Name:_____ Period: _____ Date: _____

Investigating Albedo & Ocean Feedback Loops

When light from the Sun strikes Earth's surface, some of the energy is reflected back into space. The rest is absorbed as heat. **Albedo** is the ratio (or fraction) between solar radiation reflected and absorbed by a surface:

$$\frac{\text{Solar radiation reflected}}{\text{Solar radiation absorbed}}$$

Albedo is measured as a decimal on a scale from 0 (black) to 1 (bright white).

- When something has a HIGH albedo (such as 0.9), it is “whiter” and more radiation reflects off. The substance stays cooler.
- If a substance is dark, it has a LOW albedo (such as 0.1). More solar energy is absorbed and it gets warmer.

A white sand beach in Florida Keys National Marine Sanctuary: Does it have a high or low albedo and why does that matter?
Photo: Franz Stellbrink CC-BY-3.0

Record your ideas below or in science notebooks in sentences and/or pictures.

1. Would you rather walk with bare feet on a light-colored surface (like white concrete) or a dark-colored surface (like black asphalt) if you were outside on a sunny summer afternoon? Why?

2. **Design an experiment** to measure the effect of albedo. Use materials such as:
   - Fabric (or construction paper) of different colors, such as black and white
   - Scissors
   - Clear tape and/or a stapler
   - Containers such as large cups, beakers or jars
   - Thermometers
   - Foam caps, heat-resistant plastic lids and/or cardboard
   - Lamp with high wattage incandescent or heat bulb
   - Stopwatch or smart phone to precisely record passing time
   - Ice (optional)

3. What **testable question** can you investigate to test the effect of albedo?

4. **Independent Variable** (factor you will change on purpose to test if it causes a different result):

5. **Dependent Variable** (factor you measure to see if changing the independent variable has an effect; suggestion: temperature over time):

6. **Hypothesis:** What do you predict will happen in your experiment?

7. **Experimental (variable) setup:** Draw and label a diagram of your planned experimental setup.

8. **Control setup:** Draw and label a diagram of your planned control setup.

9. **Procedure (experimental design):** What steps will you take to test your hypothesis and record your results? Why do you think it will result in relevant (useful) **data** which may help you answer the experimental question?

10. **Data Collection:** How will you record data in a way that is the most useful? For example, will you use a table, a spreadsheet or something else?

11. **Show your teacher your plan** for the experiment and then try it! Be very careful if you use a heat lamp, which can burn your skin.

12. Results of your experiment: Carefully record your data using the table below or another method.

Time (suggested) or:								
Condition 1:								
Condition 2:								

Time (continued) or:								
Condition 1:								
Condition 2:								

13. Graph your data using the table below or another method. Be sure to fully label the X and Y axes.

14. Other **observations:**

15. What **results** do your data show?

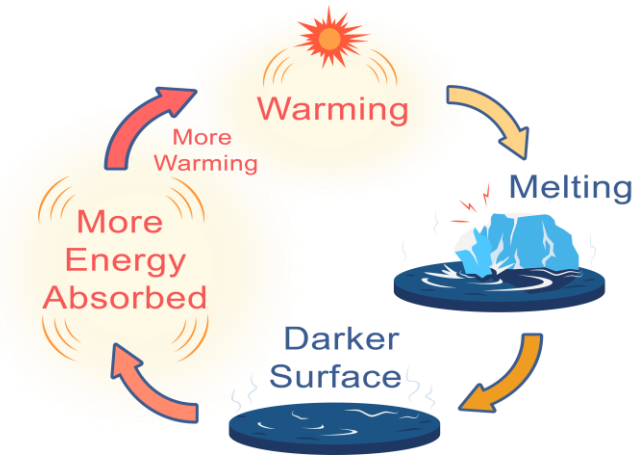
16. Was your hypothesis correct? _____ How do you explain what you observed?

17. How might you change your experiment to improve the quality of your results?

18. Based on the results of your experiments and understanding of albedo and melting ice: Do you think melting sea ice might result in other changes? If so, what changes and why?

19. The following is a feedback loop diagram. Describe what it is showing in sentences and/or with your own labeled illustration(s). How does it relate to sea ice and temperature change?

Positive Feedback Loop
(the change causes even more of a change)



20. Bonus! Expand the diagram above in your science notebook or on separate paper. Bring in one or more additional concepts, such as rising sea level and/or impacts to national marine sanctuaries. You might also consider changes that could reduce the impacts of the initial warming, such as a negative feedback loop shown to the right caused by more cloud cover.