PRACTICE EXAM #1

Chem20, Elementary Chemistry

1.) Classify each of the following as a pure element, pure compound, homogeneous mixture, and/or heterogeneous mixture and clearly explain your reasoning. (9 points)

a.) black, filtered coffee **homogeneous mixture**

Can be separated by a physical process (evaporation of the water to leave the powder behind) but it looks uniform throughout since it's been filtered.

b.) chicken noodle soup **heterogeneous mixture**

Can be separated by a physical process (straining, boiling off the water) and it is composed of different phases that look different throughout (noodles, chicken, vegetables, broth)

c.) carbon monoxide (CO) **pure compound**

Cannot be separated by a physical process, but it can be decomposed further by a chemical process into carbon and oxygen. Multiple elements are chemically bonded together.

2.) Perform the following conversions to the correct significant figures. (15 points)

a.) 1.2 kilometers = __?__ decimeters

1 km = 10^3 m, 1 $\times$ 10^{-1} m = 1 dm

$1.2\text{ km} \times \frac{10^3\text{ m}}{1\text{ km}} \times \frac{1\text{ dm}}{10^{-1}\text{ m}} = 1.\underline{2} \times 10^4 \rightarrow \mathbf{1.2 \times 10^4\ dm}$

All the conversion factors are definitions.

b.) 5.3923 μg = __?__ Mg

1 μg = 1 $\times$ 10^{-6} g, 1 $\times$ 10^6 g = 1 Mg

$5.3923\ \mu\text{g} \times \frac{10^{-6}\text{ g}}{1\ \mu\text{g}} \times \frac{1\text{ Mg}}{10^6\text{ g}} = 5.392\underline{3} \times 10^{-12} \rightarrow \mathbf{5.3923 \times 10^{-12}\ Mg}$

All the conversion factors are definitions.

c.) 18.2 °C = __?__ K?

Recall: K = °C + 273.15, so that

K = 18.2 °C + 273.15 = 291.$\underline{3}$5 K → **291.4 K**

3.) Calculate the following to the correct number of significant figures. (10 points)

a.) (433.621 – 333.9) ÷ 11.900

Parentheses first, round to the tenths place:
(99.721) ÷ 11.900
Division second, round to 3 total sig. figs:
8.379… (9 ≥ 5, so round up) → **8.38**

b.) 249.361 + 41 x (32.98 + 62)

Parentheses first, round to the ones place:
249.361 + 41 x (94.98)
Multiplication second, round to 2 total sig. figs.:
249.361 + 3894.18
Addition third, round to the hundreds place:
4143 (0 ≤ 4, round down) → **4100 or 4.1×10^3**

4.) A room measures 113 feet^2. A carpet costs \$12.34 per yard^2. How much will it cost to carpet the entire room? (1 yard = 3 feet) (12 points)

Given: 113 ft^2; Desired Unit: \$
Plan: ft^2 → yd^2 → \$

$$113\ \text{ft}^2 \times \left(\frac{1\ \text{yd}}{3\ \text{ft}}\right)^2 \times \left(\frac{\$12.34}{1\ \text{yd}^2}\right) = \$154.935$$

(money, so round to the <u>hundredths</u> place, and 5 ≥ 5, so round up)

→ **\$154.94**

5.) The density of silver is 10.5 g/cm^3. If a pure silver ring has a volume of 1.345×10^{-2} L, what is its mass in grams? (10 points)

Remember that density = mass / volume. Rearranging, mass = density x volume.
Note that the density is in grams per cm^3. The grams are the desired unit, but the cm^3 doesn't match up to the given information of L.

$$1.345 \times 10^{-2}\ \text{L} \times \frac{1\ \text{mL}}{10^{-3}\ \text{L}} \times \frac{1\ \text{cm}^3}{1\ \text{mL}} = 1.345 \times 10^{1}\ \text{cm}^3$$

Now we can use the density to convert the volume into mass.

$$1.345 \times 10^{1}\ \text{cm}^3 \times \frac{10.5\ \text{g}}{1\ \text{cm}^3} = 141.2\ \text{g}$$ (densities are <u>measured</u>, so 3 sig. figs.) → **141 g**

6.) A rock suspected to be pure gold is weighed, giving a mass of 22.34 g. The rock absorbs 98.2 J of heat, resulting in a temperature change from 25.0°C to 43.1°C. What is the specific heat of the rock? Given that the specific heat of gold is 0.128 J/g °C, is the rock pure gold? (15 points)

Recall: $q = mC_s\Delta T$. We're solving for C_s. Insert the known information.

98.2 J = (22.34 g)(C_s)(43.1°C – 25.0°C)

Parentheses first, round to the tenths place: 98.2 J = (22.34 g)(C_s)(18.$\underline{1}$°C)
Multiplication second, round to 3 sig. figs.: 98.2 J = (40$\underline{4}$.354 g °C)(C_s)
Divide both sides to get C_s alone, round to 3 sig. figs.: C_s = 0.242$\underline{8}$… → **0.243 J · g^{-1} · °C^{-1}**
0.243 J · g^{-1} · °C^{-1} > 0. 128 J · g^{-1} · °C^{-1}, so the **sample is not gold.**

7.) Round the following to 3 significant figures. (9 points)

a.) 0.00030940 ___0.000309 OR 3.09×10^{-4}___

b.) 9083400027 ___9080000000 OR 9.08×10^{9}_

c.) 4004.0001 ___4.00×10^{3}______________

8.) An unknown metal sphere has a radius of 0.0126 m and weighs 0.1189 lbs. Calculate the density of the unknown in g/mL, given that 1 lb. = 454 g and the volume of a sphere = $4/3\pi(\text{radius})^3$ (20 points)

Convert the radius (0.0126 m) into cm.
$0.0126\text{ m} \times \frac{1\text{ cm}}{10^{-2}\text{ m}} = 1.2\underline{6}\text{ cm}$
Calculate the volume of the sphere.
volume = $(4/3)(\pi)(1.2\underline{6}\text{ cm})^3 = 8.3\underline{7}9\text{ cm}^3$
Convert the volume to mL.
$8.3\underline{7}9\text{ cm}^3 \times \frac{1\text{ mL}}{1\text{ cm}^3} = 8.3\underline{7}9\text{ mL}$
Convert the mass (0.1189 lbs.) to grams.
$0.1189\text{ lbs.} \times \frac{454\text{ g}}{1\text{ lb.}} = 53.\underline{9}8\text{ g}$ (conversion factor is <u>measured</u>, count for sig. figs.)
Calculate the density.
Density = $\frac{53.98\text{ g}}{8.379\text{ mL}} = 6.4\underline{4}2$ → **6.44 g/mL**