Name_____

Show your work(the correct answer without supporting work is not worth any points)

1. Complete the following tables. Note: The data in the tables below **will not agree** with the Ksp table which has been provided. Therefore, **do not use any of that data on this problem.** (8 pts)

Compound	Ksp	gram sol	molar sol	[cation]	[anion]
$AlPO_4$	$2.7*10^{-15}$				

Compound	Ksp	gram sol	molar sol	[cation]	[anion]
$Fe(OH)_2$					0.00032

2. Complete the following proton transfer reactions(2pts ea)

a) $HCO_2^- + NH_4^+$ =>

b) => $(C_2H_5)_2NH_2^+ + F^-$

4. A solution of phosphoric acid has a pH of 3.25. What are the $[H_2PO_4^-]$,$[HPO_4^{2-}]$ and $[PO_4^{3-}]$?(5 pts)

5. If equal volumes of 0.020M calcium nitrate and 0.010M potassium sulfate are combined, will a precipitate form?(4 pts)

6. Provide a complete treatment for a 0.030M solution of nitrous acid. You may not go directly to the quadratic, but must first test the approximation.(5 pts)

7. What is K_b for potassium fluoride?(3 pts)

8. What is the pH of a solution which contains benzoic acid and potassium benzoate in 1:2 ratio? (4 pts)

9. In an acid-base titration, it is found that 31.4mL of 0.100M NaOH are required to titrate 0.274g of the weak acid. What is the acid's equivalent weight?(4 pts)

10. Name the following, **using Stock Notation.**(3 pts)

a) $CoPO_4$

b) $Cu(NO_2)_2$

c) W_2S_3

11. Give formulas for the following(3 pts)

a) vanadium(III) carbonate

b) platinum(II) hydroxide

c) titanium(IV) nitrate

12. A reaction is nonspontaneous below a minimum temperature. What can be said about the signs of the enthalpy and entropy?(4 pts)

13. Calculate E_o for the following:(4 pts)

a) The reduction Au^+ by copper metal

b) The oxidation of Cl^- by Li^+

14. Balance the following redox equation(4 pts)

a) $MnO_4^-(aq) + NO(g) => MnO_2(s) + NO_3^-(aq)$ (acidic)

15. When the reaction below is driven electrolytically the **cathode reagent** is NO_3^-. What would be the mass **consumed at the anode** if a current of 4.10amps flowed for 3.90hours?(4 pts)

$NO_3^-(aq) + Mn^{2+}(aq) \Rightarrow NO(g) + MnO_2(s)$

16. Using **only the positional relationships** in the electrochemical series, answer the following. You can assume standard conditions. Include your reasoning.(4 pts)
a) Will Cu^{2+} oxidize Fe(s)?
b) Will Pb(s) reduce Zn^{2+}
17.A Ni^{2+} complex with four ligands is diamagnetic. Present its VBT treatment below. Identify the metal and ligand electrons, the hybridization and the structure.(5 pts)

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18. A hydrocarbon has the formula C_5H_{10}. Sketch four possible structures below, including at least one ring.(8 pts)
19.Complete the following nuclear reactions(4 pts)
a) $^{210}Bi_{83} \Rightarrow$ + $^{4}\alpha_{2}$

b) $^{248}Cm_{96} \Rightarrow {}^{206}Pb_{82}$ +
20. An octahedral complex of Os^{2+} has 4 unpaired electrons. Present its CFT treatment below. (4 pts)

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21. Name the following:(2 pts)
a) $CH_3CH_2CH{=}CHCH_3$
b) $C_2H_5NH_2$
22. Sketch the following(2 pts)
a) toluene
b) 3-pentanol
23.Answer any four, **but do only four**.(3 pts ea)
a) What do nylon and proteins have in common?
b) For an electrochemical process, if Q>1 how will E compare to E^o?
c) After the first short period what significant changes occur in the bonding behavior of the elements?
d) How can the pH dependence of the solubility of certain salts be explained?
e) Differentiate between addition and condensation polymerization
f) What is meant by the statement “acid-base reactions run downhill”?
g) What is unusual about B_2H_6?
h) Describe the general nature of a fuel cell