Chem / Envsty L111: Homework 1 Solutions

Chapter 1 - The Air We Breathe

6. a. $\dfrac{9,000 \text{ atoms of Ar}}{1,000,000 \text{ molecules of air}} = \dfrac{9 \text{ atoms of Ar}}{1,000 \text{ molecules of air}} = \dfrac{0.9 \text{ atoms of Ar}}{100 \text{ molecules of air}} = 0.9\% \text{ Ar}$

b. $\dfrac{0.04 \text{ molecules of CO}}{100 \text{ molecules of air}} \times \dfrac{10,000}{10,000} = \dfrac{400 \text{ molecules of CO}}{1,000,000 \text{ molecules of air}} = 400 \text{ ppm CO}$
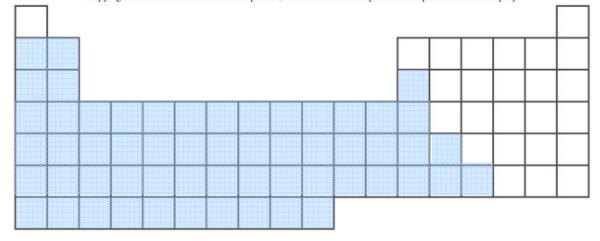
c. $\dfrac{50,000 \text{ atoms of } H_2O}{1,000,000 \text{ molecules of air}} = 5\% \, H_2O$

9.a. $1500 \text{ m} = 1.5 \times 10^3 \text{ m}$

b. $0.0000000000958 \text{ m} = 9.58 \times 10^{-11} \text{ m}$

c. $0.0000075 \text{ m} = 7.5 \times 10^{-6} \text{ m}$

d. $150,000 \text{ mg} = 1.5 \times 10^5 \text{ mg}$

14. a.

b. Fe, Mg, Al, Na, K, Ag

c. argon - Ar, helium - He, silicon - Si, carbon - C, hydrogen – H

15. a. compound

b. compound

c. mixture

d. element

e. mixture

f. element

17. a. N_2O

b. O_3

c. NaF

d. CCl_4

21. a. $C_2H_4(g)+1O_2(g) \rightarrow 2C(s)+2H_2O(g)$

b. $C_2H_4(g)+2O_2(g) \rightarrow 2CO(g)+2H_2O(g)$

c. $C_2H_4(g)+3O_2(g) \rightarrow 2CO_2(g)+2H_2O(g)$

22. The less oxygen present, the 'dirtier' the combustion product, from ash or soot $(C(s))$ to the 'cleaner' combustion product $(CO_2(g))$. In other words, the more oxygen present, the more complete the combustion.

37. a) Yes.

b) No – there are 4 molecules of reactants, but only 2 molecules of products

c) Yes – there are 2 atoms of N and 6 atoms of H on each side of the arrow

39. In 'developing countries' the air quality laws are not as strict as in the US and thus they are still using tetraethyl lead to their gasoline to prevent knocking. When the gasoline undergoes combustion, the lead is released from this compound and becomes vaporized into the air.

44. The Presidential Green Chemistry Challenge Awards were begun in 1996.

 2006 Award Recipients

- **Greener Synthetic Pathways Award**
  Merck & Co., Inc.
  Novel Green Synthesis for β-Amino Acids Produces the Active Ingredient in Januvia™
- **Greener Reaction Conditions Award**
  Codexis, Inc

Directed Evolution of Three Biocatalysts to Produce the Key Chiral Building Block for Atorvastatin, the Active Ingredient in Lipitor®

- **Designing Greener Chemicals Award**
  S.C. Johnson & Son, Inc.
  Greenlist™ Process to Reformulate Consumer Products
- **Small Business Award**
  Arkon Consultants
  NuPro Technologies
  Environmentally Safe Solvents and Reclamation in the Flexographic Printing Industry
- **Academic Award**
  Professor Galen J. Suppes
  University of Missouri-Columbia
  Biobased Propylene Glycol and Monomers from Natural Glycerin

50. a. The hazard associated with any pollutant depends on both the inherent toxicity and the exposure. The toxicity of CO is fixed, but the danger to the person breathing depends on the absolute amount breathed in. For instance, if the pollution level is 1600 ppm CO, after 1 hour one has a severe headache, after 2 hours one could collapse into a coma, and after three hours this concentration could kill you.

b. Carbon monoxide is a colorless, odorless, poisonous gas. You could be breathing it at this very minute and you wouldn't even know it, until it started to saturate your blood that is. Scientific studies have shown that by breathing in air that has as little as 0.10% carbon monoxide for just two hours could cause you to collapse into a coma – and you wouldn't even know it was coming, because carbon monoxide is the SILENT KILLER! That is why you NEED to own one of our nifty carbon monoxide detectors. It could save your life.