

Chemistry 60 - Exam I
16 January 2018

Name _____

Show all work for credit. State any assumptions made to solve a problem. Give all numerical answers with the correct number of significant figures. All answers in scientific notation must be in correct scientific notation (i.e., 6.022×10^{23} not 6.022E23 or 6.022e23). All instances of incorrect scientific notation will result in the loss of 3 points each. All numbers that require units should have the units written. All instances of numbers without units will result in the loss of 3 points each.

1. (10 points) Calculate the number of **grams of iron** in a 125.0 mL of steel that has a density of 7.84 g mL^{-1} and is 97.0% iron by mass.

$$? \text{ g Fe} = 125.0 \text{ mL steel} \times \frac{7.84 \text{ g steel}}{1 \text{ mL steel}} \times \frac{97.0 \text{ g Fe}}{100.0 \text{ g steel}} = 951 \text{ g Fe}$$

2. (10 points) The fastest spacecraft ever launched is the New Horizons spacecraft heading to Pluto. It's traveling at 23 km per second. What is this speed in **inches per day**?

$$? \frac{\text{in}}{\text{day}} = \frac{23 \text{ km}}{\text{s}} \times \frac{1 \text{ mi}}{1.609 \text{ km}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{60 \text{ s}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ h}} \times \frac{24 \text{ h}}{\text{day}} = 7.8 \times 10^{10} \frac{\text{in}}{\text{day}}$$

3. (10 points) An alloy has a density of 10.67 lb/ft^3 . The alloy is 46.9% cobalt by mass. How many **L of alloy** are needed to have 10.0 lb of cobalt?

$$? \text{ L alloy} = 10.0 \text{ lb Co} \times \frac{100.0 \text{ lb alloy}}{46.9 \text{ lb Co}} \times \frac{1 \text{ ft}^3 \text{ alloy}}{10.67 \text{ lb}} \times \left(\frac{12 \text{ in}}{1 \text{ ft}}\right)^3 \times \left(\frac{2.54 \text{ cm}}{1 \text{ in}}\right)^3 \times \frac{1 \text{ mL alloy}}{1 \text{ cm}^3 \text{ alloy}} \times \frac{10^{-3} \text{ L alloy}}{1 \text{ mL alloy}} = 56.6 \text{ L alloy}$$

4. (8 points) The temperature on the moon of Saturn Titan averages 94.2 K. What is this temperature in **°F**?

$$(94.2 \text{ K} - 273.15 \text{ K}) \times \left(\frac{9 \text{ }^\circ\text{F}}{5 \text{ K}}\right) + 32 \text{ }^\circ\text{F} = -290.1 \text{ }^\circ\text{F}$$

Conversion Factors

1 qt = 0.9463 L

1.609 km = 1 mi.

2 c = 1 pt

1 mi = 5280 feet

1 lb. = 453.6 g

2 pt = 1 qt

8 fl. oz. = 1 c

8 drams = 1 fl. oz.

1 stone = 14 lb

1 gal = 4 qt

8 furlongs = 1 mi

12 in = 1 ft

5. (12 points) Complete the following table.

Name of Element	Symbol
aluminum	Al
boron	B
nitrogen	N
neon	Ne
iodine	I
selenium	Se
palladium	Pd
cobalt	Co
argon	Ar
zirconium	Zr
Titanium	Ti
gold	Au

6. (10 points) Write formulas for the following compounds.

a. cobalt(II) hypochlorite



b. disulfur trioxide



c. sodium selenide



d. triphosphorus tetrabromide



e. ammonium oxide



f. perchloric acid



g. nitrogen trioxide



h. hydrocyanic acid



i. lithium peroxide



j. calcium permanganate



7. (10 points) Write names for the following compounds.



copper(I) bromide



neptunium(VI) sulfide



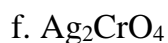
potassium peroxide



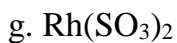
hydroiodic acid



sulfurous acid



gold(I) chromate



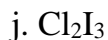
rhodium(IV) sulfite



lithium fluoride



nitrogen tribromide



dichlorine triiodide

8. (10 points) Complete the following table:

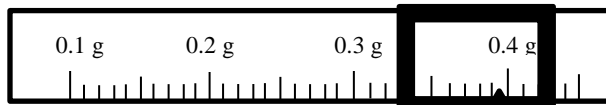
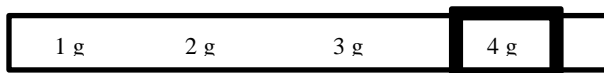
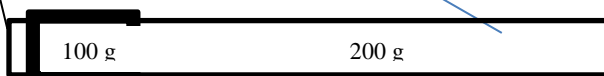
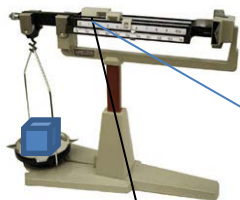
Name of Element	Isotope symbol	Mass Number	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
carbon	¹⁴ ₆ C	14	6	6	8	6
Manganese	⁵⁶ ₂₅ Mn	56	25	25	31	25
Platinum	¹⁹⁵ ₇₈ Pt	195	78	78	117	78
Tellurium	¹²⁸ ₅₂ Te	128	52	52	76	52

9. (10 points) Calculate the *relative average atomic mass* of an element that has three isotopes. The following data is given:

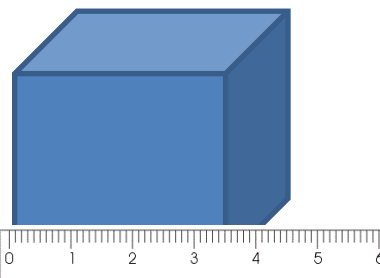
Isotope Mass	Abundance
357.903435 amu	24.67%
359.903392 amu	58.04%
362.902995 amu	17.29%

$$(357.903435 \text{ u} \times 0.2467) + (359.903392 \text{ u} \times 0.5804) + (362.902995 \text{ u} \times 0.1729) \\ = 88.2947774145 \text{ u} + 208.887928717 \text{ u} + 62.7459278355 \text{ u} = 359.928633966 \text{ u} = 359.9 \text{ u}$$

10. (10 points) A student measured the mass and volume of the cube shown and calculated the density. What is the density of the cube in $\text{g} \cdot \text{mL}^{-1}$ according to the measurements shown? (The ruler shown is marked in cm.)



The mass of the cube is $134.393 \pm 0.001 \text{ g}$.



The edge length of the cube is $3.47 \pm 0.01 \text{ cm}$ so the volume is $(3.47 \text{ cm})^3 = 41.781923 \text{ cm}^3$

The density of the cube is $\frac{134.392 \text{ g}}{41.781923 \text{ cm}^3} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} = 3.22 \text{ g mL}^{-1}$