

Chemistry 68 – Exam 1 Name _____
28 June 2017

Show all work for full credit. Answers without supporting work will receive zero credit. All numbers that require units that do not have units written will result in the loss of three (3) points each time. All numbers in scientific notation should be in correct scientific notation (i.e., 3.15×10^4 , not 31.5×10^3 or 3.15E4 or 3.15e4). Each instance of incorrect scientific notation will result in the loss of three (3) points.

1. (14 points) Calculate the **relative average atomic mass** of an element that has the three isotopes listed below. The following data is given:

Isotope Mass	Abundance
357.903435 amu	24.67%
359.903392 amu	58.04%
362.902995 amu	17.29%

$$\begin{aligned}(0.2467)(357.903435 \text{ u}) &= 88.2947774145 \text{ u} \\(0.5804)(359.903392 \text{ u}) &= 208.887928717 \text{ u} \\(0.1729)(362.902995 \text{ u}) &= 62.7459278355 \text{ u} \\&= 88.2947774145 \text{ u} + 208.887928717 \text{ u} + 62.7459278355 \text{ u} = 359.928633966 \text{ u} \\&= 395.9 \text{ u}\end{aligned}$$

2. (12 points) Name the following compounds:

- a. $\text{Fe}_3(\text{PO}_4)_2$ iron(II) phosphate
- b. H_2O water
- c. N_2O_5 dinitrogen pentoxide
- d. Li_2O_2 lithium peroxide
- e. Hg_2Cl_2 mercury(I) chloride
- f. Mg_3N_2 magnesium nitride

3. (21 points) Complete the following table:

Name of Element	Isotope symbol	Mass Number	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
arsenic	$^{76}_{33}\text{As}$	76	33	33	43	33
copper	$^{66}_{29}\text{Cu}$	66	29	29	37	29
mercury	$^{203}_{80}\text{Hg}$	203	80	80	123	80
phosphorus	$^{28}_{15}\text{P}$	28	15	15	13	15

4. (12 points) Write formulas for the following names:

- sulfuric acid $\text{H}_2\text{SO}_4(\text{aq})$
- disulfur dichloride S_2Cl_2
- ammonium dichromate $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$
- chromium(III) oxalate $\text{Cr}_2(\text{C}_2\text{O}_4)_3$
- calcium borate $\text{Ca}_3(\text{BO}_3)_2$
- ammonia NH_3
- hydrocyanic acid $\text{HCN}(\text{aq})$
- strontium fluoride SrF_2
- tetranitrogen pentaboride N_4B_5
- iron(III) thiocyanate $\text{Fe}(\text{SCN})_3$
- mercury(II) nitrate $\text{Hg}(\text{NO}_2)_2$
- aluminium phosphite AlPO_3

5. (16 points) A metal cylinder is 66.53% copper by mass, 24.78% tin by mass and the rest is vanadium. The density of the cylinder is 5.83 g mL⁻¹. If the radius is 5.4437 inches and the height is 16.8674 inches. How many pounds of vanadium were used to create the cylinder? $V_{\text{cylinder}} = \pi r^2 h$, 1 in = 2.54 cm (exact), 1 lb = 453.59 g

$$\% V = 100.00\% - 66.53\% - 24.78\% = 8.69\%$$

$$\begin{aligned} ? \text{ lb V} &= \pi r^2 h = \pi (5.4437 \text{ in})^2 (16.8674 \text{ in}) \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}} \right)^3 \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{5.83 \text{ g cyl}}{1 \text{ mL}} \times \frac{8.69 \text{ g V}}{100.00 \text{ g cyl}} \times \frac{1 \text{ lb V}}{453.59 \text{ g V}} \\ &= 4.9327242129 \text{ lb V} = 4.93 \text{ lb V} \end{aligned}$$

6. (10 points) On another planet they are obsessed with prime numbers. One group of beings defines the freezing point of water as 2 °U and the boiling point of water as 97 °U. A different group of beings defines the freezing point of water as 3 °Q and the boiling point of water as 73 °Q. If the first group of beings states that the temperature of a liquid is 156.4 °U, what temperature would the second group of beings record this as in °Q?

	°U	Range °U	°Q	Range °Q
Freezing point	2	95	3	70
Boiling point	97		73	

$$(156.4 \text{ °U} - 2 \text{ °U}) \times \frac{70 \text{ °Q}}{95 \text{ °U}} + 3 \text{ °Q} = 116.8 \text{ °Q}$$

7. (5 points) Classify the following as a *pure substance*, a *homogenous mixture* or a *heterogeneous mixture*.

- a. sugar *pure substance*
- b. sewage *heterogeneous mixture*
- c. nitrogen dioxide gas *pure substance*
- d. milk (from the store) *homogenous mixture*
- e. egg whites *homogeneous mixture*

8. (10 points) When iron rusts in moist air, the product is typically a mixture of two iron–oxygen compounds. In one compound, there is an equal number of iron and oxygen atoms. In the other compound, there are three oxygen atoms for every two iron atoms. Write the formulas for the two iron oxides.

FeO and Fe₂O₃