

CHM 109 Study Guide for Exam I

Fall 2009

Covering material from 1st day through Weak Interactions **Answers posted by Mon, 11 PM.** Supplemental Information at end of guide. Bring a pencil or pen to the exam. No additional material (notes, etc.) permitted. On the real exam, do the easiest problems first. Try to be as efficient with your time as possible. Show logic and calculations for all problems. Remember to include units and be careful with sig. fig. Help session will start at 5:30 on Tuesday.

Example of some of the types of questions you might encounter on the test:

1. Short answer:

- Describe a genetic disease that demonstrates the importance of biochemistry to human health. How can this disease be treated?
- Is it sound reasoning to criticize a scientific concept by saying “_____ (Many things could be inserted into the blank.) is just a theory?” Why or why not?
- What things do chemists study?
- Are you haploid or diploid? Expound briefly.
- Approximately how many jobs must the human body perform to remain healthy?

2. Perform the following conversions:

- $4.07 \times 10^5 \text{ mg} \rightarrow \text{g}$
- $9.31 \text{ kg} \rightarrow \text{lb}$
- $5.00 \times 10^{-2} \text{ km} \rightarrow \text{nm}$

3. For a) & b) below, how many s.f. does each value have, & which **place** is the least sig. place?

- Also, express 0.0007601 in scientific notation.
- Also, express 8.320075×10^4 in standard notation.

4. What factors influence nuclear stability? Predict whether a newly discovered isotope of plutonium ($_{94}\text{Pu}$) is more likely to have a stable or unstable nucleus. Briefly explain your answer.

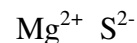
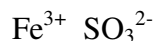
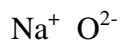
5. Give the number of p^+ , e^- , n , number of valence e^- and electronic configuration of:

- | | <u>p^+</u> | <u>e^-</u> | <u>n</u> | <u># valence e^-</u> | <u>electronic configuration</u> |
|-------------------------|-------------------------|-------------------------|-----------------------|-----------------------------------|---------------------------------|
| a) ^{40}K | | | | | |
| b) $^{32}\text{P}^{3-}$ | | | | | |

6. Explain why scientists considered Mendeleev’s development of the Periodic Table an important scientific advance.

7. What is an ionic bond?

8. a) Give the correct ionic compound formulas for the cation/anions pairs below:



b) What is the charge of the $\text{NO}_2^{??}$ ion in: $\text{Ca}(\text{NO}_2)_2$?

9. 10. Fill in the table shown below: (Central atom is underlined.) (Boxes bigger on test.)

Formula	<u>C</u> H_2Cl_2	<u>N</u> O_2^-	PCl_3
# valence e^-			
Lewis structure			
molecular type			
e^- pair geom. name/sketch			
molecular shape name/sketch			
polar? (Y or N)			

10. From Q#9, what are the orbital hybridization patterns of CH_2Cl_2 , NO_2^- , and PCl_3 ? Xenon (Xe) is in the inert or noble gas group. What does this mean, and why, in terms of electron structure, is Xe inert?

11. What three biochemicals (linked by arrows) represent a major theme for this course?

12. What is the definition of valence electrons, and why are they important?

13. What is the Lewis Octet Principle?

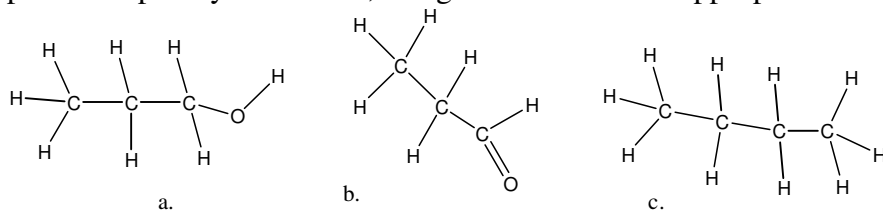
The following problems may not all be on the test depending on how far we get in lecture by the end of Wednesday.

14. Regarding the Boltzmann molecular simulator program used in lecture, would increasing the number of red spheres in the box increase or decrease the pressure? Explain your answer using the Kinetic Molecular Theory.

15. What pressure is exerted by 0.533 moles of Ar(g) at 24.7° C in a 2.500 L container?

16. A syringe if filled with 48.0 mL of air at a pressure of 748 mm Hg. What would the pressure in the syringe be when the volume is decreased to 9.2 mL?

17. Which of the following compounds would have the highest, intermediate, and lowest boiling point? Explain your answer, using structures where appropriate.



18. What would be the physical state of a compound at room temperature that boiled at 55.9 °C and melted at 10.8 °C.?

19. Draw a picture of three molecules of water connected by hydrogen bonds.

Supplemental Information (that you will be provided)

Periodic Table (see below)

Electronegativity Table (see below)

Equations for temperature: °F = 1.8 °C + 32 K = °C + 273.15

English to metric conversions from back inside cover of Denniston, *et al.*

Length 1 m = 39.47 in

Mass 1 kg = 2.205 lb

Volume 1 L = 1.057 qt

1 in = 2.54 cm

1 lb = 453.5 g

Internal metric conversions like cm → mm, *etc.* and internal English conversions like oz → lb, *etc.*, you should memorize.

R = 0.08205 (L•atm/mol•K)

1 atm = 760. mm Hg

1 atm = 760. Torr

Periodic Table of the Elements

1A																				8A																									
1 H 1.00794	2A																													2 He 4.00260															
3 Li 6.941	4 Be 9.01218	← Atomic number ← Elemental symbol ← Atomic weight																			5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797																			
11 Na 22.98977	12 Mg 24.305	3B 4B 5B 6B 7B ← 8B → 1B 2B																			13 Al 26.98154	14 Si 28.0855	15 P 30.97376	16 S 32.066	17 Cl 35.4527	18 Ar 39.948																			
19 K 39.0983	20 Ca 40.0783	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.9332	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 93.80																												
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.9055	46 Pd 105.42	47 Ag 107.868	48 Cd 112.41	49 In 114.82	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.9045	54 Xe 131.29																												
55 Cs 132.9054	56 Ba 137.33	57 La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.207	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.966	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)																												
87 Fr (223)	88 Ra 226.0254	89 Ac (227)	104 Rf (261)	105 Ha (263)	106 Sg (263)	107 Nh (265)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Uu (277)																																		

58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.9253	66 Dy 162.50	67 Ho 164.9303	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.0359	92 U 238.029	93 Np 237.0482	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Electronegativity Table (Pauling scale)

1A																				8A																									
1 H 2.1	2A																													2 He															
3 Li 1.0	4 Be 1.5	← Atomic number ← Elemental symbol ← Electronegativity																			5 B 2.0	6 C 2.5	7 N 3.0	8 O 3.5	9 F 4.0	10 Ne																			
11 Na 0.9	12 Mg 1.2	3B 4B 5B 6B 7B ← 8B → 1B 2B																			13 Al 1.5	14 Si 1.8	15 P 2.1	16 S 2.5	17 Cl 3.0	18 Ar																			
19 K 0.8	20 Ca 1.0	21 Sc 1.3	22 Ti 1.5	23 V 1.6	24 Cr 1.6	25 Mn 1.5	26 Fe 1.8	27 Co 1.9	28 Ni 1.9	29 Cu 1.9	30 Zn 1.6	31 Ga 1.6	32 Ge 1.8	33 As 2.0	34 Se 2.4	35 Br 2.8	36 Kr																												
37 Rb 0.8	38 Sr 0.8	39 Y 0.8	40 Zr 0.8	41 Nb 0.8	42 Mo 0.8	43 Tc (0.8)	44 Ru 0.8	45 Rh 0.8	46 Pd 0.8	47 Ag 0.8	48 Cd 0.8	49 In 0.8	50 Sn 0.8	51 Sb 0.8	52 Te 0.8	53 I 2.5	54 Xe																												
55 Cs 0.7	56 Ba 0.7	57 La 0.7	72 Hf 0.7	73 Ta 0.7	74 W 0.7	75 Re 0.7	76 Os 0.7	77 Ir 0.7	78 Pt 0.7	79 Au 0.7	80 Hg 0.7	81 Tl 0.7	82 Pb 0.7	83 Bi 0.7	84 Po (0.7)	85 At 2.1	86 Rn																												
87 Fr (223)	88 Ra 226.0254	89 Ac (227)	104 Rf (261)	105 Ha (263)	106 Sg (263)	107 Nh (265)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Uu (277)																																		

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The electronegativity values for H, N, O, and F will be in black on the test.