Dr. Grandinetti

Chemistry 121
Fall Quarter 2007
Quiz 1

Monday
Oct. 1, 2007

Name KEY Rec. Instr. _____

Two-Digit Section No. _____ Lab. Instr. _____

1. [6 points] Circle the pure substances below.

An egg	(Caffeine)	(Snow)
A Tree Leaf	Blade of Grass	Brass Nail

2. [4 points] How many significant figures are there in the following numbers?

1.035 (4) 0.0010 (2)

1.00×10^6 (3) π infinite (exact number)

3. [10 points] A bullet, of density 5.40 g/cm^3 and mass 80.0 g is dropped into a 100-mL graduated cylinder containing exactly 50.0 mL of water. To what height will the water level rise in the cylinder? Give the answer to the correct number of significant figures.

$$\frac{80.0\,g}{5.40\,g}\left|\frac{cm^3}{1\,cm^3}\right|\frac{1\,ml}{} = 14.8\overline{148}\,ml \leftarrow \text{volume of bullet}$$

$$V_{TOTAL} = 50.0\,ml + 14.8\overline{148} = 64.8\overline{148}\,ml$$

$$\boxed{V_{TOTAL} = 64.8\,ml}$$

4. [10 points] To account for nitrogen's atomic weight of 14.0067, what must be the ratio of ^{15}N (15.0001 amu) to ^{14}N (14.00307 amu) atoms in natural nitrogen? Give the answer to the correct number of significant figures.

let $x \equiv$ fraction of ^{14}N, Then $1-x \equiv$ fraction of ^{15}N

$$x(14.00307) + (1-x)(15.0001) = 14.0067$$

$$x(14.00307 - 15.0001) = 14.0067 - 15.0001$$

$$x = \frac{-0.9934}{-0.99703} = 0.9963592$$

$$1-x = 0.0036408$$

$$\text{Ratio} = \frac{0.0036408}{0.9963592} = 0.0036541 \simeq \boxed{0.0036}$$

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Wednesday
Oct. 3, 2007

Name KEY Rec. Instr. _____

Two-Digit Section No. _____ Lab. Instr. _____

1. [2 points] Does chemical change occur inside an incandescent light bulb when you switch it on ?

NO - Current flow in a metal (W) is not a chem. change.

2. [6 points] The color of light depends on it's wavelength. The longest visible rays, at the red end of the visible spectrum, are 7.8×10^{-7} m in length. Express this length in micrometers, in nanometers, and in angstroms.

$$7.8\times10^{-7}\,m \left| \frac{10^6\,\mu m}{m} \right. = 0.78\,\mu m$$

$$7.8\times10^{-7}\,m \left| \frac{10^9\,nm}{m} \right. = 7.8\times10^{2}\,nm$$

$$7.8\times10^{-7}\,m \left| \frac{10^{10}\,\text{Å}}{1\,m} \right. = 7.8\times10^{3}\,\text{Å}$$

3. [8 points] A solid has a volume of 1.23 cm^3. Its mass plus that of a piece of weighing paper is 10.024 g; the paper weighs 0.03 g. Calculate the density of the solid to the proper number of significant figures.

$$\begin{array}{r} 10.024\,g \\ -0.03\,g \\ \hline 9.994\,g \end{array} \leftarrow \text{mass of solid}$$

$$\frac{9.994\,g}{1.23\,cm^3} = 8.1252033\,\frac{g}{cm^3}$$

$$= \boxed{8.13\,g/cm^3}$$

4. [7 points] In a crystal of platinum, centers of individual atoms are 2.8Å apart along the direction of closest packing. How many atoms would lie on a 1.0-in length of a line in this direction? (Hint: 2.54 cm = 1 inch)

$$1.0\,inch \left| \frac{2.54\,cm}{1\,inch} \right| \frac{10^8\,\text{Å}}{cm} \left| \frac{1\,atom}{2.8\,\text{Å}} \right. = 9.071428571\times10^{7}\,\frac{atom}{inch}$$

$$= \boxed{9.1\times10^{7}\,atoms/inch}$$

5. [7 points] Before 1961, a physical atomic weight scale was used whose basis was an assignment of the value 16.000000 to ^{16}O. What would have been the physical atomic weight of ^{12}C on the old scale?

Ratio of masses of any two nuclides must be independent of reference point chosen

$$\frac{\text{old AW}(^{12}C)}{\text{old AW}(^{16}O)} = \frac{\text{new AW}(^{12}C)}{\text{new AW}(^{16}O)} = \frac{12.000000}{15.9949}$$

$$\text{So, old AW}(^{12}C) = 16.000000 \times \left(\frac{12.000000}{15.9949}\right) = \boxed{12.0038}$$