Exam 2 Chm 203 (Dr Mattson) 11 October 2012

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:

Instructions: Show all work whenever a calculation is required! Write legibly. Include units whenever appropriate. BOX YOUR ANSWERS! You will receive credit for <u>how</u> 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 the answer box and then attach the periodic table. At 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 stored in the front of the room. Cell phones must be OFF and placed at the front of the room.

1. (5 pts) Which of these ions are always soluble? Circle all that apply.

A. acetates B. sulfides C. hydroxide

- D. bromides E. perchlorates
- 2. (5 pts) Which of these ions forms salts that are *generally* insoluble? Circle all that apply.
 - A. nitrates B. sulfates C. carbonates
 - D. ammonium E. chlorides
- 3. (6 pts) Classify the following reactions as acid-base (AB), precipitation (P), oxidation-reduction (OR) or no reaction (NR).

AgNO ₃ (aq) + NH ₄ Cl(aq) →	AB	Ρ	OR	NR
HNO ₃ (aq) + KOH(aq) →	AB	Ρ	OR	NR
$Ba(NO_3)_2(aq) + Na_2SO_4(aq) →$	AB	Ρ	OR	NR
HC ₂ H ₃ O ₂ (aq) + NaOH(aq) →	AB	Ρ	OR	NR
$CuSO_4(aq) + Mg(s) \rightarrow$	AB	Ρ	OR	NR
Cu(s) + MgSO ₄ (aq)				
$FeSO_4(aq) + NaNO_3(aq) \rightarrow$	AB	Ρ	OR	NR
CuCl(aq) + CoCl ₃ (aq) →	AB	Ρ	OR	NR
CuCl ₂ (aq) + CoCl ₂ (aq)				

4. We saw, as a demonstration, the reaction between aqueous copper(II) chloride and aluminum foil.



- 4a. (2 pts) Sketch the aqueous copper(II) chloride solution in the beaker at right.
- 4b. (2 pts) Write and balance the overall reaction in the box below.

4c. (2 pts) Write the balanced net ionic reaction.

5. (5 pts) Which of these solutions form strong electrolytes when dissolved in water? Circle all that apply.

A.
$$KC_2H_3O_2$$
 B. $HC_2H_3O_2$ C. C_2H_5OH
D. $HCIO_2$ E. H_2SO_4

6. (2 pts) Write the net ionic reaction that takes place between nitric acid and potassium hydroxide.



7. (4 pts) Assign oxidation numbers to the vanadium in each of these compounds.

A. V ₂ O ₅	B. VCI ₃
C. K ₄ VCl ₆	D. (NH ₄) ₂ VO ₃

8. (3 pts) Balance the reaction below under acidic conditions.



9. (3 pts) Consider the balanced reaction below which takes place in aqueous solution. What volume of 0.5367 M H_3 AsO₃ is required for complete reaction with 20.00 mL of 0.2119 M KIO₄ solution?

$4 H_3AsO_3 + IO_4^- \rightarrow I^- + 4 H_3AsO_4$

Formula:	Name:	
Ag ₂ SO ₄		
HF		
HCIO ₄		
Cl ₂ O ₅		
HNO ₃		
	sodium chlorite	
	sulfuric acid	
	chlorous acid	
	vanadium(IV) phosphide	
	ammonia	

10. (10 pts) Nomenclature. Complete the table. (Skip this question if you are nomenclature certified.)

- 11. (4 pts) In each case, circle the value with the larger energy.
 - A. $\lambda = 1.3 \times 10^{-6} \text{ m}$ or $\lambda = 130 \text{ nm}$

B.
$$v = 6.3 \times 10^{12} \text{ s}^{-1}$$
 or $v = 6.3 \times 10^{13} \text{ s}^{-1}$

- C. E = 1.7×10^{-19} J or E = 1.7×10^{-18} J
- D. $\lambda = 1 \times 10^{-9}$ m or $v = 3.0 \times 10^{15}$ s⁻¹
- 12. In class, we used the hydrogen discharge tube to show the Balmer series. Through the view glasses/viewers we saw the following four bands: λ = 656 nm, 486 nm, 434 nm, 410 nm, all of which are in the visible region of the electromagnetic spectrum.

12a. (1 pt) These lines represent:

- A. an absorption of energy B. an emission of energy
- 12b. (1 pt) The colors of these lines include red, green, blue and violet. Which wavelength is the violet one?

 λ = 656 nm, 486 nm, 434 nm, 410 nm

- 12c. (1 pt) These lines correspond to the electron transitions: $n = 3 \rightarrow n = 2$, $n = 4 \rightarrow n = 2$, $n = 5 \rightarrow n = 2$, and $n = 6 \rightarrow n = 2$. Which wavelength corresponds to $n = 4 \rightarrow n = 2$?
 - λ = 656 nm, 486 nm, 434 nm, 410 nm

12d. (4 pts) Convert λ = 434 nm to units of kJ/mol.

12e. (1 pt) The transition n = 4 → n = 3, is not in the visible region of the electromagnetic spectrum. It is in one of these two, however. Hint: think about the energy diagram. Circle your choice:

A. infrared B. ultraviolet

13. (4 pts) Which member of each pair has the higher energy in a polyelectronic atom? If the two have the same energy, circle "Same"

4s	Same
n = 2, l = 1	Same
$n = 4, I = 1, m_I = 0$	Same
4f	Same
	4s n = 2, l = 1 n = 4, l = 1, m _l = 0 4f

14. (5 pts) What is the: (Note: Do NOT list range of values)

A. maximum value for I, if n = 6?

B. maximum value for m_I , if I = 2?

C. maximum value for m_l , if n = 4?

- D. minimum value for n, if I = 3?
- E. minimum value for I, if $m_I = 2?$
- 15. (2 pts) Write the electron configuration for a ground state selenium atom. You may use the "core notation" if you wish.

16. (5 pts) Use the periodic table to complete these series of orbitals, arranging them in the order in which they are filled in a neutral atom.

	filled before		fills after
Α.		3р	
В.		4d	
C.		5s	
D.		4f	

17. (2 pts) What two elements have 2 unpaired electrons in the n = 4, I = 2 orbitals? Assume the ground state.

18. (1 pt) How many electrons in a ground state zinc atom have n = 3?

19. (1 pts) How many orbitals are possible with n = 5 and I = 3?

20. (1 pt) What is the atomic number of the element that would be placed below francium, Fr, on the periodic table?

For DocM to complete:

Subtotal from exam:

Folder work: (20 max)

Total:

Answers:

1. A, E

2. C

3. P, AB, P, AB, OR, NR, OR

- 4. We saw, as a demonstration, the reaction between aqueous copper(II) chloride and aluminum foil.
- 4a. Picture should show one Cu⁺² ion for every two Cl[−] ions.

4b. 3 $CuCl_2(aq)$ + 2 $Al(s) \rightarrow$ 3 Cu(s) + 2 $AlCl_3(aq)$

4c. 3 Cu⁺²(aq) + 2 Al(s) → 3 Cu(s) + 2 Al⁺³(aq) 5. A, E

6. $H^+(aq) + OH^-(aq) \rightarrow H_2O(I)$ or

 $H_3O^+(aq) + OH^-(aq) \rightarrow 2 H_2O(I)$

8. All aqueous: 10 CrO_4^{2-} + 3 Br_2 + 44 $\text{H}^+ \rightarrow$

 $10 \text{ Cr}^{3+} + 6 \text{ BrO}_3^- + 22 \text{ H}_2\text{O}$

9. 31.59 mL H₃AsO₃

10.

Formula:	Name:
Ag ₂ SO ₄	silver(I) sulfate
HF	hydrogen fluoride
HCIO ₄	perchloric acid
Cl ₂ O ₅	dichlorine pentoxide
HNO ₃	nitric acid
NaClO ₂	sodium chlorite
H ₂ SO ₄	sulfuric acid
HCIO ₂	chlorous acid
V ₃ P ₄	vanadium(IV) phosphide
NH ₃	ammonia

11. A. λ = 130 nm

B. $v = 6.3 \times 10^{13} \text{ s}^{-1}$

C. E = $1.7 \times 10^{-18} \text{ J}$

D.
$$\lambda = 1 \times 10^{-9} \text{ m}$$

12a. B

- 12b. 410 nm
- 12c. 486 nm
- 12d. 276 kJ/mol.

12e. A

13. A. 4s

B. n = 2, l = 1

C. Same

D. 4f

14. 5, 2, 3, 4, 2

15. [Ar] 4s² 3d¹⁰ 4p⁴

16.

	filled before		fills after
Α.	3s	Зр	4s
В.	5s	4d	5р
С.	4р	5s	4d
D.	6s	4f	5d

17. Zr and Pd

18. 18

19.7

20. 119