Chemistry: *Quantitative Relationships in Chemical Equations*

When we balance a chemical equation, we are satisfying the law of conservation of mass; that is, we are making sure that there are the same number of atoms of each element on both sides of the equation. The coefficients we place in front of the substances in an equation are very important because they tell us the mole ratio of the substances in that reaction. For instance, the balanced equation…
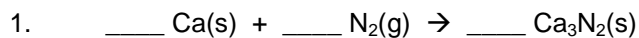
hydrogen gas + oxygen gas → liquid water

$2 H_2(g) + O_2(g) \rightarrow 2 H_2O(l)$
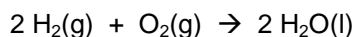
can be thought of in terms of…

2 moles $H_2(g)$ + 1 mole $O_2(g)$ → 2 moles $H_2O(l)$

Directions:
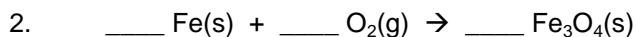   A. *Balance each equation.*
   B. *Solve the problems, assuming that you have excess of the other reactant(s).*

1.   _____ Ca(s) + _____ N_2(g) → _____ Ca_3N_2(s)
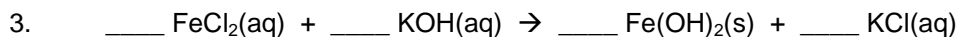
   a. How many moles of Ca_3N_2 can be made from 16.8 moles of Ca?

   b. If you need to make 34.4 moles of Ca_3N_2, how many moles of N_2 will you need?
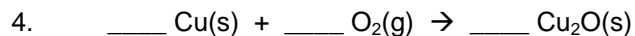
2.   _____ Fe(s) + _____ O_2(g) → _____ Fe_3O_4(s)

   a. How many moles of O_2 will react with 42.5 moles of Fe?

   b. If you need to make 1.56 moles of Fe_3O_4, how many moles of Fe will you need?

3.   _____ $FeCl_2$(aq) + _____ KOH(aq) → _____ $Fe(OH)_2$(s) + _____ KCl(aq)

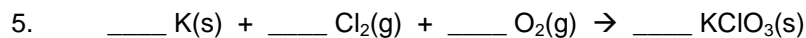   a. How many moles of KOH will react with 86.2 moles of $FeCl_2$?

   b. If you need to make 12.4 moles of KCl, how many moles of $FeCl_2$ will you need?

4.   _____ Cu(s) + _____ O$_2$(g) → _____ Cu$_2$O(s)

a. How many moles of Cu$_2$O can be made from 25.6 moles of Cu?

b. How many moles of O$_2$ does it take to produce 214 moles of Cu$_2$O?

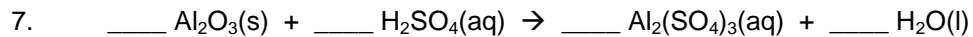5.   _____ K(s) + _____ Cl$_2$(g) + _____ O$_2$(g) → _____ KClO$_3$(s)

a. How many moles of KClO$_3$ can be made from 89 moles of O$_2$?

b. If you have 24.6 moles of Cl$_2$, how many moles of KClO$_3$ can you produce?

6.   _____ NH$_3$(g) + _____ H$_2$S(g) → _____ (NH$_4$)$_2$S(s)

a. How many moles of (NH$_4$)$_2$S can be made from 15.8 moles of NH$_3$?

b. If you have 462 moles of NH$_3$, how many moles of H$_2$S do you need?

7.   _____ Al$_2$O$_3$(s) + _____ H$_2$SO$_4$(aq) → _____ Al$_2$(SO$_4$)$_3$(aq) + _____ H$_2$O(l)

a. How many moles of Al$_2$(SO$_4$)$_3$ can be made from 6.3 moles of H$_2$SO$_4$?

b. How many moles of Al$_2$O$_3$ does it take to make 7.2 moles of H$_2$O?

c. If you have 588 moles of Al$_2$O$_3$, how many moles of Al$_2$(SO$_4$)$_3$ can you produce?

Answers:

1a. 5.6 mol Ca$_3$N$_2$	3a. 172.4 mol KOH	5a. 59.3 mol KClO$_3$	7a. 2.1 mol Al$_2$(SO$_4$)$_3$
1b. 34.4 mol N$_2$	3b. 6.2 mol FeCl$_2$	5b. 49.2 mol KClO$_3$	7b. 2.4 mol Al$_2$O$_3$
2a. 28.3 mol O$_2$	4a. 12.8 mol Cu$_2$O	6a. 7.9 mol (NH$_4$)$_2$S	7c. 588 mol Al$_2$(SO$_4$)$_3$
2b. 4.68 mol Fe	4b. 107 mol O$_2$	6b. 231 mol H$_2$S	