A Helium Hot Air Balloon

Purpose

To demonstrate the relationship between temperature and volume of a gas. To bring about a discussion of density of gases.

Materials

store bought helium balloon	(for balloon's "basket")
(silver sided Mylar)	hot plate
paper or small paper cup	twist tie

Procedure

1. Fill a Mylar balloon about 95% full using either helium or hydrogen. There should be noticeable slack in the balloon. Use a twist tie to close it.

   **Alternative: Buy a helium filled Mylar balloon and remove about 5% of the helium. Twist the neck and seal the balloon with a twist tie.

2. Attach a paper basket to the balloon adjusting the weight till the balloon just hovers.
3. Show the balloon and basket to the students discussing the fact that it just hovers. Ask for suggestions to get the balloon to float or rise.
4. Place the silver side of the balloon on a hot plate and observe the balloon expand. When it appears inflated close to capacity, remove it from the heat.
5. Release the balloon and it will ascend.
6. As the balloon cools, it will descend.

Additional Information

1. Make sure the balloon is not fully expanded before you heat it. This may require that you untie the balloon and let some helium out. Make the basket the right weight so that the balloon and basket just hover.
2. It is very effective to do this demonstration twice. The second time while heating ask "What is happening to the mass of the balloon?"

   Relate this idea to density and then to how the balloon works:

   mass is constant, so if:

   - volume increases, density decreases and the balloon rises.
   - volume decreases, (as the balloon cools) so density increases and the balloon sinks again.

Questions for the Students

1. Why does a helium balloon float?
2. Why did heating this balloon help it to ascend?
3. Why did the balloon descend?

Reference

Becker, Bob. Twenty Demonstrations Guaranteed to Knock Your Socks Off, 1994.