PRACTICE EXAM #2

Chem20, Elementary Chemistry

1.) Identify whether the following compounds are molecular or ionic and name them appropriately:

a.) $Fe_3(PO_4)_2$ ___ionic type II – iron(II) phosphate___

b.) N_4O_8 ___molecular – tetranitrogen octoxide___

c.) Cs_2S ___ionic type I – cesium sulfide___

d.) P_4O_{10} ___molecular – tetraphosphorous decoxide___

2.) Perform the following conversions to correct significant figures:

a.) 4.37 mols Bi = _?_ atoms Bi

Use Avogadro's number as a conversion factor.

$$4.37 \text{ mols Bi} \times \frac{6.022 \times 10^{23} \text{ atoms Bi}}{1 \text{ mol Bi}} = 2.6\underline{3}1614 \times 10^{24} \rightarrow \mathbf{2.63 \times 10^{24} \text{ atoms Bi}}$$

b.) 12.34 g Kr = _?_ mols Kr

Use the molar mass of Kr in one conversion
(g → mols)

$$12.34 \text{ g Kr} \times \frac{1 \text{ mol Kr}}{83.80 \text{ g Kr}} = 0.147\underline{2}5537 \rightarrow \mathbf{0.1473 \text{ mols Kr}}$$

c.) 25.316 g Si = _?_ atoms Si

Use the molar mass of Si and Avogadro's number in two conversions
(g → mols → atoms)

$$25.316 \text{ g Si} \times \frac{1 \text{ mol Si}}{28.09 \text{ g Si}} \times \frac{6.022 \times 10^{23} \text{ atoms Si}}{1 \text{ mol Si}} = 5.427\underline{3}03382 \times 10^{23} \rightarrow$$

$$\mathbf{5.4273 \times 10^{23} \text{ atoms Si}}$$

3.) Give the charge-balanced formula units for the following ionic compounds:

a.) ammonium carbonate $(NH_4)_2CO_3$

b.) calcium bromide $CaBr_2$

c.) sodium phosphate Na_3PO_4

d.) magnesium oxide MgO

4.) Thymine is one of the four components of DNA. Its chemical formula is $C_5H_6N_2O_2$.

a.) Calculate the molar mass for thymine.

Use the molar masses of each atom present in the chemical formula.

= (5)(12.01 g/mol) + (6)(1.008 g/mol) + (2)(14.01 g/mol) + (2)(16.00 g/mol)
= 126.118 → **126.12 g/mol**

b.) In a 35.6 g sample of thymine, how many grams of N are present?

Convert g thymine to mols thymine (molar mass thymine).
Convert mols thymine to mols N (chemical formula).
Convert mols N to g N (molar mass N).

$$35.6 \text{ g thymine} \times \frac{1 \text{ mol thymine}}{126.12 \text{ g thymine}} \times \frac{2 \text{ mols N}}{1 \text{ mol thymine}} \times \frac{14.01 \text{ g N}}{1 \text{ mol N}} = 7.909229305 \rightarrow \mathbf{7.91\ g\ N}$$

c.) In the same 35.6 g sample of thymine, how many grams of H are present?

Convert g thymine to mols thymine (molar mass thymine).
Convert mols thymine to mols H (chemical formula).
Convert mols H to g H (molar mass H).

$$35.6 \text{ g thymine} \times \frac{1 \text{ mol thymine}}{126.12 \text{ g thymine}} \times \frac{6 \text{ mols H}}{1 \text{ mol thymine}} \times \frac{1.008 \text{ g H}}{1 \text{ mol H}} = 1.70717412 \rightarrow \mathbf{1.71\ g\ H}$$

c.) A 423.12 g mixture from a worm was found to contain 25.3 g thymine. What is the mass percent of thymine in this mixture?

Use the percent composition formula.

$$\frac{25.3 \text{ g thymine}}{423.12 \text{ g mixture}} \times 100\% = 5.97939119 \rightarrow \mathbf{5.98\ \%\ thymine}$$

5.) Complete the following table.

Atomic Notation	Atomic Number (Z)	Mass Number (A)	Ionic Charge	Number of protons	Number of neutrons	Number of electrons
$^{197}_{79}Au^{+1}$	**79**	**197**	**+1**	**79**	**118**	**78**
$^{16}_{8}O^{2-}$	**8**	**16**	**-2**	**8**	8	**10**
$^{89}_{39}Y^{+3}$	39	89	**+3**	**39**	**50**	36
$^{131}_{54}Xe$	**54**	**131**	**0**	54	**77**	**54**
$^{80}_{35}Br^{-1}$	**35**	80	-1	**35**	**45**	36

6.) A second component of DNA is adenine, composed of only carbon, hydrogen, and nitrogen. The decomposition of this substance produced 3.158 g carbon, 0.2661 g hydrogen, and 3.685 g nitrogen. What is the empirical formula for adenine?

Convert the grams of each element to mols using the molar masses.

$3.158 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = 0.2629475437 \text{ mols C}$

$0.2661 \text{ g H} \times \frac{1 \text{ mol H}}{1.008 \text{ g H}} = 0.2639880952 \text{ mols H}$

$3.685 \text{ g N} \times \frac{1 \text{ mol N}}{14.01 \text{ g N}} = 0.2630264097 \text{ mols N}$

Divide by the smallest (0.2629 mols C).

0.2629 mols C/0.2629 mols → 1 C

0.2640 mols H/0.2629 mols → 1.004 or 1 H

0.2630 mols N/0.2629 mols → 1.000 or 1 N

Empirical Formula: **CHN**