EPS 100 (Stapleton) Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solar Oven and Climate Concepts

Background Information:

**Albedo**: a measure of how much light is reflected from a surface. A surface with a high albedo reflects most of the light that hits it. A surface with a low albedo absorbs most of the light that hits it.

Light has properties of a wave and a particle:

**Photon**: a particle of light.

**Light wave**:a wave of light.

**Electromagnetic radiation**: Energy that travels through space as waves. Examples are visible light, infrared waves, ultraviolet waves, and microwaves.

**Visible light:** Electromagnetic waves that we can see. Visible light can travel easily through clear substances.

**Infrared waves:** Sometimes called “heat waves.” These are electromagnetic waves with a wavelength that is too long for humans to see – but we can feel their heat. Infrared waves cannot travel easily through glass, plastic wrap, or greenhouse gases in the atmosphere.

**Greenhouse gas:** A gas in the Earth’s atmosphere allows visible waves to pass easily but greenhouse gases do not allow infrared waves to pass as easily. Greenhouse gases absorb or reflect many infrared waves. The two main greenhouse gases in our atmosphere are CO2 (**Carbon** **Dioxide**) and CH4 (**Methane**). Most of the Methane that is released into the atmosphere is [produced by industry and livestock.](https://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html)  Most of the Carbon Dioxide that humans release into the atmosphere comes from [burning fossil fuels to produce electricity, to power vehicles, and to support industry.](https://www3.epa.gov/climatechange/ghgemissions/gases/co2.html)

**Angle of incidence**: This describes the angle at which the sun’s rays hit a surface. Sunlight provides the most energy when it hits a surface at a right angle (90 degrees).

Match the following definitions to their terms.

Answer choices: a. **Convection** b. **Conduction** c. **Radiation**

1. \_\_\_\_\_ Heat transfer by touch

2. \_\_\_\_\_ Heat transfer by light waves, infrared waves, or other electromagnetic waves

3. \_\_\_\_\_ Heat transfer by the movement of warm currents of fluid (such as air).

4. \_\_\_\_\_ Suppose you seal your solar oven tightly so that no air can enter and no air can escape. What type of energy loss are you preventing?

5. \_\_\_\_\_ You notice that the ground under your solar oven is very cold. You are afraid that the heat of your solar oven will pass into the cold ground. To solve the problem, you place a layer of insulation between your solar oven and the ground. When you do this, you are preventing heat loss by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

6. \_\_\_\_\_ You are afraid that the sides of your solar oven are losing heat by giving off invisible infrared waves. To prevent this, you cover the outside of your solar oven with reflective mylar. This will help stop heat from leaving your oven walls in the form of \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

7. Does a black surface have a high albedo or a low albedo?

8. Does a shiny surface have a high albedo or a low albedo?

9. Which part of a solar oven should have a very low albedo? Why?

10. Which part of a solar oven should have a very high albedo?

11. Explain how your solar oven’s reflectors increase the amount of energy in your solar oven. Estimate the how much extra energy they provide, and explain how you got your answer. [For example, “my reflectors double the amount of energy,” or “my reflectors triple the amount of energy. The way they do this is…”]

12. When the ground is covered with snow, what does that do to the Earth’s albedo in that area? Does this albedo cause the Earth to absorb more energy or less energy from the sun?

13. If the Earth begins to warm, and areas that are now covered with snow begin to melt, how will that change the Earth’s albedo?

 What effect will this have on the amount of energy that the Earth is absorbing from the sun?

14. A solar oven is covered with clear plastic wrap. What kind of radiation can easily pass through the plastic?

15. What kind of electromagnetic radiation cannot pass easily through plastic wrap?

16. The clear window of a solar oven functions like certain gases in our atmosphere. What are the most prominent greenhouse gases in our atmosphere?

17. Create a diagram showing the best angle for sunlight hitting the window of a solar oven. Draw a labeled line for the solar oven window, and use a labeled arrow to represent at least one ray of sunlight.