**Climate Change in the Arctic**

**Modelling the Greenhouse Effect**

**Task**

Build a model of the greenhouse effect on the Arctic using discarded plastic bottles. Compare the effects of an increase in greenhouse gases on the temperature of the atmosphere and on ice melting rates. Make two different models, with the control model representing Earth with the current concentration of greenhouse gases and the experimental model representing Earth with an increased concentration of greenhouse gases in the atmosphere. The bubbles in pop provide the extra carbon dioxide.

**Materials**

2 identical plastic drink bottles (1L or 2L)

2 thermometers

2 ice cubes with the same mass

150mL each of fresh and flat cola at room temperature

ruler

marker

2 pieces of aluminum foil (15cm x 15cm)

Plasticine

scissors

clear tape

stop watches (optional)

scale available

**Action**

1. Write a prediction.
2. Read the procedure.
3. Draw the sketch.
4. Complete only the missing labels on the observation table.
5. Show all this work to the teacher to get your materials.
6. Build and test the model and record the data.
7. Complete the conclusions.

**Prediction (Hypothesis)**

Increasing the amount of greenhouse gases in the atmosphere will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (increase/decrease) the temperature of the atmosphere because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This will result in the ice \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Procedure**

1. Cut the tops off two bottles using scissors.
2. Make a hole in the side of each bottle about 7 cm from the top of a 1L bottle (or 12 cm from the top of a 2L bottle).
3. Using a marker, draw a fill line on each bottle 7 cm up from the bottom.
4. Fill one bottle to the fill line with flat cola and fill the other bottle to the fill line with carbonated cola.
5. Wait 5-10 minutes for carbon dioxide to fill the second bottle.
6. Make two “boats” from aluminum foil to hold the ice cubes.
7. Find two ice cubes with the same mass. (Use the scales provided to find two ice cubes with the same mass to the nearest gram)
8. Put an ice cube in each foil boat and float one in each bottle.
9. Remove the caps from the bottle tops and put a top back on each bottle securing it with tape.
10. Put a thermometer through the hole on each bottle (step 2) so the tip of the thermometer is in the middle of the bottle and secure the thermometers with Plasticine.
11. Carefully place both bottles in the sunshine.
12. Begin recording the results of your experiment.

**Design**

Draw a well **labelled** sketch of your experimental setup. There should be at least 10 labels.

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**Observation Table**

Design a well-labelled table to record the temperature in the bottles and your observations of the ice cubes every 2 minutes from zero minutes to 20 minutes.

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| **Time**  **(minutes)** | **Control Bottle** | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| \_\_\_\_\_\_\_\_\_\_\_\_  (\_\_\_\_) | \_\_\_\_\_\_\_\_\_\_\_\_ | (\_\_\_\_) | \_\_\_\_\_\_\_\_\_\_\_\_ |
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**Conclusions**

Do your results support your prediction? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What did you use to increase the concentration of greenhouse gases in the experimental model? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain why your results do or do not support your prediction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Analysis**

What two changes could be made to improve this model? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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What are two major limitations of this model compared to our real atmosphere around Earth? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Explain which Arctic plants and animals will be most affected by the increased melting of Arctic ice due to climate change. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_