

Chemistry 1

First Lecture Exam

Fall 2011

NAME \_\_\_\_\_

Circle the name of your **recitation/lab** instructor(s)

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Before you begin the exam, write your name on this page and read all these instructions.Answer all questions in these pages. No scrap paper allowed For questions 16-25, show all work.**Express answers with the proper units and to the correct number of significant figures.** You have 90 minutes. Do not spend too much time on one question.**There are questions on BOTH SIDES of most pages.** This exam has 9 pages and 5 sheets. Make sure you have all of them.

Calculators may be inspected to make sure they do not contain a cheating sheet.

Use of cell phones is prohibited and will be considered as cheating.

## PERIODIC CHART OF THE ELEMENTS

IA	IIA												IIIA	IVA	VA	VIA	VIIA	0	
1 H 1.0079																		1 H 1.0079	2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.81	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179		
11 Na 22.989	12 Mg 24.305											13 Al 26.981	14 Si 28.086	15 P 30.974	16 S 32.06	17 Cl 35.453	18 Ar 39.948		
19 K 39.098	20 Ca 40.08	21 Sc 44.956	22 Ti 47.88	23 V 50.941	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.69	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80		
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.22	41 Nb 92.905	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.29		
55 Cs 132.91	56 Ba 137.33	57 * La 138.90	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra 226.0	89 # Ac 227.03																	
* Lanthanides			58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97			
# Actinides			90 Th 232.03	91 Pa 231.03	92 U 238.03	93 Np 237.05	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (254)	100 Fm (257)	101 Md (257)	102 No (255)	103 Lr (256)			

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NAME \_\_\_\_\_

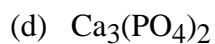
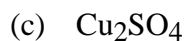
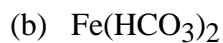
1. (4 pts) Do these calculations. Assume all numbers are exact so do not round off.

$$\frac{(2 \times 10^{1200})(6 \times 10^{-2400})}{4 \times 10^{-1000}}$$

$$(6.00 \times 10^{-1400}) + (1.5 \times 10^{-1401})$$

2. (1 pt) How many nuclei are there in one molecule of H<sub>2</sub>O?

3. (8 pts) Name these compounds



4. (8 pts) Give the formula of

(a) lead(II) nitride

(b) mercury(I) iodide

(c) hydrosulfuric acid

(d) ammonium phosphate

5. (2 pts) Do this calculation and round off the answer to the proper number of significant figures.

Be careful. Do one step at a time. (Exam continued on the **BACK** of this page.)

$$\frac{(64.297 \text{ g}) - (64.231 \text{ g})}{26.42 \text{ cm}^3} =$$

6. (3 pts) State whether **each** of the following properties is intensive or extensive. (If you want a hint, recall that extensive properties depend on the size of the system.)
- (a) temperature                      (b) volume                      (c) density
7. (1 pt) Which of these is NOT an exact number.
- (a) The number of dollar bills in a wallet.  
(b) The number of milligrams in a kilogram  
(c) The measured mass of a penny.  
(d) All of a, b, and c are exact.  
(e) None of a, b, and c are exact.
8. (5 pts) True or false?
- (a) Water is a mixture of hydrogen and oxygen.  
(b) Compounds with different molecular formulas but the same empirical formula have the same percentage composition by weight.  
(c) Avogadro's number is defined as the number of carbon atoms in exactly twelve grams of  $^{12}\text{C}$ .  
(d) One mole of  $\text{CO}_2$  has the same number of molecules as one mole of  $\text{N}_2\text{O}_5$ .  
(e) Professor Levine never makes a mistake in lecture.
9. (2 pts) If compound X containing only C and H is burned in oxygen and we are told how many grams of water are formed and how many grams of carbon dioxide are formed, but we are not told how many grams of X were burned, can a competent chemistry student find the empirical formula of compound X?
- (a) Yes      (b) No
10. (2 pts) An atom contains three kinds of particles.
- (a) Which of these particles is not present in the nucleus?  
(c) Which of these particles has the smallest mass?

11. (2 pts) State whether each of the following is an element, a compound, a homogeneous mixture, or a heterogeneous mixture. (No credit for “mixture” as the answer.)
- (a) iron                      (b) a solution of sugar in water
12. (2 pts) Find the number of electrons present in one  $\text{NO}_2$  ion.
13. (3 pts) Find the number of protons, the number of electrons, and the number of neutrons in one  ${}_{19}^{39}\text{K}^+$  ion.
14. (2 pts) (a) Millikan’s oil-drop experiment measured what property of the electron?
- (b) The experiment in which alpha particles were scattered by a gold foil, showed what about the atom?
15. (3 pts) A certain compound has the empirical formula CH and its molecular weight is 117 amu. Find its molecular formula.

For questions 16–26 show all work. If you need more space, use the back page or page 2.

16. (8 pts) Do these conversions. (Exam continued on the BACK of this page.)
- (a) 6.8 mg to ng (one ng =  $10^{-9}$  g)
- (b) 245 K to  $^{\circ}\text{C}$
- (c)  $3.84 \text{ m}^3$  to  $\text{cm}^3$

(d) 2.4 g/mL to mg/L

17. (6 pts)  $C_7H_{12}$  reacts with  $O_2$  to produce  $CO_2$  and  $H_2O$ . Suppose 348 g of  $CO_2$  are produced in this reaction. What mass of  $O_2$  reacted?

18. (6 pts) Find the empirical formula of a compound if a sample of this compound contains 163.8 g of carbon, 518.1 g of fluorine, and 145.4 g of oxygen. Fluorine is next to oxygen in the periodic table.

19. (4 pts) Find the mass in grams of one molecule of  $NO_2$ ; you MUST express your answer in grams.

20. (6 pts) A certain compound contains only the elements C, H and O. When a 5.107 g sample of this compound is burned in oxygen, 9.769 g of  $\text{CO}_2$  and 5.997 g of  $\text{H}_2\text{O}$  are formed. Find the mass of carbon, the mass of hydrogen, and the mass of oxygen in the 5.107 g sample. Do **NOT** find the empirical formula.

21. (6 pts) In 6.72 g of  $\text{N}_2\text{H}_4$

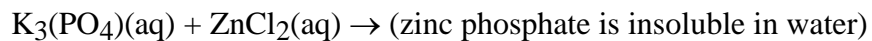
(a) how many  $\text{N}_2\text{H}_4$  molecules are present?

(b) how many N atoms are present?

(c) how many protons are present

22. (3 pts) Find the percentage composition by mass for each element in  $\text{NF}_3$  (Exam continued on the BACK of this page.)

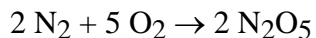
23. (4 pts) (a) Complete and balance this reaction



(b) Now find the net ionic reaction

24. (3 pts) Classify each of these as ionic or molecular: (a)  $\text{HCl}(\text{g})$  (b)  $\text{H}_2\text{O}(\text{l})$  (c)  $\text{CaCO}_3(\text{s})$

25. (6 pts) Suppose 75.0 g of  $\text{N}_2$  and 246.0 g of  $\text{O}_2$  are mixed and the following reaction occurs:



At the end of the reaction: what mass of  $\text{N}_2$  will be present, what mass of  $\text{O}_2$  will be present, and what mass of  $\text{N}_2\text{O}_5$  will have been produced?

Extra credit

EC1 (1/2 pt) At the question session on Wed last week, the number of people attending was about



(a) 5 (b) 15 (c) 45 (d) 100 (e) 200 (f) 637

EC2 (2 pts) Suppose 364 g of element X reacts with 10.0 g of hydrogen to form 334 g of the compound  $\text{XH}_2$  with 40 g of X left over and no  $\text{H}_2$  left over. What is the atomic weight of element X? Show work