Chapter 2 Homework Solutions

8/29/17

3. (a), (b), and (d) are pure substances. Each consists of only one component. Particularly for (a) and (d) the book tries to confuse you by saying that there are components, but each material it asks about is a specific substance in its own right. Baking powder consists of two different substances that can be separated mechanically and so is a mixture.

8. (b), (c) shows no reaction, while (a) shows only one product.

20. mass percent_{A} = \frac{11.3 \text{ g}}{378 \text{ g}} \times 100\% = 2.99\%

Likewise, mass percent_{B} = 3.84\% and mass percent_{C} = 3.05\%, so sample A would have the smallest environmental impact.

25. (c), the number of neutrons

26. 36, 38, and 40, respectively
   36Ar: 18 p, 18 e, 18 n
   38Ar: 18 p, 18 e, 20 n
   40Ar: 18 p, 18 e, 22 n

28. a) same protons and electrons, but different neutrons (same Z)
   b) same neutrons, but different protons and electrons (same N)
   c) all different (same A)

34. avg atomic weight = [(0.6011)(68.9256 \text{ amu}) + (0.3989)(70.9247 \text{ amu})]
   = 69.72 \text{ amu}

36. This problem is solved by setting the percentage of one of the isotopes to x, then assuming the balance (100%-x) is the other isotope.
   35.4527 \text{ amu} = (34.9689 \text{ amu})x + (36.9659 \text{ amu})(1-x)
   x = 0.7577
   Thus, chlorine is 75.77\% ^{35}\text{Cl} and 24.23\% ^{37}\text{Cl}.

38. a) In the …, increasing atomic number. (or increasing number of protons.)
   b) Elements in a group have …
   c) Elements may …, metalloids, or metals.

47. MgO. The ionic charges are +2 and -2 vs. +1 and -1 in LiF. Coulomb’s law is energy \propto \frac{\text{charge}_1 \times \text{charge}_2}{\text{distance}^2}. Since the ionic sizes are about the same, the distance component doesn’t change much so we see that the interaction between Mg^{2+} and O^{2-} is about 4 times stronger than that between Li^{+} and F^{-}.
57. MgO. It is true that the Mg\(^{2+}\) ion is smaller (about 5%) and that increases the interaction, but as you saw in problem 47, the charge is 200% larger so that is where most of the effect comes from.

62. a) Na\(_3\)N  
   b) SrO  
   c) AlCl\(_3\)

63. a) CsBr  
   b) BaS  
   c) CaF\(_2\)

66. a) SnCl\(_4\)  
   b) iron(III) bromide  
   c) CuBr  
   d) manganese(III) oxide

67. a) sodium hydrogen phosphate  
   b) K\(_2\)CO\(_3\)•2H\(_2\)O  
   c) sodium nitrite  
   d) NH\(_4\)ClO\(_4\)

68. a) BaO  
   b) Fe(NO\(_3\))\(_2\)  
   c) MgS

69. a) copper(I) iodide  
   b) iron(II) hydrogen sulfate  
   c) magnesium dichromate

76. a) \((\text{NH}_4)_2\text{SO}_4\):  
   \[
   \text{MW} = (2 \text{ atoms N})(\frac{14.0067 \text{ amu}_N}{\text{atom}_N}) + (8 \text{ atoms H})(\frac{1.00794 \text{ amu}_H}{\text{atom}_H}) + (1 \text{ atom S})(\frac{32.065 \text{ amu}_S}{\text{atom}_S}) + \\
   (4 \text{ atoms O})(\frac{15.9994 \text{ amu}_O}{\text{atom}_O}) = 132.139 \text{ amu}
   \]

   b) NaH\(_2\)PO\(_4\):  
   \[
   \text{MW} = (1 \text{ atom Na})(\frac{22.989770 \text{ amu}_{Na}}{\text{atom}_{Na}}) + (2 \text{ atoms H})(\frac{1.00794 \text{ amu}_H}{\text{atom}_H}) + (1 \text{ atom P})(\frac{30.973761 \text{ amu}_P}{\text{atom}_P}) + \\
   (4 \text{ atoms O})(\frac{15.9994 \text{ amu}_O}{\text{atom}_O}) = 119.977 \text{ amu}
   \]

   c) KHCO\(_3\):  
   \[
   \text{MW} = (1 \text{ atom K})(\frac{39.0983 \text{ amu}_K}{\text{atom}_K}) + (1 \text{ atom H})(\frac{1.00794 \text{ amu}_H}{\text{atom}_H}) + (1 \text{ atom C})(\frac{12.0107 \text{ amu}_C}{\text{atom}_C}) + \\
   (3 \text{ atoms O})(\frac{15.9994 \text{ amu}_O}{\text{atom}_O}) = 100.1151 \text{ amu}
   \]

77. a) Na\(_2\)Cr\(_2\)O\(_7\): 261.9675 amu  
   b) NH\(_4\)ClO\(_4\): 117.489 amu  
   c) Mg(NO\(_2\))\(_2\)•3H\(_2\)O: 170.3618 amu

86. compound: calcium sulfate  
   homogeneous: tea  
   heterogeneous: orange juice, vegetable soup, cement