

CHEM 101-080 Fall 2004
Problem-Solving Session 2
September 27, 2004

1. Give the location and examples of elements for each family. (Sec. 4-3, 4-4)

Family	Location	Example elements
Group 1		
Alkali metals	Group IA	Li, Na, K
Alkaline earth metals	Group IIA	Be, Mg, Ca
Group 2		
Halogens	Group VIIA	F, Cl, Br, I
Chalcogens	Group VIA - except oxygen	S, Se, Te
Group 3		
Lanthanides	Second-last row (at bottom)	Ce, Pr, Nd
Actinides	Last row (at bottom)	Th, U, Pu
Group 4		
Transition metals	Groups IB - VIII B	Ti, Fe, Cu, Ag, Au, Pt
Metalloids	Adjacent to the zig-zag line separating transition metals from nonmetals	Si, Ge, As, Sb
Group 5		
Noble gases	Group VIIIA	He, Ne, Ar, Kr
Semimetals	Same as metalloids	Same as metalloids

2. Name each anion and write the formula of each corresponding acid. (Sec. 4-8)

Anion	Name of anion	Name of Acid	Formula of Acid
Group 1			
NO_3^-	Nitrate	Nitric	HNO_3
SO_4^{2-}	Sulfate	Sulfuric	H_2SO_4
I^-	Iodide	Hydroiodic	HI
Cl^-	Chloride	Hydrochloric	HCl
Group 2			
PO_4^{3-}	Phosphate	Phosphoric	H_3PO_4
NO_2^-	Nitrite	Nitrous	HNO_2
BO_3^{2-}	Borate	Boric	H_2BO_3
F^-	Fluoride	Hydrofluoric	HF
Group 3			
ClO_4^-	Perchlorate	Perchloric	HClO_4
ClO_3^-	Chlorate	Chloric	HClO_3
$\text{C}_2\text{O}_4^{2-}$	Oxalate	Oxalic	$\text{H}_2\text{C}_2\text{O}_4$
Br^-	Bromide	Hydrobromic	HBr
Group 4			
$\text{C}_2\text{H}_3\text{O}_2^-$	Acetate	Acetic	$\text{HC}_2\text{H}_3\text{O}_2$
MnO_4^-	Permanganate	Permanganic	HMnO_4
$\text{Cr}_2\text{O}_7^{2-}$	Dichromate	Dichromic	$\text{H}_2\text{Cr}_2\text{O}_7$
Group 5			
CO_3^{2-}	Carbonate	Carbonic	H_2CO_3
S^{2-}	Sulfide	Hydrosulfuric	H_2S
SO_3^{2-}	Sulfite	Sulfurous	H_2SO_3

3. Name the following compounds using the Stock method where appropriate. (Sec. 4-5)

Compound	Name
Group 1	
CrSO ₄	Chromium (II) sulfate
Al ₂ (SO ₃) ₃	Aluminum sulfite
Group 2	
Fe(CN) ₂	Iron (II) cyanide
(NH ₄) ₂ CO ₃	Ammonium carbonate
Group 3	
RbHCO ₃	Rubidium bicarbonate
NH ₄ NO ₃	Ammonium nitrate
Group 4	
Bi(OH) ₃	Bismuth hydroxide
FeSO ₄	Iron (II) sulfate
Group 5	
FeCl ₃	Iron (III) chloride
Mn(ClO ₄) ₂	Manganese (II) perchlorate

4. Name the following compounds using the Stock method where appropriate. (Sec. 4-5)

Compound	Name
Group 1	
NaCl	Sodium chloride
Na ₂ SO ₄	Sodium sulfate
Mg ₂ C ₂ O ₄	Magnesium oxalate
FeC ₂ O ₄	Iron (II) oxalate
Group 2	
KI	Potassium iodide
Cs ₂ CO ₃	Cesium carbonate
MnCO ₃	Manganese (II) carbonate
NiCl ₂	Nickel (II) chloride
Group 3	
HgCrO ₄	Mercury (II) chromate
Hg ₂ CrO ₄	Mercury (I) chromate
CaCrO ₄	Calcium chromate
MoCl ₄	Molybdenum (IV) chloride
Group 4	
K ₂ CO ₃	Potassium carbonate
AlN	Aluminum nitride
TiN	Titanium nitride
RhCl ₃	Rhodium (III) chloride
Group 5	
TiS ₂	Titanium (IV) sulfide
TiS	Titanium (II) sulfide
ZnSe	Zinc selenide
ZrI ₄	Zirconium (IV) iodide

5. Write formulas for the following compounds. (Sec. 4-5)

Compound	Name
Group 1	
Zirconium dibromide	ZrBr ₂
Zirconium (IV) bromide	ZrBr ₄
Iron (II) iodide	FeI ₂
Bismuth (II) sulfide	BiS
Group 2	
Cobalt (II) chloride	CoCl ₂
Copper (II) bromide	CuBr ₂
Cobalt (III) acetate	Co(C ₂ H ₃ O ₂) ₃
Calcium oxide	CaO
Group 3	
Calcium sulfate	CaSO ₄
Iron (II) acetate	Fe(C ₂ H ₃ O ₂) ₂
Iron (II) sulfite	FeSO ₃
Magnesium selenide	MgSe
Group 4	
Palladium (II) chloride	PdCl ₂
Potassium bromate	KBrO ₃
Potassium carbonate	K ₂ CO ₃
Ruthenium (V) fluoride	RuF ₅
Group 5	
Tin (II) oxide	SnO
Tin (IV) sulfide	SnS ₂
Sodium sulfate	Na ₂ SO ₄
Sodium nitrite	NaNO ₂

6. Chapter 5 HW

Problem	Answer	Problem	Answer
Group 1		Group 4	
5-4	Excited state: can emit light by moving back to the second energy level (i.e. orbital)	5-68	(a) Tl (b) Y (c) Ce (d) As
5-25	(a) 5p (b) 6s (c) 5s (d) 4d (e) 4f (f) 3d		
Group 2		Group 5	
5-35 see orbital diagrams on classroom whiteboard	(a) As: [Ar] 4s ² 3d ¹⁰ 4p ³ (b) Ar: [Ar] (c) Tc: [Kr] 5s ² 4d ⁵ (d) Tl: [Xe] 6s ² 4f ¹⁴ 4d ¹⁰ 6p ¹	5-74	Ga ⁺ : 578.8 kJ/mol Ga ²⁺ : 2557.8 Ga ³⁺ : 5520.8 Ga ⁴⁺ : 11,720.8 (Ga ³⁺ has [Ar] cfg.)
Group 3		Group 6	
5-47	(a) N, (b) Zr, (c) Kr, (d) Ac, (e) Tl, (f) Zn	5-76	Aluminum

7. Ch. 5 - For each ion, write the electron configuration using the noble gas core notation. Write also the formula and name of the compound formed by each pair of ions. Explain the pattern that develops in the electron configuration of these common ions.

Ion	Electron Configuration	Formula & Name
Group 1		
Se ²⁻	[Kr]	Cs ₂ Se - Cesium Selenide
Cs ⁺	[Xe]	
Group 2		
Br ⁻	[Kr]	LiBr - Lithium Bromide
Li ⁺	[He]	
Group 3		
O ²⁻	[Ne]	CaO - Calcium Oxide
Ca ²⁺	[Ar]	
Group 4		
N ³⁻	[Ne]	Sr ₃ N ₂ - Strontium Nitride
Sr ²⁺	[Kr]	
Group 5		
S ²⁻	[Ar]	Al ₂ S ₃ - Aluminum Sulfide
Al ³⁺	[Ne]	
Group 6		
Cl ⁻	[Ar]	BeCl ₂ - Beryllium Chloride
Be ²⁺	[He]	

8. Ch. 5 -Write an orbital diagram for each atom and ion.

Ion	Orbital Diagram														
Group 1															
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9. Ch. 15 - Radiation

Group 1: Problem 23

Given: half-life = 10 years, and initial mass = 10.0 g

Mass after one half-life (10 years) = $10.0 \text{ g} / 2 = 5.0 \text{ g}$

Mass after two half-lives (20 years) = $5.0 \text{ g} / 2 = 2.5 \text{ g}$

Therefore, the final mass is 2.5 g.

Group 2: Problem 24

Given: initial mass = 12.0 g and after 11 years final mass = 3.0 g

Mass after one half-life = 6.0 g

Mass after two half-lives = 3.0 g

Comparing the second mass to the final mass indicates that two half-lives have elapsed.

Therefore, the half-life is $11 \text{ years} / 2 = 5.5 \text{ years}$.

Group 3: Problem 25

Given: half-life = 5,760 years, and emission of radiation from the bone is one-fourth the current level

Emission after one half-life (5,760 years) = one-half the current level

Emission after two half-lives (11,520 years) = one-fourth the current level

Therefore, the age of the bone is approximately 11,520 years.