

CHEM 101 Exam 1**Page 1****September 21, 2001****Name** _____**Student ID #** _____

This exam consists of 7 pages. When the exam begins make sure you have one of each. Print your name at the top of each page now The last page is blank and you may tear it off and use it for scratch paper. Show your work on calculations, this is the only way partial credit can be given. Be sure to include units on calculations, and give answer to the correct number of significant figures. When a blank is not provided make sure you place a box around the correct answer. The exam is 100 points and 50 minutes.

Page Points

2	_____
3	_____
4	_____
5	_____
6	_____

If anything confuses you or is not clear, raise your hand and ask!**Total** _____**USEFUL INFORMATION**Avogadro's number = $6.02214 \times 10^{23} \text{ mol}^{-1}$

Points

10 1) Complete the following table:

Symbol		$^{54}_{26}\text{Fe}^{2+}$			
Protons	5			79	86
Neutrons	6		16	117	136
Electrons	5		18	79	
Net Charge			-3		0

8 2) Name or provide the molecular formula for the following:

a) CuI

b) Na_2CO_3 c) SF_6 d) NH_4NO_3

e) sodium hydroxide

f) tin(II) fluoride

g) carbon tetrachloride

h) lithium nitride

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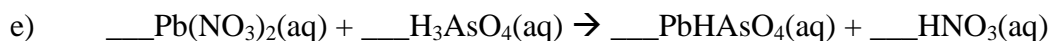
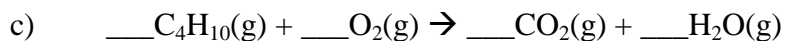
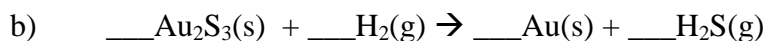
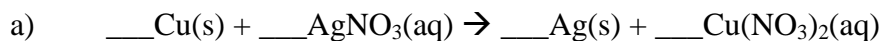
Points

8 3) At a certain temperature the density of liquid water is 1.00 g/cm^3 . At the same temperature the density of solid β -carotene, $\text{C}_{40}\text{H}_{56}$, the orange pigment in carrots food for vision is also 1.00 g/cm^3 .

a) How many molecules of water are there in 1.00 mL?

b) How many molecules of β -carotene are there in 1.00 mL?

10 4) Balance the following equations by filling in the provided blanks:



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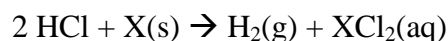
Points

16 5) Caffeine is a central nervous stimulant found in coffee, tea, and cola nuts (and often consumed by students the night before exams!). Caffeine is found to be 49.48% C, 5.19% H, 28.85% N, and 16.48% O by mass.

a) What is the empirical formula for caffeine?

b) If the molar mass of caffeine is 194.2 g/mol what is the molecular formula?

10 6) a) Calculate the atomic weight of the metal (X) that reacts with hydrochloric acid according to the following equation if 125 mL of 0.200 M HCl consumes 0.113 g of the metal.

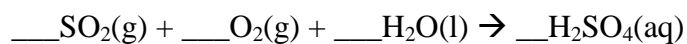


b) What metal is "X"? _____ (name or atomic symbol)

Points

- 8 7) Protoporphyrin IX is an important part of many naturally occurring biomolecules including hemoglobin, myoglobin, and most cytochromes. Zinc protoporphyrin IX has one bound Zn atom. The % mass of Zn in the complex is 10.44%. What is the molar mass of zinc protoporphyrin IX?

- 18 8) Sulfur dioxide is a major contributor to the environmental problem of acid rain. Below is the **unbalanced reaction** for acid rain production in the atmosphere:



- a) Fill in the blanks above to balance the reaction.
- b) 150.0 g of SO₂ and 100.0 g of O₂ and an excess of water are mixed. Which is the limiting reactant?
- c) How many grams of the excess reagent remains? Assume the reaction goes to completion.

Points

d) Again, assuming the reaction goes to completion and the final volume of the solution is 3400. mL. What is the final concentration of $\text{H}_2\text{SO}_4(\text{aq})$?

12 9) a) How many grams of $\text{K}_2\text{Cr}_2\text{O}_7$ are needed to make 600. mL of a 0.0350 M solution?

b) How many milliliters of the solution made in a) are necessary to make 125 mL of a 0.00100 M solution of $\text{K}_2\text{Cr}_2\text{O}_7$?

c) What are the final concentrations of the ions in solution?