Egg in a Bottle

Demonstrate the relationship between temperature and pressure by trying to fit a hardboiled egg into a flask, and then trying to get the egg out of the flask.

Difficulty / Time Commitment:

6 out of 10

Coolness Factor:

10 out of 10

Materials:

- 1000mL Erlenmeyer flask with a mouth of 1.5" diameter (or anything with an opening barely too small for the egg to fit through)
- matches or lighter
- paper that burns easily
- hard-boiled egg (large or jumbo)
- glass of water

Instructions:

1. Hard-boil a large or jumbo egg.
2. Peel the shell off the hard-boiled egg.
3. Place the egg on the mouth of the flask and observe that it won't slide into the flask. Then take the egg off of the beaker.
4. Curl up a piece of paper into a narrow spiral that will fit into the flask.
5. Light the paper on fire and drop into the flask, taking care that the fire keeps burning after it is dropped into the flask.
6. Quickly place the egg back onto the flask mouth, and watch it slide in.
7. Pour water into the flask to wash out the ashes.
8. Turn the flask upside-down, and make the egg plug up the narrow part of the

flask, making a valve.

9. Blow hard into the flask, holding the flask nearly vertical, and the egg will slide out.

What Happened? Putting the burning paper into the flask increased the pressure because of the temperature increase. When the egg was placed onto the flask mouth, the fire suddenly went out inside the flask and thus the temperature suddenly dropped, thereby creating lower pressure inside the flask compared to the pressure outside the flask. The higher pressure outside the flask then pushed the egg into the flask. Blowing into the flask got the egg out of the flask because we forced more air molecules inside, which increased the pressure inside the flask relative to the pressure outside the flask.

Basic Concepts Learned:

10. The egg always goes from high low pressure, just like the wind blows from high low pressure.

11. The ideal gas law states that $pV=nRT$. Pressure (p) can be changed by either changing the temperature (T) or by changing the number of air molecules (n). (R is a constant.) More air molecules and higher temperatures lead to higher pressure.