

Challenge Problem Aqueous Stoichiometry

1. You are Bond, James Bond. While at a soiree with the European jet set, you drink a 0.25 L glass of champagne that a lovely young lady, handed you. A few minutes later, Q ops into your wristcom and tells you that the lovely young lady was Ursula. She wants revenge for your having killed her sister Xenia and put 2.0 nanograms of Blyotoxin' in your champagne. You recall from your Secret Agent Chemistry Manual' that the molar mass of Blyotoxin' is 344.22 g/mol, and that its toxicity is based on the concentration of the dose

Dose	$\leq 1 \times 10^{-8} \text{ M}$	$\leq 2 \times 10^{-8} \text{ M}$	$\leq 3 \times 10^{-8} \text{ M}$	$> 3 \times 10^{-8}$
Reaction	No reaction	Mild discomfort	Nausea	Death

Are you? a) Fine b) feeling a little ill c) puking your guts out d) dead

Federal regulations set an upper limit of 50 parts per million (ppm) - measured by volume - of NH_3 in the air in a work environment. The density of NH_3 at room temperature is 0.771 g/L. Air from a manufacturing operation was drawn through a solution containing $1.00 \times 10^2 \text{ mL}$ of 0.0105 M HCl. The ammonia in the air reacts with the HCl by the equation:



After drawing air through the acid solution for 10.0 min at a rate of 10.0 L/min, part of the acid reacts with the ammonia. The remaining acid required 13.1 mL of 0.0588 M NaOH to completely react. (The equivalence point in the titration was reached with this volume of sodium hydroxide).

- (a) How many grams of ammonia were drawn into the acid solution?
- (b) How many ppm of ammonia were in the air?(ppm mass /1000000L)
- (c) Is this manufacturer in compliance with Federal regulations?