

Gateway General Chemistry 125/126/130**Exam 1****October 3, 2006 (8:00-10:00pm)**

Name _____

Section (*circle one*): 601 (Colin) 602 (Brannon) 603 (Mali) 604 (Xiaomu)

The exam has a total of 8 pages including the cover and a periodic table which you may remove. You do not need to turn the periodic table in with your exam. Please neatly show all of your work.

Page	Questions	Possible points	Score
2	1-6	6	
3	7-8	3	
4	9-10	7	
5	11-12	9	
6	13	5	
7	14	10	

Total _____/40

Q1-6 (1 point each) Please place the correct letter/s in the box.

1) How many electrons can the third principal quantum level ($n = 3$) hold?

- a. 2
- b. 8
- c. 16
- d. 18
- e. 32

1)

2) Arrange the elements given in order from largest to smallest atomic radii.

Al Ca Sr Mg S

- a. $\text{Sr} > \text{Ca} > \text{Mg} > \text{Al} > \text{S}$
- b. $\text{Sr} > \text{Ca} > \text{S} > \text{Al} > \text{Mg}$
- c. $\text{Al} > \text{Sr} > \text{S} > \text{Ca} > \text{Mg}$
- d. $\text{Ca} > \text{Mg} > \text{Sr} > \text{Al} > \text{S}$
- e. $\text{Mg} > \text{Al} > \text{S} > \text{Ca} > \text{Sr}$

2)

3) Which of the following has the largest ionic radius?

- a. Li^+
- b. F^-
- c. S^{2-}
- d. Na^+
- e. Cl^-

3)

4) Which of the following is a correct electron configuration: What element does it represent?

- a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6$
- b) $1s^2 2s^2 2p^5 3s^2 3p^6$
- c) $1s^2 2s^2 2p^6 3s^2 3d^{10}$
- d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
- e) $1s^2 2s^2 2p^6 3s^2 3p^7 4s^1$

4)

5) In general, the periodic trend for this property increases as you go up the periodic table and from left to right across the periodic table. (Note, there may be more than one correct answer)

- a) density
- b) # of oxygen atoms the elements combine with
- c) Electronegativity
- d) Atomic weight
- e) Atomic radius
- f) Ionization energy

5)

6) Which statement/s about electrons is false?

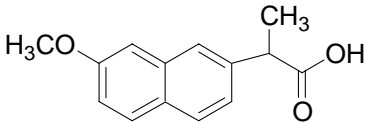
- a. Electrons have the same charge as alpha particles.
- b. Electrons are attracted to positively charged electrodes.
- c. Electrons have the same mass as neutrons.
- d. Electrons have much less mass than any atom.
- e. Electrons are negatively charged.

6)

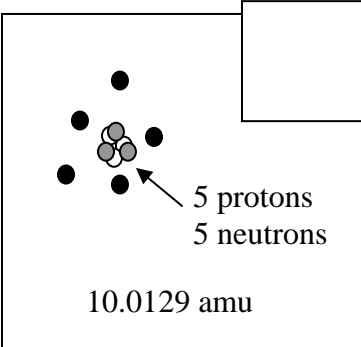
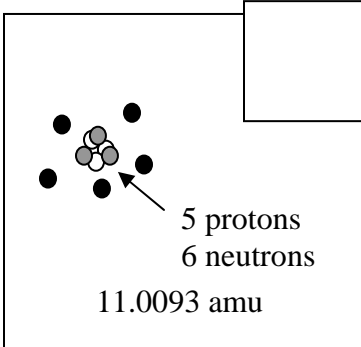
7) (1 point) Rutherford estimated the nucleus of an atom to be $1/10000$ of the size of the entire atom. The box that you used to model Rutherford's experiment in lecture was 8 inches by 6 inches by 4 inches. If the box were an atom, what would the volume of its nucleus be in mm^3 ? (1 inch = 2.54 cm)

	Volume of nucleus:
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8) (2 points) A tablet of Aleve contains 200 mg of its active ingredient naproxen. How many molecules of naproxen are in each Aleve tablet? Fill in the two empty boxes in the table.

	Aleve (naproxen) 
Molecular formula	$\text{C}_{14}\text{H}_{14}\text{O}_3$
Dose	200. mg
Molecular weight	
Number of molecules in dose:	

9a) (5 points) The following model is missing some information. Fill in the empty boxes in the upper right of each model with its elemental symbol, atomic number, and mass number: $\begin{matrix} A \\ Z \\ X \end{matrix}$

		<p>b) What word is used to describe the relationship between the two atoms represented in the models on the left.</p>
<p>Relative abundance:</p>	<p>Relative abundance:</p>	

c) Using the periodic table, find the relative abundance of each atom. Show your work below and fill in the abundances in the boxes above.

10) (2 points) Using the correct number of protons, neutrons, and electrons, draw beryllium atom (Be) as it would appear using the chocolate chip cookie model (the plum pudding model), and according to a modern model of the atom.

13) (5 points) In the middle column, write one of the symbols: <, > or =. (In order to receive credit for your answer, all estimation and work must be shown.)

<p>The density of Amalthea The Galileo spacecraft obtained the following data on Amalthea, one of Jupiter's moons, on the 5th of November 2002: a mass of 2.08×10^{18} kilograms and in 1996 and 19997: a volume of 2.43×10^6 cubic kilometers.</p>		<p>The density of water (1 g/cm^3)</p>
<p>The number of significant figures in the completed calculation: $12.567 - (9.04/3.7345)$</p>		<p>The number of significant figures in the completed calculation: $(10.0 * 7.64) + 0.0345$</p>
<p>The number of atoms in 1 mole of hydrogen gas</p>		<p>The number of atoms in 8.12 g of lithium metal</p>
<p>The bond order of the nitrogen-nitrogen bond in N_2</p>		<p>The bond order of the carbon nitrogen bond in CN^-</p>
<p>The number of water molecules in a 100.0 g apple that is 85% water.</p>		<p>The number of sugar molecules in a 100.0 g apple that is 15% sugar ($\text{C}_6\text{H}_{12}\text{O}_6$)</p>

14) (10 points) BrO_3F_2^- has recently been synthesized by reacting BrO_3F with NOF . (*J. Am. Chem. Soc.* **2005**,127, 9416-9427.)

a) Draw the Lewis structures for F-N-O and N-O-F. Include formal charges. Which is the more probably structure for a molecule with this formula? Why?

b) Would you be able to distinguish the molecules from their shape? Explain.

B) For BrO_3F : a) count the number of valence electrons; b) draw the Lewis Structure including any formal charges; c) draw out the shape of the molecule according to VSEPR; d) name the electron pair geometry, and e) name the molecular geometry.

Valence electrons:

Lewis structure	VSEPR shape
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electron pair geometry:	molecular geometry:
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PERIODIC CHART OF THE ELEMENTS

1	¹ H 1.00794											² He 4.00260	
2	³ Li 6.941	⁴ Be 9.01218											⁹ F 18.998403
3	¹¹ Na 22.98977	¹² Mg 24.305											¹⁷ Cl 35.453
4	¹⁹ K 39.0983	²⁰ Ca 40.08	²¹ Sc 44.9559	²² Ti 47.88	²³ V 50.9415	²⁴ Cr 51.996	²⁵ Mn 54.9380	²⁶ Fe 55.847	²⁷ Co 58.9332	²⁸ Ni 58.69	²⁹ Cu 63.546	³⁰ Zn 65.38	³⁵ Br 79.904
5	³⁷ Rb 85.4678	³⁸ Sr 87.62	³⁹ Y 88.9059	⁴⁰ Zr 91.22	⁴¹ Nb 92.9064	⁴² Mo 95.94	⁴³ Tc (98)	⁴⁴ Ru 101.07	⁴⁵ Rh 102.9055	⁴⁶ Pd 106.42	⁴⁷ Ag 107.8682	⁴⁸ Cd 112.41	⁵³ I 126.9045
6	⁵⁵ Cs 132.9054	⁵⁶ Ba 137.33	⁵⁷ La 138.9055	⁵⁸⁻⁷¹ LANTHANIDES	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 196.9665	⁸⁰ Hg 200.59
7	⁸⁷ Fr (223)	⁸⁸ Ra 226.0254	⁸⁹ Ac 227.0278	⁹⁰⁻¹⁰³ ACTINIDES	¹⁰⁴ Rf (261)	¹⁰⁵ Db (262)	¹⁰⁶ Sg (263)	¹⁰⁷ Bh	¹⁰⁸ Hs	¹⁰⁹ Mt	¹¹⁰	¹¹¹	¹¹²
			LANTHANIDE SERIES	⁵⁸ Ce 140.12	⁵⁹ Pr 140.9077	⁶⁰ Nd 144.24	⁶¹ Pm (145)	⁶² Sm 150.36	⁶³ Eu 151.96	⁶⁴ Gd 158.9254	⁶⁵ Tb 158.9	⁶⁶ Dy 162.50	⁶⁷ Ho 164.9304
			ACTINIDE SERIES	⁹⁰ Th 232.0381	⁹¹ Pa 231.0359	⁹² U 238.0289	⁹³ Np 237.0442	⁹⁴ Pu (244)	⁹⁵ Am (243)	⁹⁶ Cm (247)	⁹⁷ Bk (247)	⁹⁸ Cf (251)	⁹⁹ Es (252)
				⁶⁸ Er 167.26	⁶⁹ Tm 168.9342	⁷⁰ Yb 173.04	⁷¹ Lu 174.967	¹⁰⁰ Fm (257)	¹⁰¹ Md (258)	¹⁰² No (259)	¹⁰³ Lr (260)	⁸¹ Tl 204.383	⁸² Pb 207.2
				⁸³ Bi 208.9804	⁸⁴ Po (209)	⁸⁵ At (210)	⁸⁶ Rn (222)						