

Homework 2

Chapter 1: 22, 64, 77, 78, 86; Chapter 2: 12, 17, 21, 23, 61, 91, 96, 61, 102, 115; Non-book problems

22) An irregularly shaped piece of lead weighs 10.0 g. It is carefully lowered into a graduated cylinder containing 30.0 mL of ethanol, and it sinks to the bottom of the cylinder. To what volume reading does the ethanol rise?

64) Write a nanoscale representation and symbolic representation and describe what happens at the macroscale when bromine evaporates to form bromine vapor.

77 & 78) you need the textbook for the figures

86) You have some metal shot, small spheres like BBs and you want to identify the metal. You have a flask that is known to contain exactly 100.0 mL when filled with liquid to a mark in the flask's neck. When the flask is filled with water at 20°C, the mass of flask and water is 122.3 g. The water is emptied from the flask and 20 of the small spheres of metal are carefully placed in the flask. The 20 small spheres had a mass of 42.3 g. The flask is again filled to the mark with water at 20°C and weighed. This time the mass is 159.9g.

- What metal is in the sphere? (Assume that that spheres are all the same and consist of pure metal.)
- What volume would 500 spheres occupy?

Chapter 2

12) A Volkswagen engine has a displacement of 120. in³. What is this volume in cubic centimeters? In liters?

17) A crystal fluorite (a mineral that contains calcium and fluorine) has a mass of 2.83 g. What is this mass in kilograms? In pounds? Give the symbols for the elements in this crystal.

21) How many significant figures are present in these measured quantities?

- 1374 kg
- 0.00348 s
- 5.619 mm
- 2.475×10^{-3} cm
- 33.1 mL

23) For each of these numbers, round to four significant digits and write the result in scientific notation.

- 247.583
- 100578
- 0.0000348719
- 0.004003881

25) Perform these calculations and express the result with the proper number of significant figures.

- $2221.05 - (3256.5/3.20)$
- $343.3 \times (2.01 \times 10^{-3})$
- $S = 4\pi r^2$ where $r = 2.55 \text{ cm}$
- $2802/15 - (0.0025 \times 10,000.)$

61) If you divide Avogadro's number of pennies among the 285 million men, women, and children in the United States, and if each person could count one penny each second every day of the year for eight hours per day, how long would it take to count all of the pennies?

91) The density of a solution of sulfuric acid is 1.285 g/cm^3 , and it is 38.08% acid by mass. What volume of the acid solution (in mL) do you need to supply 125g of sulfuric acid?

96) A common fertilizer used on lawns is designated as "16-4-8." These numbers mean that the fertilizer contains 16% nitrogen-containing compound, 4.0% phosphorous and 8.0% potassium-containing compounds. You buy a 40.0 lb bag of this fertilizer and use all of it on your lawn. How many grams of the phosphorous-containing compound are you putting on your lawn? If the phosphorous-containing compound consists of 43.64% phosphorous (the rest is oxygen), how many grams of phosphorous are there in 40.0 lb of fertilizer?

102) Draw a picture showing the approximate positions of all protons, electrons, and neutrons in an atom of helium-4. Make certain that your diagram indicates both the number and position of each type of particle.

115) Air mostly consists of diatomic molecules of nitrogen (about 80%) and oxygen (about 20%). Draw a nanoscale picture of a sample of air that contains a total of ten molecules.

Non-book problems

1) Complete the following table:

	# electrons	#protons	#neutrons
^{24}Mg			
$^{23}\text{Na}^+$			
^{35}Cl			
$^{35}\text{Cl}^-$			
$^{56}\text{Fe}^{+3}$			
^{15}N			
$^{16}\text{O}^{-2}$			
$^{27}\text{Al}^{+3}$			

2) Complete the following table:

Isotope	Atomic number	Mass number	Number of electrons
	27	59	25

^{14}N			
	3	7	3
	3	6	3
$^{58}\text{Zn}^{+2}$			
$^{19}\text{F}^-$			

3) Isotopic abundances are different in other parts of the universe. Suppose that on planet Krypton we find the following stable isotopes and abundances for boron:

^{10}B (10.013 amu) 65.75%

^{11}B (11.009 amu) 25.55%

^{12}B (12.014 amu) 8.70%

What is the value of the average atomic mass of boron on planet Krypton?

4) Naturally occurring chlorine is composed of ^{35}Cl and ^{37}Cl . The mass of ^{35}Cl is 34.9689 amu and the mass of ^{37}Cl is 36.9659 amu. The average atomic mass of chlorine is 35.453 amu. What are the percentages of ^{35}Cl and ^{37}Cl in naturally occurring chlorine?

5) Calculate the number of atoms in each of the following: a) 50.7 g of hydrogen; b) 1.00 milligrams of cobalt; c) 1.00 kilograms of sulfur; d) 1.00 ton of iron.

6) What mass of iodine contains the same number of atoms as 25.0 g chlorine?

7) Indicate whether each of the following statements is true or false and explain your reasoning.

a) On average, one Li atom weights 6.941 grams

b) Every H atom weighs 1.008 amu

8) Indicate whether each of the following statements is true or false and explain your reasoning.

a) A certain mass of solid Na contains fewer atoms than the same mass of gaseous Ne.

b) The molecular weight of an unknown gas is 0.045 g/mol

9) The entry in the periodic table for chlorine contains the symbol Cl and two numbers 17 and 34.453. List four pieces of information about the element chlorine which can be determined from these numbers.

10) The atomic mass of rhenium is 186.2. Given that 37.1% of natural rhenium is rhenium -185, what is the other stable isotope?

11) Which element contains atoms that have an average mass of 5.14×10^{-23} grams?

12) Which member of each pair has a greater mass? Explain

a) 1 mol Cl^- or 1 mol Cl_2

b) 1 nitrogen atom or 1 nitrogen molecule

c) 20.2 g Ne or 1 mole Ne

d) 1g Ca or 6.023×10^{23} calcium atoms

e) 1 mole iron atoms or 1 mol Al atoms

13) Which member of each pair has a greater number of particles? Explain

- a) 1 copper atom or 1 mol copper
- b) 1 mol Cl or 1 mol Cl₂
- c) 24.3 g Mg or 1 mol Mg
- d) 1 oxygen molecule or 1 oxygen atom
- e) 107.9 g Ag or 6.9 g Li