CHEM 1115 Unit 1 Practice Problems – Solutions

Please note that the following problems do not represent everything that will be on the exam. Use your objectives to study!!!

1. For each of the following elements, list its elemental symbol and separately classify it as:

   - metal, nonmetal, or metalloid
   - main group element, transition metal, lanthanide or actinide
   - alkali metal, alkaline earth metal, halogen, noble gas, or none of these

Hydrogen	H	Nonmetal	Main group	None of these
Iron	Fe	Metal	Transition metal	None of these
Silicon	Si	Metalloid	Main group	None of these
Fluorine	F	Nonmetal	Main group	Halogen
Helium	He	Nonmetal	Main group	Noble gas
Potassium	K	Metal	Main group	Alkali metal
Uranium	U	Metal	Actinide	None of these
Cerium	Ce	Metal	Lanthanide	None of these
Barium	Ba	Metal	Main group	Alkaline earth metal
gold	Au	Metal	Transition metal	None of these

2. List the chemical formula for each of the diatomic elements that are **not** halogens.

   H_2 N_2 O_2

3. Write the name and elemental symbol for the only metal that is a liquid at room temperature.

   Mercury Hg

4. Write the name and chemical formula for the only nonmetal that is a liquid at room temperature.

   Bromine Br_2 (Note: Br is the elemental symbol but Br_2 is its chemical formula).

5. Identify each of the following as an element, compound, pure substance, homogeneous mixture, or heterogeneous mixture. Note: More than one term may apply to a particular substance.

   a. a chocolate chip cookie — **heterogeneous mixture**
   b. water — **compound** **pure substance**
   c. sugar water — **homogeneous mixture**
   d. copper — **element** **pure substance**

6. Which of the following are phyical changes?

   a. the formation of carbon dioxide and water when natural gas is burned — **chemical chg.**
   b. boiling water — **physical chg.**
   c. the formation of frost on your car window on a cold winter day — **physical chg.**

7. How many significant figures are in the following measurements?

a. 1.09 g **3 SF**
b. 0.00312 km **3 SF**
c. 9.120×10^{-3} L **4 SF**
d. 10,000 mi **1 SF** (no decimal pt so none of the zeroes are significant)

8. Perform the following calculations and report your answer using the rules for calculations involving measured values (i.e. with the correct number of significant figures).

a. $8.074 + 9.11 - 2.5 = 14.684 \Rightarrow \boxed{14.7}$ (1 dec. pl.)

b. $(1.04 \times 10^5)(6.3 \times 10^3)/(2.908 \times 10^{-6}) = 2.2530948 \times 10^{14} \Rightarrow \boxed{2.3 \times 10^{14}}$
(3 SF, 2 SF, 4 SF; 2 SF)

c. $\dfrac{9.113 - 8.993}{8.993} = \dfrac{0.120}{8.993} = 0.01334371 = \boxed{0.0133}$ 3 SF
(3 dec. pl.; 3 dec. pl. + 3 SF; 4 SF)

9. A 12.5 mL sample of liquid has a mass of 10.897 g. What is the density of the liquid?

Given: V = 12.5 mL
mass = 10.897 g
Find: d

$d = \dfrac{\text{mass}}{V} = \dfrac{10.897\text{ g}}{12.5\text{ mL}} = 0.8717 = \boxed{0.872\text{ g/mL}}$

10. What is the mass of a 6.2 cm^3 piece of metal if its density is 8.91 g/cm^3?

Given: $V = 6.2\text{ cm}^3$
$d = 8.91\text{ g/cm}^3$
Find: mass

$g = 6.2\text{ cm}^3 \times \dfrac{8.91\text{ g}}{\text{cm}^3} = 55.242 = \boxed{55\text{ g}}$

11. What volume of a liquid with a density of 0.890 g/mL is needed to provide 25.20 g?

Given: $d = 0.890\text{ g/mL}$
mass = 25.20 g
Find: V

$mL = 25.20\text{ g} \times \dfrac{\text{mL}}{0.890\text{ g}} = 28.3146 = \boxed{28.3\text{ mL}}$

12. A silver colored solid cube has the following dimensions: 0.50 cm x 0.50 cm x 1.00 cm.

a. If it has a mass of 0.625 g, calculate its density.

Given: mass = 0.625 g

$Vol = l \times w \times h = 0.50\,cm \times 0.50\,cm \times 1.00\,cm = 0.25\,cm^3$

Find: $d = \frac{mass}{V} = \frac{0.625\,g}{0.25\,cm^3} = \boxed{2.5\,g/cm^3}$

b. If the density of aluminum is 2.702 g/cm^3, is this sample pure aluminum?

Probably not. The density of aluminum should be 2.702 g/cm^3 assuming temp is constant.

13. Using the equations given in your book and class, convert 298 K to °F.

Given: 298 K → °C

Find: °F ← °C

$°C = 298K - 273 = 25\,°C$

$°F = \frac{9}{5}(25°C) + 32 = \boxed{77°F}$

14. A particular brand of sunscreen contains 12.0% PABA (p-aminobenzoic acid) by mass. How many kilograms of PABA are needed to produce exactly 500 tubes of sunscreen if each tube contains 8.0 ounces of sunscreen? (Use any other conversion factors needed from the back of your book.)

Given: $12.0\%\ PABA = \frac{12.0\,g\ PABA}{100.0\,g\ sunscreen}$

$16\,oz = 1\,lb$

$1\,lb = 453.59\,g$

500 tubes

8.00 z suncreen = 1 tube

Find: kg PABA

$kg\ PABA = 500\ tubes \times \frac{8.0\,oz\ sunscreen}{1\ tube} \times \frac{1\,lb}{16\,oz} \times \frac{453.59\,g}{1\,lb} \times \frac{12.0\,g\ PABA}{100.0\,g\ sunscreen}$

$\times \frac{1\,kg}{1000\,g} = 13.6077\,kg\ PABA$

$= \boxed{14\,kg\ PABA}$

15. Using **only** the metric to metric conversion factors you were required to learn and the ones given below, perform the following conversions using dimensional analysis.

2.20 lb = 1 kg	4 qt = 1 gal	1 cal = 4.184 J
2.54 cm = 1 in	1 L = 1.0567 qt	1 eV = 1.602×10^{-19} J
12 in = 1 ft	1 furlong = 660.0 ft	1 mi = 5280 ft
1 min = 60 s	1 hr = 60 min	1 day = 24 hr
1 fortnight = 14 days		

a. 1.00 g/cm^3 = _____ lb/gal

$$\frac{lb}{gal} = \frac{1.00\,g}{cm^3} \times \frac{1\,kg}{1000\,g} \times \frac{2.20\,lb}{1\,kg} \times \frac{1\,cm^3}{1\,mL} \times \frac{10^3\,mL}{1\,L} \times \frac{1\,L}{1.0567\,qt} \times \frac{4\,qt}{1\,gal}$$

$$= \boxed{8.33\ lb/gal}$$

b. 2.5×10^4 mg = _____ lb

$$lb = 2.5 \times 10^4\,mg \times \frac{1\,g}{10^3\,mg} \times \frac{1\,kg}{10^3\,g} \times \frac{2.20\,lb}{1\,kg} = \boxed{0.055\ lb}$$

c. 1.8×10^6 cm^3 = _____ ft^3

$$ft^3 = 1.8 \times 10^6\,cm^3 \times \left(\frac{1\,in}{2.54\,cm}\right)^3 \times \left(\frac{1\,ft}{12\,in}\right)^3 = 63.5664$$

$$= \boxed{64\ ft^3}$$

d. 5.0×10^{24} eV = _____ kcal

$$kcal = 5.0 \times 10^{24}\,eV \times \frac{1.602 \times 10^{-19}\,J}{1\,eV} \times \frac{1\,cal}{4.184\,J} \times \frac{1\,kcal}{10^3\,cal}$$

$$= 191.44$$

$$= \boxed{190\ kcal}$$

e. 11.2 m/s = _____furlong/fortnight

$$\frac{\text{furlong}}{\text{fortnight}} = 11.2\ \frac{\text{m}}{\text{s}} \times \frac{60\ \text{s}}{1\ \text{min}} \times \frac{60\ \text{min}}{1\ \text{hr}} \times \frac{24\ \text{hr}}{1\ \text{day}} \times \frac{14\ \text{day}}{1\ \text{fortnight}} \times \frac{100\ \text{cm}}{1\ \text{m}}$$

$$\times \frac{1\ \text{in}}{2.54\ \text{cm}} \times \frac{1\ \text{ft}}{12\ \text{in}} \times \frac{1\ \text{furlong}}{660.0\ \text{ft}} = 67344.3$$

$$= 67300\ \frac{\text{furlong}}{\text{fortnight}}$$

or

$$6.73 \times 10^{4}\ \frac{\text{furlong}}{\text{fortnight}}$$