Chemistry 105 Exam 1. Fall 2000

Name_____

By submitting this exam, I certify that I have neither given nor received unauthorized aid on this assignment.

For full credit, show all work. Please report all numbers to the correct number of significant figures.
Useful information:

(1) An irregularly shaped object was placed in a graduated cylinder. The water level without the object was 32.8 mL and with the object was 47.1 mL. The mass of the object is 9.7653 g. What is the density?

Volume = 47.1 mL − 32.8 mL = 14.3 mL

mass = 9.7653 g

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{9.7653\ \text{g}}{14.3\ \text{mL}} = \boxed{0.683\ \frac{\text{g}}{\text{mL}}}$$

(2) A student needs to add 5.02 g of xylene to a reaction. If the density of xylene is 0.790 g/mL, what was the volume of xylene does the student need to add?

$$5.02\ \text{g} \times \frac{1\ \text{mL}}{0.790\ \text{g}} = \boxed{6.35\ \text{mL}}\ \text{of xylene}$$

↑ reciprocal of density

(3) Perform the following conversions:

(a) 1.65×10^{-7} s to ns $\quad 1\,ns = 10^{-9}\,s$

$$1.65 \times 10^{-7}\,s \times \frac{1\,ns}{10^{-9}\,s} = 165\,ns$$

(b) 35.6 in to m $\quad 1\,in = 2.54\,cm$

$100\,cm = 1\,m$

$$35.6\,in \times \frac{2.54\,cm}{1\,in} = 90.4\,cm$$

$$90.4\,cm \times \frac{1\,m}{100\,cm} = 0.904\,m$$

(c)

$23K - 273 = -250\,^{\circ}C$

23 K to °F

$$t_{^{\circ}F} = (-250\,^{\circ}C \times \tfrac{9}{5}) + 32$$

$$t_{^{\circ}F} = -418\,^{\circ}F$$

(4) Given the number of protons and neutrons in the nucleus of several nuclides, list the mass number, number of electrons, and the element for each as shown in the example.
example: 6 protons, 7 neutrons: mass number 13, 6 electrons, carbon

(a) 4 protons, 5 neutrons: mass number 9, 4 electrons, beryllium

(b) 65 protons, 72 neutrons mass number 137, 65 electrons, Tb

(c) 35 protons, 34 neutrons mass number 69, 35 electrons, Bromine

(d) 15 protons, 18 neutrons mass number 33, 15 electrons, phosphorus

(5) List 4 SI base units and the quantity they measure.

meter – length
kilogram – mass
second – time
Kelvin – temperature

(6) Perform the following calcuations and report the answer to the proper number of significant figures.

(a) (768.32 + 31.4654)/14.2768 = 56.020

768.32
+ 31.4654
799.7854 = 799.79

799.79 / 14.2768 = 56.020

(b) 1243.4564 - 1243.443274 = 0.0137

1243.4564
−1243.44274
0.01366

(c) 0.00853 x 16.31 = 0.139

(d) 41.276 ÷ 5.2 = 7.9

(7) Identify the following as elements, compounds, homogeneous solutions, or heterogeneous mixtures.

(a) yard clippings heterogeneous mixture

(b) Kool Aid homogeneous solution

(c) Bronze homogeneous solution

(d) Uranium element

(8) What famous experiment was performed under Ernest Rutherford's direction? How did it work and why was it important?

These answers are in the textbook

(9) List 4 points from Dalton's Atomic Theory

(10) What is the Law of Multitple Proportions? Give an example.

These answers are in the textbook

(11) Light Travels at 3.00 x 10^{10} cm/s. Convert this to miles/hr.

$\frac{3.00 \times 10^{10}\ cm}{s} \times \frac{1\ m}{100\ cm} = \frac{3.00 \times 10^{8}\ m}{s}$

$\frac{3.00 \times 10^{8}\ m}{s} \times \frac{1\ km}{1000\ m} = \frac{3.00 \times 10^{5}\ km}{s}$

$\frac{3.00 \times 10^{5}\ km}{s} \times \frac{3600\ s}{1\ hr} = \frac{1.08 \times 10^{9}\ km}{hr}$

$\frac{1.08 \times 10^{9}\ km}{hr} \times \frac{1\ mile}{1.609\ km} = 6.71 \times 10^{8}\ mi/hr$

(12) Sugar is dissolved in water. The water is then boiled off and condensed to form the separate water and sugar again. The sugar is then burned. List all of the chemical or physical processes from the above sequence. Label them as chemical or physical processes.

Sugar dissolved in water - physical
water boiled - physical
water condensed - physical
sugar burned - chemical

(13) When Mg is heated, it burns to form magnesium oxide (MgO). If 3.56 g of magnesium is burned, it produces 5.93 g of magnesium oxide. What is the mass of the oxygen that reacted with the magnesium?

$5.93\ g = Mg + O$

$-\ 3.56\ g = Mg$

2.37 g O

(14) Two samples of a compound are tested. Sample A has a mass of 6.24 g and is found to contain 2.45 g of Na and 3.79 g of Cl. Sample B has a mass of 10.58 g and consist of 4.16 g of Na and 6.42 g of Cl. What law is demonstrated here and why (show mathematically)?

Sample A $\frac{2.45\text{g Na}}{6.24\text{g total}} = 0.393 = 39.3\%\text{Na}$ $\frac{3.79\text{g Cl}}{6.24\text{g total}} = 0.607 = 60.7\%\text{Cl}$

Sample B

$\frac{4.16\text{g Na}}{10.58\text{g total}} = 0.393 = 39.3\%\text{Na}$ $\frac{6.42\text{g Cl}}{10.58\text{g total}} = 0.607 = 60.7\%\text{Cl}$

Both samples of the compound have the exact same composition

Law of Constant Composition

(15) A certain element consists of three isotopes. The first isotope has a fractional abundance of 0.7899 and a mass of 23.9850 amu. The second has a fractional abundance of 0.1000 and a mass of 24.9858 amu. The third has a fractional abundance of 0.1101 and a mass of 25.9826 amu. What is the weighted average mass of this element? Which element is it?

weighted average $= 0.7899(23.9850\text{ amu}) + 0.1000(24.9858\text{ amu}) + 0.1101(25.9826\text{ amu})$

$= 24.31\text{ amu}$, Mg