Model of Oceanic Heat Transfer

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Core Curriculum Standard Fulfilled:
Standard IV: Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.

Core Curriculum Objective Fulfilled:
Objective 2: Analyze the physical and biological dynamics of the oceans.

Intended Learning Outcomes (ILOs) fulfilled:
ILO 1. Use Science Process and Thinking Skills

a. Observe objects, events and patterns and record both qualitative and quantitative information.
b. Use comparisons to help understand observations and phenomena.
c. Construct models, simulations and metaphors to describe and explain natural phenomena.

ILO 3. Demonstrate Understanding of Science Concepts, Principles and Systems

a. Know and explain science information specified for the subject being studied.
b. Apply principles and concepts of science to explain various phenomena.

Description: Students will design a model that demonstrates the energy flow from the equator to the poles.

Materials: a clear container, clamp light, 100 watt light bulb, ring stand and ring, water, ice cubes (with food coloring in it), food coloring.

Time Needed: 60 to 70 minutes

Introduction: Guided inquiry lab activity

The radiation from the Sun heats the tropical regions of the Earth more than the Polar Regions. This causes the oceans near the equator to be warmer, and the water near the poles to be colder.

Students will use the materials provided to build a model of a cross-section of the ocean from the polar ice cap to the equator. Then they will observe the flow of water using food coloring contained in the ice cubes and/or added to the water at opposite ends of the tank.

Background Knowledge: It should be explained to the students that the container will represent a cross-section of the ocean with the polar ice cap at one end and the equator at the other end. The food coloring is used to show the movement of the water. The food

coloring maybe added to the ice cubes before hand.

Procedures:
Day 1 (20 to 30 minutes)

1. Students will read the instructions on the student page. Show the students the materials, and go over the procedure with them.

2. Explain to the students that a model is used to represent how systems operate in nature.

3. Give the students time to work in their groups, and determine what materials they want to use for their model. If student choose to use materials other than the materials provided, the students will need to bring those materials in for day two.

4. The student groups will then need to draw a diagram of their model, and write a procedure for the construction of their model.

Day 2 (30 to 40 minutes)

1. Have the students collect their materials and construct their models.

2. The students will need to record observations of their model every two minutes until a maximum of ten minutes. If students are getting the results that they need sooner, the time period maybe changed to one minute intervals.

3. The students need to answer the questions that are on the student handout.

4. Each group can report on how they built their model, and their results to the class.

Scoring Guide
1. Student participation ……..... 5 points
2. Student observations and diagram……..… 5 points
3. Student correctly answers analysis questions …….5 points

Name_____
Date_____
Period_____

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Problem: Construct a model to demonstrate how the heat energy is transferred in the Earth's oceans.

Materials list
(Write down the materials that your group will use to construct your model.)

Procedure:
1. Draw a diagram of your model, and list the steps needed to construct the model.

Second half of assignment

Directions: Construct and operate your model.

1. Record an observation every two minutes. Diagrams maybe used to help explain your observations.

0 minutes

2 minutes

4 minutes

6 minutes

8 minutes

10 minutes

2. Using a blue colored pencil, draw arrows, on your diagram, to show the movement of the cold water. Using a red colored pencil, draw arrows, to show the movement of the warm water.

ANALYSIS:

Use the concept of density to answer the following questions.

1. Explain why the water behaved in the way that it did in your model.

2. Relate the motion of the ocean currents to the way in which the water behaved in your model.

3. England is at a latitude that is the same as Northern Canada, but England has a moderate climate. Use your model to explain why this happens.

4. If these currents in the Northern oceans were interrupted, what do you think would happen to the climate of the Northern Hemisphere?

5. Explain how you would change your model to make it work better.