Handout H07-1 KEY: Heat transfer and fuel properties

1. This diagram shows a common way to build and ignite a campfire. (Imagine that there are lots more fine and coarse fuels in it.) Use the diagram to answer the following questions.

   a. Which method of heat transfer has the greatest influence on STARTING the fire, and which kind of fuel is likely to be ignited first? Convection rising from the match into the fine fuels is the strongest influence on starting the fire, and fine fuels will be ignited first.

   b. Once the campfire has started, where does the heat from convection go? How does it help the fire continue to burn? Most of the heat from convection goes up, driving off moisture from the fuels above and heating them up.

   c. Where does the heat from conduction go? How does it help the fire continue to burn? The heat from conduction goes into the ground, heats the interior of fuel particles, and transfers heat from one fuel particle to another wherever they touch.

   d. Where does the heat from radiation go? How does it help the fire continue to burn? The heat from radiation goes in through space in any direction, until it is intercepted by a molecule. That means it is heating the air, the surface of the ground under the fire, and the surface of all fuel particles that lie between it and the open air. Anything that is heated up (by convection, conduction, or radiation) then radiates heat from its own surface. Lots of radiant heat is thus trapped inside the tipi structure, drying the fuels and heating them up.

   e. Use the methods of heat transfer to explain what would happen to the fire if you knocked the tipi over and scattered the coarse fuels around the fire ring. The fine fuels would probably burn quickly and almost completely. The coarse fuels would burn slowly and would most likely go out before burning completely. Why? There is no convective heat from beneath, no radiant heat from materials burning nearby, and no conductive heat from adjacent fuels to keep the coarse fuels at ignition temperature. All of the radiant heat that was trapped by the tipi is now escaping into the open air.