RECYCLED SCIENCE

DESIGNING A LIQUID COOLING GARMENT (LCG)

Outside of their spacecraft on the Moon and in free space, astronauts must wear a pressurized spacesuit which protects the whole body from vacuum conditions. This suit contains several layers: a liquid cooling garment, a pressure garment and a thermal micro-meteoroid garment. The thermal micro-meteoroid garment keeps in the astronaut's body heat and protects the pressure garment from any rips. The pressure garment is inflated to about four pounds per square inch. (Sea level atmospheric pressure on Earth is 14 pounds per square inch.) Like a balloon, this garment does not leak air. Beneath the pressure garment is a Liquid Cooling Garment.

The Liquid Cooling Garment is made of nylon with little tubes sewn into it. These tubes are worn next to the body. Water is circulated through the tubes.

To simulate this effect, wrap thin plastic tubing around one Young Astronaut's arm many times, as the drawing shows. The tubing must be worn next to the skin at all times, but be sure that it does not hinder circulation. Another student places a funnel into the top of the tube and pours ice water through the tubing very slowly. The water is caught in a beaker at the elbow.

Record the water temperature at the funnel and at the elbow.

Water temperature at funnel:

Water temperature at elbow:

What causes the water to change temperature?

Disconnect the funnel and beaker from the tubing - but leave the tubing in place around the Young Astronaut's arm. Tape the ends of the tubing so that the tubing will not move. Ask the Young Astronaut to run as fast as possible in place for five minutes. Then repeat the first part of the experiment - dripping the water slowly through the tubing. Record temperature readings again.

Water temperature at funnel:

Water temperature at elbow:

Compare the change in water temperature ith the first experiment. Explain the differance.

Why would an astronaut want to regulate the temperature or speed of the water flowing through the tubes in the Liquid Cooling Garment?