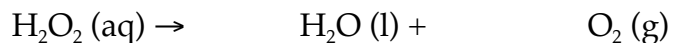


**Exercise 8: Gas laws and solution concentrations***Gases*

1. When hydrogen peroxide ( $\text{H}_2\text{O}_2$  solution) is poured down the sink, you will notice it bubble when it hits metal. Iron **catalyzes** the following reaction:



a. Balance the reaction above.

b. A 3% solution of hydrogen peroxide (a typical concentration) contains 3.000 g of  $\text{H}_2\text{O}_2$  for every 100.0 mL of solution. How many **liters of oxygen gas** will be produced by the **complete** decomposition of 400.0 mL (roughly a pint bottle's worth) of hydrogen peroxide? Assume **STP** conditions.

c. The 2 L soda bottles are 2.000 L in volume. They are built to withstand 2.000 atm of pressure. Will the complete decomposition of 400.0 mL of hydrogen peroxide produce enough oxygen gas at exactly 25°C to **burst** an empty 2 L soda bottle? Assume that there is already 2.000 L of air inside the bottle and that the volume of the hydrogen peroxide solution and water can be ignored.

2. The **density** of oxygen at 0.913 atm and 18.0°C is 1.22 g/L. Explain how this shows that the **chemical formula** of oxygen is O<sub>2</sub> rather than just O.

*Solution concentrations*

3. a. A common solution used by EMTs for keeping veins from collapsing in accident victims is 5% (w/v) dextrose in water. This concentration is **isotonic** with human blood. Why is this isotonic property important for the accident victim?

b. Dextrose has the chemical formula C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (look familiar? dextrose is a simple sugar like glucose). Write a **recipe** to make one blood unit (=450.0 mL) of 5% (w/v) dextrose in water. Hint: Do you need the molar mass (formula weight of dextrose = 180.2) here?

c. Calculate the **molarity** of 5% (w/v) dextrose in water. Hint: start by assuming 100 mL of the dextrose solution. Further hint: Do you need the **molar mass** here?

4. Write balanced molecular **and** net ionic equations for the following reactions. Be sure to indicate the states:

a. A solution of iron(III) chloride combines with a solution of ammonium hydroxide to produce a brown solid.

b. A solution of hydroiodic acid is neutralized by the addition of powdered calcium hydroxide.

c. A solution of copper (II) sulfate oxidizes elemental iron to the 2<sup>+</sup> state

**d.** Elemental aluminum reacts with sulfuric acid to produce aluminum sulfate and molecular hydrogen.