Exam 3 Chm 203 (Dr Mattson) 31 October 2014

Academic Integrity Pledge: *In keeping with Creighton University's ideals and with the Academic Integrity Code, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.*

Signature:

Name:

Circle your Folder group:

H He Li Be B C N O F Ne Na Mg Al Si P

Instructions: Show all work whenever a calculation box is provided! Write legibly. Include units whenever appropriate. You will receive credit for **how** you worked each problem as well as for the correct answer. If you need more space, you may use the back of the periodic table provided — Write: "See PT" in the answer box and then hand the periodic table in with your exam. On your desk you are allowed only pencils (but no pencil pouch), an eraser, and a non-programmable calculator without a slipcover. Backpacks and purses must be closed and stored on the floor under the table. Cell phones must be OFF and placed in your backpack/purse – not in your pocket. When you re done, hand in your exam and periodic table and you are free to go. May you do well!

$c = \lambda\upsilon$ $\quad \Delta E_{per\ photon} = hc/\lambda$ $\quad c = 3 \times 10^{8}\ m/s$

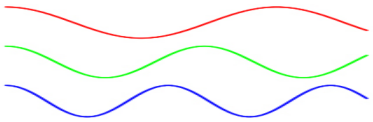
$\Delta E_{per\ mol\ photon} = \Delta E_{per\ photon} \times N_A$

$E = -2.178 \times 10^{-18} J(1/n^2)$

$\Delta E = E_f - E_i = -2.178 \times 10^{-18} J(1/n_f^2 - 1/n_i^2)$

$1/\lambda = 1.097 \times 10^{-2}\ nm^{-1}(1/n_f^2 - 1/n_i^2)$

$h = 6.626 \times 10^{-34}\ J\ s$ $\quad N_A = 6.023 \times 10^{23}\ mol^{-1}$



1a. (1 pt) Suppose the green wave in the figure above (middle) has a wavelength of 650 nm. Which of these is the best estimate of the wavelengths of the red (top) and blue (bottom) waves?

A. Red: 550 nm; Blue: 920 nm

B. Red: 920 nm; Blue: 550 nm

C. Red: 1030 nm; Blue: 850 nm

D. Red: 320 nm; Blue: 550 nm

1b. (4 pts) What is the frequency of the green wave?

Answer with units:_____

1c. (5 pts) What the corresponding energy in **kJ/mol** of the green wave?

Answer with units:_____

1d. (1 pt) Which wave has the largest frequency?

A. Red wave B. Green wave C. Blue wave

1e. (1 pt) Which wave corresponds to the largest energy?

A. Red wave B. Green wave C. Blue wave

2. (4 pts) What is the longest wavelength line **in nm** in the hydrogen spectrum for the series in which $n_f = 3$?

Answer:_____

3. (14 pts; 1 pt each, except as noted) Consider atomic sulfur in the ground state to answer all parts of this question.

3a. (2 pts) What is the ground state electron configuration for sulfur? Do NOT use core notation this time.

3b. What are the values of n and l = for the partially filled orbitals in a ground state sulfur atom?

A. $n = 4$ and $l = 1$ B. $n = 3$ and $l = 1$

C. $n = 3$ and $l = 2$ D. $n = 4$ and $l = 2$

3c. How many unpaired electron are present in a ground state sulfur atom?

0 1 2 3 4 5 6 7 8 9 10 Other

3d. How many orbitals for a ground state sulfur atom are (a) filled and (b) have $n = 2$?

0 1 2 3 4 5 6 7 8 9 10 Other

3e. How many orbitals for a ground state sulfur atom are (a) filled and (b) have $n = 2$ and $l = 1$?

0 1 2 3 4 5 6 7 8 9 10 Other

3f. How many electrons for a ground state sulfur atom have $n = 2$?

0 1 2 3 4 5 6 7 8 9 10 Other

3g. How many electrons for a ground state sulfur atom have $n = 2$, $l = 1$ and $m_l = 0$?

0 1 2 3 4 5 6 7 8 9 10 Other

3h. How many electrons for a ground state sulfur atom have $n = 2$, $l = 2$ and $m_l = 1$?

0 1 2 3 4 5 6 7 8 9 10 Other

3i. How many electrons for a ground state sulfur atom have $n = 2$, $l = 1$, $m_l = 1$ and $m_s = +½$?

0 1 2 3 4 5 6 7 8 9 10 Other

3j. How many electrons for a ground state sulfur atom have $l = 0$?

0 1 2 3 4 5 6 7 8 9 10 Other

3k. What transition occurs when an electron is removed from a ground state sulfur atom?

A. $n = 3$ to $n = 1$ B. $n = 1$ to $n = 3$

C. $n = 3$ and $n = 0$ D. $n = 3$ and $n = \infty$

3l. (2 pts) Using core notation, write an electron configuration for an excited state for sulfur, limiting yourself to one excited electron.

4. (4 pts) Which of these groups correctly shows the order of orbital filling according to the aufbau principle? (May be more than one correct answer.)

A. 4s 3d 4p B. 4d 5s 5p

C. 2p 3s 3p D. 4p 5s 4d

Important! Questions 5 – 10 each have four answers.

5. (4 pts) Which orbital in each grouping is highest in energy?

A. 2p 3p 4p B. 4s 3d 3p

C. 6s 4d 2s D. 5p 5d 5f

6. (4 pts) In each set of three elements, circle the member with the largest effective nuclear charge.

A. Co Ni Cu B. Be B C

C. Kr Rb Sr D. K Ca Sc

7. (4 pts) In each set of three elements, circle the member with the largest atomic radius.

A. Co Ni Cu B. Ni Pd Pt

C. As S Cl D. K Ca Rb

8. (4 pts) In each set of three elements, circle the member with the smallest first ionization energy.

A. Sc Ti V B. As Se Br

C. Mg Ca Sr D. Ga Si C

9. (4 pts) In each set of three elements, circle the member with the largest electron affinity.

A. Co Ni Cu B. Sr Cd In

C. Se Br Kr D. K Ca Sc

10. (4 pts) In each set of three elements, circle the member with the smallest radius.

A. F F^+ F^- B. Mn^{+2} Mn^{+3} Mn^{+4}

C. N^{3-} O^{2-} F^- D. Mg^{+2} Ca^{+2} Sr^{+2}

11. (8 pts) Without using core notation, write the electron configurations for these ions.

11a. N^{3-}
11b. Ca^{2+}
11c. Mn^{2+}
11d. Cr^{3+}

12. (4 pts) Considering the Period 3 elements, circle the member with the largest ____ ionization energy.

A.first: Na Mg Al Si P S Cl Ar

B.second: Na Mg Al Si P S Cl Ar

C.fourth: Na Mg Al Si P S Cl Ar

D.sixth: Na Mg Al Si P S Cl Ar

Note: If you are Nomenclature Certified you may stop.

13. (5 pts) Provide formulas for these substances.

sodium nitride
silicon tetrachloride
ammonium bromite
phosphoric acid
chromium(III) oxide

14. (5 pts) Circle the correct name for each of these.

A. K_3PO_4

potassium phosphate tripotassium phosphate

potassium phosphide tripotassium phosphite

B. $NaClO_3$

sodium chlorate sodium chlorite

sodium perchlorite sodium hypochlorate

C. HIO_4

iodic acid iodous acid

hydrogen iodate periodic acid

D. As_2S_3

arsenic trisulfide diarsenic trisulfide

arsenic acid arsenic trisulfate

E. $(NH_4)_2SO_3$

ammonium sulfide diammonium sulfate

ammonium sulfate ammonium sulfite

Subtotal from exam: _____

Folder work: (20 max) _____

Total: _____

Answers

1a. B

1b. 4.62 x 10^{+14} s^{-1}

1c. 184 kJ/mol

1d. C

1e. C

2. 1875 nm

3a. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

3b. B

3c. 2

3d. 4

3e. 3

3f. 8

3g. 2

3h. 0

3i. 1

3j. 6

3k. D

3l. Any reasonable configuration based on the ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ but with one electron in an higher energy orbital such as $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ 4s^1$

4. A, C, and D

5. A. 4p	B. 3d	C. 6s	D. 5f
6. A. Cu	B. C	C. Kr	D. Sc
7. A. Co	B. Pt	C. As	D. Rb
8. A. Sc	B. As	C. Sr	D. Ga
9. A. Cu	B. In	C. Br	D. Sc
10. A. F^+	B. Mn^{+4}	C. F^-	D. Mg^{+2}

11a. N^{3-} $1s^2\ 2s^2\ 2p^6$

11b. Ca^{2+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

11c. Mn^{2+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3p^5$

11d. Cr^{3+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^0\ 3p^3$

12. A. Ar	B. Na	C. Al	D. P	
13. Na_3N;	$SiCl_4$;	;	NH_4BrO_2;	H_3PO_4; Cr_2O_3

14. (5 pts) Circle the correct name for each of these.

A potassium phosphate

B. sodium chlorate

C. periodic acid

D. diarsenic trisulfide

E. ammonium sulfite