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## Magical Egg

### The Problem

A small amount of water in a conical flask was heated to boiling point. As the water started boiling, a neatly peeled hard-boiled egg was placed on the mouth of the flask. As the water continued to boil, the egg gently bounced up and down. The conical flask was then removed from the burner and gently laid down on a heat proof mat / placed inside a trough containing some water. The egg started to get sucked into the flask and ended up at the bottom of the flask with a clonking noise after some time. The question is, why did the egg get sucked into the flask? (Extension: How would you get the egg out of the conical flask in one piece without breaking the flask?)

### The Solution

#### Solution 1:

If sufficient amount of heat is provided to a substance it may melt, if it is a solid, or it may boil, if it is a liquid. When boiling a liquid in a container, the particles released into the empty part of the container increases the overall kinetic energy of the particles increasing the pressure exerted by them. As the pressure exerted by the gaseous particles inside the container is greater than that of air outside, the gaseous particles escape from the mouth of the container.

If on the other hand, a heated container of liquid is allowed to cool down, the liquid molecules in the gas phase condense reducing the pressure exerted by the gaseous particles. As condensation proceeds, it may even happen that the pressure inside reduces to below atmospheric pressure.

When the water in the conical flask boil, the water vapor displaces and warms up the air molecules, raising the pressure inside. The higher pressure inside caused the egg to bounce at the mouth of the conical flask as steam and air escaped. Removing the conical flask from the burner caused the water to stop boiling, and the water vapor to

start condensing, as the flask started cooling down. The reduction in the amount of water vapor molecules in the container brought about a reduction in pressure to such a value that the air pressure outside was greater pushing the egg into the conical flask.

#### Solution 2:

Heating and cooling of a liquid brings about changes in vapor pressure if evaporation and condensation occurs. When being heated, the vapor pressure increases as more and more of the liquid particles turn into the gas phase and the temperature of the air molecules above the liquid also increases. Cooling the container causes the liquid vapor to condense reducing the number of gaseous molecules in the container thereby bringing about a reduction in the vapor pressure.

Boiling the water in the conical flask caused some of the water to turn into steam, at the same time raising the temperature of the air above it. As the water continued to evaporate, the vapor pressure inside increased until it was significantly more than the air pressure outside causing the egg at the mouth of the flask to bounce. When the flask however was removed from the burner, it started cooling and the water vapor inside started condensing, reducing the pressure, creating a partial vacuum inside the flask. And as such, the significantly higher air pressure from the outside was able to push the egg into the flask.