1. The lowest layer of Earth’s atmosphere has undergone a large increase in temperature due to the presence of greenhouse gases. State the name of this temperature-zone layer.

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1. Explain why most scientists believe an increase in the greenhouse effect will cause sea levels to rise:

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1. Explain the process of the Greenhouse Effect. Why is good and how it is becoming an issue?

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**Station 10: Angle of Insolation Demonstration**

1. Hold the flashlight 6-12 inches above your paper, shining it straight down at a 90 degree angle. Have your partner trace the outline of the brightest part on the graph paper below.
2. Repeat the procedure, only this time hold the flashlight so that it strikes the paper at a 45 degree angle.

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1. Determine how many squares (surface area) that the light energy covers and record in the chart below:

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|  | 90 Degrees | 45 Degrees |
| Surface Area of Light |  |  |
| 50 divided by S.A. |  |  |

1. If we assume that the amount of light energy (50 energy units) is the same at both angles, divide the number of energy units (50) by the number of squares (surface area) to figure out how much energy per square there is. Record in the chart above.
2. What conclusion can you draw from the above data:

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1. How does this relate to our seasons on Earth?

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1. Diagram below the Earth during both winter and summer for the North Hemisphere:

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| Winter | Summer |
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**Station 11: Heat Transfer Animations**

Go to the following link: <http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304>

1. Using the navigation in the animations, go through and answer the following questions. (Conduction – the pot, Convection – the balloon, Radiation – The sun).
2. What is conduction and how was conduction shown in the first animation?

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1. What is convection and how was it shown in the animation?

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1. What is radiation and how was it shown in the animation?

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**Station 12: Analysis Questions**

Use the diagram at the lab station to answer the following questions. The diagram shows the percentage of light reflected due to a surfaces albedo:

1. Which substance has the highest and lowest albedo?

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1. Explain why it is cooler on a cloudy day based on the information given in the diagram?

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1. Explain how albedo can help you determine what to wear on a hot day?

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1. Compare a clear day after a fresh snow fall with a cloudy day in a field of corn in terms of albedo.

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**Station 13: Solar Absorption Demonstration**

1. Record the initial and current temperatures for both land and water below:

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| Surface | Land | Water |
| Original Temperature |  |  |
| Current Temperature |  |  |

1. Record the current temperatures on the log on the lab table.
2. Predict or analyze what will happen/did happen to the temperature of both the land and water as the heat source is/was on?

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1. Predict or analyze what will happen/did happen to the temperature of both the land and water after the heat source is/was turned off?

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1. Based on this information, if you are at the beach, would you expect the land or water to heat up first and why?

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1. Using this information, if you were to go to Ocean City in the spring versus the fall, how might the water and land temperatures differ?

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**Station 14: Local Winds Animation**

Go to the following link: <http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm?chapter_no=visualization>

1. In the chart below, diagram both a land breeze and a sea breeze. Be sure to include labels and temperatures:

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| --- | --- | --- | --- |
| Land Breeze | | Sea Breeze | |
|  | |  | |
| Land Temp: | Ocean Temp: | Land Temp: | Ocean Temp: |

1. Where do we see radiation, convection, and conduction in both models?

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1. Why does the wind shift directions when it goes from day to night?

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