

**EXAM THREE  
CHM 203 (Dr. Mattson)  
15 OCTOBER 2010**

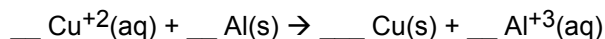
*Print your name:*

*Signature:*

**Instructions:** Show all work whenever a calculation is required! 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 your periodic table — Write: "See PT" in box and then attach the periodic table. **BOX YOUR ANSWERS!** Write legibly.

1. In an experiment, aluminum foil, Al(s), is placed in a container with 440 mL 0.224 M CuCl<sub>2</sub>(aq). The reaction continues until all of the blue color of Cu<sup>+2</sup> is gone. Some aluminum remains.

1a. (2 pts) The reaction produces copper metal, Cu(s), and Al<sup>+3</sup>(aq). Balance the net ionic reaction:



1b. (1 pt) What was oxidized?

- A. Cu<sup>+2</sup>(aq)                      B. Al(s)  
C. Al<sup>+3</sup>(aq)                      D. Cu(s)

1c. (1 pt) What was reduced?

- A. Cu<sup>+2</sup>(aq)                      B. Al(s)  
C. Al<sup>+3</sup>(aq)                      D. Cu(s)

1d. (1 pt) What was the oxidizing agent?

- A. Cu<sup>+2</sup>(aq)                      B. Al(s)  
C. Al<sup>+3</sup>(aq)                      D. Cu(s)

1f. (4 pts) How many moles of copper metal were produced?

1g. (1 pt) What was the limiting reagent?

- A. Cu<sup>+2</sup>(aq)                      B. Al(s)  
C. Al<sup>+3</sup>(aq)                      D. Cu(s)

1h. (3 pts) What mass of Al(s) was consumed?

2. (4 pts) In a certain chemical reaction that emits light as a form of energy, the wavelength of 509 nm is observed. Convert this energy to kJ/mol.

3. (3 pts) In the Brackett series, electrons drop in energy from  $n > 4$  to  $n = 4$ . Calculate the wavelength of an electron transition from  $n = 7 \rightarrow n = 4$ .

4. (3 pts) If  $n = 3$ , which of the following values for  $l$  are allowed? Circle all that are allowed.

- A.  $l = 2$     B.  $l = -2$     C.  $l = 3$     D.  $l = 0$

5. (3 pts) If  $l = 2$ , which of the following values for  $m_l$  are allowed? Circle all that are allowed.

- A.  $m_l = 3$     B.  $m_l = -3$     C.  $m_l = 0$     D.  $m_l = 2$

6. (5 pts) What type of orbital is described from the following combination of quantum numbers? The first one is done for you.

	$n$	$l$	$m_l$	Answer:
(a)	2	1	-1	2p
(b)	4	0	0	
(c)	5	2	2	
(d)	1	0	0	
(e)	5	3	-1	
(f)	3	1	0	

7. (4 pts) Which orbital from each pair is lower in energy?

(a) 4s or 3p	(b) 3d or 4d
(c) 3d or 3p	(d) 3d or 4p

8. (5 pts) What is the largest atomic number for an atom that has a ground-state electron in the following orbitals? The first one is one as an example.

(a) 2s	4	(b) 3p
(c) 4d		(d) 7s
(e) 6p		(f) $n = 4, l = 1$

9. (5 pts) What atom is identified by each of these electron configurations?

(a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
(b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$
(c) $[\text{Ar}] 4s^2 3d^{10} 4p^1$
(d) $[\text{Kr}] 5s^2 4d^5$
(e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$

10. (4 pts) Which member of each group has the largest atomic radius?

(a) Na K Rb	(b) B C N
(c) Sc Zn Kr	(d) Z = 9 10 11

Z = atomic number

11. (4 pts) Which member of each group has the smallest first ionization energy?

(a) Na K Rb	(b) B C N
(c) Sc Zn Kr	(d) Z = 9 10 11

12. (4 pts) Which member of each group has the smallest effective nuclear charge?

(a) O F Ne	(b) B C N
(c) Sc Zn Kr	(d) Z = 29 30 31

13. (4 pts) Which member of each group has the largest electron affinity?

(a) O F Ne	(b) Sc Ti V
(c) K Ca Sc	(d) Z = 29 30 31

14. (3 pts) Write electron configurations for the following ions. You may use core notation.

(a) $\text{Ca}^{+2}$
(b) $\text{Mn}^{+2}$
(b) $\text{Se}^{2-}$

15. (4 pts) Circle the largest member of each pair.

(a) Na $\text{Na}^+$	(b) F $\text{F}^-$
(c) Sc $\text{Sc}^{+3}$	(d) P $\text{P}^{-3}$

16. (2 pts) Are combustion reactions also oxidation-reduction reactions? YES or NO

17. (10 pts) Nomenclature. Name the following ionic compounds. Print!

a. $\text{NH}_4\text{NO}_2$
b. $\text{NaHCO}_3$
c. $\text{K}_2\text{SO}_4$
d. $\text{Ag}_2\text{SO}_4$
e. $\text{Pb}(\text{SO}_4)_2$
f. $\text{LiNO}_3$
g. $\text{KClO}_2$
h. $\text{Mg}(\text{BrO}_2)_2$
i. $\text{Al}_2\text{S}_3$
j. $\text{CuBr}_2$

Print your name below:

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For DocM to complete:

Subtotal from exam: \_\_\_\_\_

Homework: (20 max) \_\_\_\_\_

Total: \_\_\_\_\_

Determine your grade:

A+  $\geq 95$ ; A  $\geq 90$ ; B+  $\geq 85$ ; B  $\geq 80$ ; C+  $\geq 75$ ; C  $\geq 70$ ; D  $\geq 60$

## Answers:



1b. B. Al(s)

1c. A.  $\text{Cu}^{2+}(\text{aq})$

1d. A.  $\text{Cu}^{2+}(\text{aq})$

1f. 0.0986 mol Cu(s)

1g. A.  $\text{Cu}^{2+}(\text{aq})$

1h. 1.77 gAl(s)

2. 235 kJ/mol

3. 2166 nm

4. A and D

5. C and D

6. (b) 4s; (c) 5d; (d) 1s; (e) 5f; (f) 3p

7. (a) 3p; (b) 3d; (c) 3p; (d) 3d

8. (b) 18; (c) 48; (d) 88; (e) 86; (f) 36

9. (a) Ca; (b) Cr; (c) Ga; (d) Tc; (e) Ga

10. (a) Rb; (b) B; (c) Sc; (d) Z = 11

11. (a) Rb; (b) B; (c) Sc; (d) Z = 11

12. (a) O; (b) B; (c) Sc; (d) Z = 29

13. (a) F; (b) V; (c) Sc; (d) Z = 31

14. (a) [Ar]; (b) [Ar]  $4s^0 3d^5$ ; [Kr]

15. (a) Na; (b)  $\text{F}^-$ ; (c) Sc; (d)  $\text{P}^{3-}$

16. YES

17. (a) ammonium nitrite; (b) sodium bicarbonate (or sodium hydrogen carbonate); (c) potassium sulfate; (d) silver(I) sulfate; (e) lead(IV) sulfate; (f) lithium nitrate; (g) potassium chlorite; (h) magnesium bromite; (i) aluminum sulfide; (j) copper(II) bromide