PLI 2
Wednesday May 25, 2016

1. Label each substance as pure (P) or as a mixture (M):

a) H_2O P
b) Orange juice (with pulp) M
c) Blood M
d) Iron P
e) Sucrose P

2. Label each substance as heterogeneous (Het) or homogeneous (Hom):

a) Air Hom
b) Sand on the beach Het
c) A cup of black coffee Hom
d) Rain water Hom
e) Simple syrup Hom

3. Label each property as extensive (E) or intensive (I):

a) Volume E
b) Density I
c) Mass E
d) Melting point I
e) Boiling point I
f) Solubility I

4. Does the following description of a compound or element refer to its physical properties (phys) or chemical properties (chem)?

a) The atomic weight of carbon is 12 amu phys
b) Magnesium burns in air to produce white solid chem
c) The melting point of gold is 1062 ºC phys
d) The density of uranium is 18.70 g/cm^3 phys
e) Zinc reacts with hydrochloric acid to produce hydrogen gas chem

5. Label each as kinetic (K) or potential (P) energy?

a) Wheel spinning K
b) Skier at the top of a mountain P
c) Fuel before it is burned P
d) Current in a wire K

e) Vibrations of water molecules in an ice cube K

6. For each of the following elements, give both the name and the chemical formula of its ion. (use the periodic table)

a) ex. Sodium: Na+, sodium cation.

b) Calcium: Ca^{2+}, calcium cation

c) Silver: Ag^{+}, silver cation

d) Sulfur: S^{2-}, sulfide anion

e) Chromium (2 answers!): Cr^{2+}, chromium (II) cation; Cr^{3+}, chromium (III) cation

f) Iodine: I^{-}, iodide anion

g) Hydrogen (2 answers!): H^{+}, hydrogen cation (also known as a proton!)
H^{-}, hydride anion

7. The element copper has two stable isotopes. Isotope A has an atomic mass of 62.9296 u, while Isotope B has an atomic mass of 64.9278 u. According to the periodic table, copper has an atomic mass of 63.5463 u. Determine the percentage occurrence of each isotope.

Let proportion isotope A = x; Let proportion isotope B = 1 − x

$62.9296u(x) + 64.9278u(1-x) = 63.5463u$

$62.9296ux - 64.9278ux + 64.9278u = 63.5463u$

$-1.9982ux = -1.3815u$

$x = 0.6914 \longrightarrow \times 100 =$ isotope A represents 69.14%.

$1-x = 0.3086 \longrightarrow \times 100 =$ isotope B represents 30.86%.

8. Theobromine, $C_7H_8N_4O_2$, is found in chocolate and has been shown to have properties that stimulate the heart, dilate blood vessels, and increase fluid lose in the urine:

a) What is the molar mass of theobromine?

carbon = 7 × 12.01 g/mol = 84.07 g/mol +

hydrogen = 8 × 1.008 g/mol = 8.06 g/mol +

nitrogen = 4 × 14.01 g/mol = 56.04 g/mol +

oxygen = 2 × 16.00 g/mol = 32.00 g/mol

180.17 g/mol

↳ 180.17 g/mol

b) What is the percent composition by moles of each of the elements in theobromine?

In one mole theobromine there are

7 moles C + 8 moles H + 4 moles N + 2 moles O = 21 moles of elements. Therefore:

C represents $7/21 = 33\%$. H represents $8/21 = 38\%$.

N represents $4/21 = 19\%$. O represents $2/21 = 10\%$.

c) What is the percent composition by mass of each of the elements of theobromine?

refer to part A for calculations:

carbon: $\frac{84.07 \text{ g/mol C}}{180.17 \text{ g/mol theobromine}} = 46.66\%$

hydrogen: $\frac{8.064 \text{ g/mol H}}{180.17 \text{ g/mol theobromine}} = 4.476\%$

nitrogen: $\frac{56.04 \text{ g/mol N}}{180.17 \text{ g/mol theobromine}} = 31.10\%$

oxygen: $\frac{32.00 \text{ g/mol}}{180.17 \text{ g/mol}} = 17.76\%$

9. I poured 1.50 mL of 100% isopropyl alcohol, $CH_3CHOHCH_3$ (density 0.786 g/mL at room temperature), on a paper cut to clean it. How many carbon atoms did I just pour on my finger?

step 1: $CH_3CHOHCH_3 = C_3H_8O$

step 2 = find molar mass:

C: $3 \times 12.01 = 36.03$

H: $8 \times 1.008 = 8.064$

O: $1 \times 16.00 = 16.00$

$60.094 = 60.09$ g/mol

Step 3: calculate (mL → g)(g → moles)(moles → atoms)

$$1.50 \text{ mL } C_3H_8O \left(\frac{0.786 \text{ g}}{1 \text{ mL}}\right)\left(\frac{1 \text{ mole}}{60.09 \text{ g}}\right)\left(\frac{3 \text{ mole C}}{1 \text{ mole } C_3H_8O}\right)\left(\frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mole C}}\right) =$$

3.54×10^{22} atoms of C