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Title: Experiment 3 – Thermal Oven.

Objective: To conduct a solar oven to determine energy conservation effectiveness.

Theory:

Heat is a form of energy flowing from an object with higher temperature, to that having low temperatures. The heat transfer is made possible by the temperature difference between the objects. Thermal energy can be transferred from one body having high temperatures to that having low temperature in various ways. These includes conduction, radiation and by convection. All three processes often occur once together.

As Min (2018) points out, thermal radiation remains to be the only mechanism of heat transfer with the vacuum compatibility as it carries the heat energy as a slightly light speed (Pg. 75).

Thermal energy transfer by radiation occurs via the electromagnetic radiation. Heat transfer by this method do not require any medium to travel through. This same method is how the light from the sun reaches the earth's surface but thermal energy transfer by both conduction and convection require medium which heat can travel through.

According to Åzizik (1993) the energy which is given up by the free electrons, atoms or molecules which are considered as constituent particles in the regions of high temperatures of an object to those objects that are cooler is called heat (P.1). Heat conduction can be defined as heat transfer through objects whose particles are not in motion. These includes stagnant fluid or solid. An example on this could be a metal transferring heat energy from one end to another. This is possible to the conduction process, where heat from one end having high temperatures to the other end having low temperatures. Convection on the other hand is the transfer of heat by the movement of fluid in bulk, whereby, the heat energy is carried by fluid from one point to

another. In the case of the solar-thermal oven or the solar-thermal panel, we will be trying heating above the ambient temperatures by harnessing thermal energy travelling by radiation from the sun coming down to earth. However, inside the solar thermal harnessing object, there is an increase in temperature. Convection and conduction will be working against this entire process by taking away, thermal energy from the heated object.

The functionality of the solar collecting object depends on its ability to absorb the radiation as well as the amount of heat lost due to absence of insulation. When the solar collecting gadget heats up, there is an increase in the amount of heat lost ambient outside air. When the solar collecting gadget is hot (i.e. when the temperatures differences between the heated air in the solar collector and the cold air outside), there is a faster rate of heat loss to the neighborhood or surroundings. With time, the rate of heat loss will be equivalent to the rate at which heat is gained and the solar collector will reach the stagnation temperature.

The amount of thermal energy Q which must be supplied to increase the temperature of an object with a mass of M , by an amount ΔT is as follows;

$$Q = m.c. \Delta T$$

C- Specific heat of an object. $c_{\text{water}} \sim 4180 \text{ J kg}^{-1} \text{ K}^{-1}$. $C_{\text{air}} \sim 1000 \text{ J kg}^{-1} \text{ K}^{-1}$.

References

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- Min G, Shuai Y.Y -Cheng, C.J., C and Yu-B.C, 2018. Designing a Thermal Radiation for Smart Phone panels. Thermal oven. Retrieved on 8th January 2021; <https://www.mdpi.com/2411-5134/3/2/36/htm>