1.1 Exploding Balloons

Subjects: Intro to chemistry (physical versus chemical change), Thermodynamics, Properties of Gases, Combination reactions, stoichiometry, oxidation/reduction

Description: Two balloons, one filled with hydrogen and the other with helium are ignited with a lit splint, with different results.

Materials:
Hydrogen cylinder‡
Helium cylinder‡
Cylinder adaptor for filling balloons (optional)
String
Balloons
Wood splint attached to a long rod*
Matches, lighter, or burner*

‡Cylinders of hydrogen and helium are stored in the general chemistry lab, room 166. Be sure to check first and reorder if necessary.

*Shared items: A long rod with a splint is located on the shelf in the alcove or on the central bench top. Burners are located in the top drawer opposite the bin storage shelves. Extra splints are located in the top left drawer next to the sink.

Pre-class Preparation:
1. Fill the balloons and attach a string.
2. Secure the balloons in the lecture hall.

Procedure:
1. Dim the lights.
2. Light the splint.
3. Hold the splint up to the surface of the balloon.
4. The helium balloon will pop loudly.
5. The hydrogen balloon produces a loud fireball.

Discussion:
Helium is an inert gas and does not react with oxygen. The balloon pops, but there is no explosion.

The reaction between hydrogen and oxygen is as follows:

$2H_2(g) + O_2(g) \rightarrow 2H_2O\ (g)$

Two molecules of hydrogen react with one molecule of oxygen gas to produce two molecules of water. The heat breaks the balloon and allows the hydrogen to mix

with oxygen in the air, while also providing the activation energy required for the reaction to take place. This is a highly exothermic reaction.

Safety: Be sure to protect your ears and have the students cover theirs. Perform in a large room with a high ceiling without flammable materials or a smoke alarm nearby. Know the location of the nearest fire extinguisher.

References:

1. B.Z. Shakhashiri; *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wiscosin; Vol 1; 1983; p. 106-112
2. University of Oregon Lecture demonstrations website: http://chemdemos.uoregon.edu/pages/detail.php?s=balloon&page=1&id=3d3e450d1a917016a49ba871d3b3f950#
3.Purdue University lecture movie website: http://chemed.chem.purdue.edu/demos/main_pages/10.1.html