AP Free Response Topic 4

1993

2) Elemental analysis of an unknown pure substance indicates that the percent composition by mass is as follows:

Carbon - 49.02%
Hydrogen - 2.743%
Chlorine - 48.23%

A solution that is prepared by dissolving 3.150 grams of the substance in 25.00 grams of benzene, C_6H_6, has a freezing point of 1.12°C. (The normal freezing point of benzene is 5.50°C and the molal freezing-point depression constant, K_f, for benzene is 5.12 C°/molal.)

(a) Determine the empirical formula of the unknown substance.

1998

2) An unknown compound contains only the three elements C,H, and O. A pure sample of the compound is analyzed and found to be 65.60 percent C and 9.44 percent H by mass.

(a) Determine the empirical formula of the compound.

2003B

2. Answer the following questions that relate to chemical reactions.

a. Iron (III) oxide can be reduced with carbon monoxide according to the following equation.

$$Fe_2O_3(s) + 3\ CO(g) \rightarrow 2\ Fe(s) + 3\ CO_2(g)$$

A 16.2 L sample of CO(g) at 1.50 atm and 200. ^oC is combined with 15.39 g of $Fe_2O_3(s)$.

i. How many moles of CO(g) are available for the reaction?

ii. What is the limiting reactant for the reaction? Justify your answer with calculations.

iii. How many moles of Fe(s) are formed in the reaction?