

## Scientists Ideas on “The Mitten Problem”

### **Purpose:**

The purpose of this assessment probe is to elicit students’ ideas about sources of heat energy. The probe is designed to find out whether students believe an insulating object, like a mitten, produces its own heat. Their explanations reveal whether they can differentiate between a heat source and an object affected by a heat source.

### **Explanation:**

The best response is C. The temperature readings inside the mitten and outside the mitten will be the same. Heat describes the energy that is transferred between two interacting systems at different temperatures. A heat source can produce its own heat energy or it may simply be an object that is at a higher temperature than the surroundings. The mitten in this case does not produce its own heat energy, and it did not have a higher starting temperature to begin with when the thermometer was inserted. The mitten is an insulator that keeps heat, generated by the human body and transferred to the surrounding air, from leaving the mitten as quickly as it leaves a bare hand. The mitten, which is an insulator, slows down the transfer of heat energy to the surrounding environment outside the mitten. If there is no source of additional heat energy inside the mitten, the mitten will have the same temperature as its ambient surroundings. Temperature is closely related to the measure of the average kinetic energy of molecules and atoms. During this experiment there is nothing to significantly cause the average motion of the atoms and molecules of the mitten or the air inside it to increase. The temperature in the room remained the same throughout the experiment. Therefore the temperature will most likely remain the same inside the mitten as outside the mitten.

\*From *Uncovering Student Ideas in Science* by Page Keeley, NSTA Press, 2005, pp. 104-105.