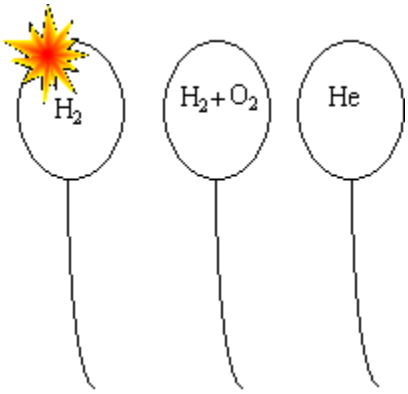
The Chemistry of Hydrogen

Chemical Concepts Demonstrated

- Chemistry of hydrogen
- Activation energy

Demonstration

- Three balloons (the first one filled with He, the second one filled with H_2, and the third one filled with a mixture of H_2 and O_2) are ignited!



Observations

The helium balloon pops. The H_2 balloon explodes into a cloud of flame. The balloon with the mixture of H_2 and O_2produces a very large explosion.

Explanations

Helium is an "inert" gas and does not react in the presences of heat or air. This is why the balloon filled with helium does nothing more than pop.

Hydrogen gas is very flammable. This is why the balloon filled with hydrogen ignites.

The heat given off by the candle provides the activation energy required for the reaction that produces water from hydrogen and oxygen. This reaction is highly exothermic, producing the prodigious explosion. It should be noted that, if this reaction were carried out with the stoichiometric ratios for a complete reaction (i.e. two parts hydrogen for each part oxygen), the resulting explosion would be larger, but would also be too dangerous to be used as lecture demonstration.

Thermodynamically, the reaction between hydrogen and oxygen is very favorable. However, a balloon filled with hydrogen and oxygen at room temperature will remain inert indefinitely. Kinetically, one must apply an energy of some kind in order to get the reaction started. Once the candle provides this activation energy, the balloon's chemicals react, and the balloon detonates.

Contributors

- Dr. George Bodner (Perdue University)

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