Given the following spectrochemical series:
CN⁻ > NO₂⁻ > en > NH₃ > H₂O > OH⁻ > F⁻ > Cl⁻ > Br⁻ > I⁻

1. a.) Which complex ion absorbs the higher frequency photon FeCl₆⁻⁴ or Fe(en)₃⁺²

b.) Which complex ion absorbs the higher frequency photon FeCl₆⁻⁴ or FeCl₆⁻³

c.) Which ion in a.) is more paramagnetic

d.) Which ion in b.) is likely to be a low spin complex

2. a.) K₃[Fe(C₅O₄)₃]

2. 3.) Upon addition of AgNO₃ to 1 mole of [Co(H₂O)₅Cl]Br₂ one will obtain (how many) ______ moles of a precipitate of ________.

2. 4.) Draw the structure of the square planar cis diammine dichloro platinum (II)

10. 5.) The half life of ⁹⁰Sr = 28.9 years. How long will it take for the activity of a sample containing ⁹⁰Sr to diminish to 12% of its original value?
6.) Calculate the binding energy per nucleon in Mev for $^{40}\text{Ca}$ whose atomic mass = 39.96259. Remember that 1 amu corresponds to 931.5 Mev. The atomic mass of a neutron = 1.00866 amu, and that of a proton = 1.00783 amu.

7.) Given the following $E^0$ values:

- $\text{UO}_2^+ + 4 \text{H}^+ + e^- \rightarrow \text{U}^{4+} + 2 \text{H}_2\text{O} \quad E^0 = +0.55 \text{ V}$
- $\text{UO}_2^{+2} + 4 \text{H}^+ + 2 e^- \rightarrow \text{U}^{4+} + 2 \text{H}_2\text{O} \quad E^0 = +0.334 \text{ V}$

Find $E^0$ for $\text{UO}_2^{+2} + e^- \rightarrow \text{UO}_2^+$.

8.) A round plate having a diameter of 30.0 cm is being silver plated on one side, by electrolysis of silver nitrate, where the plate is the cathode. It is desired to have a silver coating having a thickness of 3.50 microns ($1 \text{ micron} = 10^{-6} \text{ m}$). How many minutes do we have to carry out the electrolysis using a current of 2.80 Amp? The density of silver = 10.50 g/cm$^3$ and the atomic wt. of silver = 107.9.
Given the following thermodynamic data for the reaction:

\[
2 \text{NO}_2(g) \rightarrow \text{N}_2\text{O}_4(g)
\]

\[\Delta H^0 / \text{kJ/mol} \quad 33.2 \quad 11.1\]

\[S^0 / \text{J/mol K} \quad 240.1 \quad 304.4\]

Calculate the value of \(\Delta G^0\) of this reaction and the equilibrium constant at 25°C.

Calculate the equilibrium constant for this reaction at 45°C.

Calculate the pH of the following solutions:

(a) 0.0100 M hydroxylamine solution. \(K_b = 1.1 \times 10^{-8}\)

(b) 0.100 M NaNO₂ solution. \(K_a\) of HNO₂ = 4.6 \times 10⁻⁴.

(c) the solution obtained on adding 20.0 ml of a 0.100 M HCl solution to 60.0 ml of a 0.100 M NaNO₂ solution.
(4) d.) the solution obtained on adding 120.0 ml of a 0.100 M HCl solution to 60.0 ml of a 0.100 M NaNO₂.

(12) 11.) The $K_{sp}$ of AgBr = $5.35 \times 10^{-13}$, and $K_f$ of $Ag(S_2O_3)^{-3} = 2.8 \times 10^{13}$. Find the molar solubility of AgBr in a 0.100 M Na₂S₂O₃ solution.

(6) 12.) List all of the salts whose solubility will increase noticeably on lowering the pH of the solution from 7.0 to 1.0
BaSO₄, BaSO₃, PbSO₄, PbS, PbSO₃, ZnS

Note: Do not guess on this problem. You will be penalized for putting down an incorrect answer.

(10) 13.) The $K_{sp}$ of BaF₂ = $2.45 \times 10^{-5}$. Find the molar solubility of BaF₂ in a 0.10 M CuF₂ solution.
14.) Find the cell potential for the cell $Zn | Zn^{2+}_{(0.10 \text{ M})} \parallel H^{+}_{(\text{pH} = 3.0)} | H_2_{(0.10 \text{ atm})} | \text{Pt.}$

$Zn^{2+} + 2 e^- \rightarrow Zn \quad E^0 = -0.76 \text{ V}.$

15.) The activation energy of a first order reaction = 150.0 kJ/mol. How much faster is this reaction at 37°C than at 25°C?

16.) Given the reaction $2 \text{NO}_2_{(g)} \rightarrow \text{N}_2\text{O}_4_{(g)}$ indicate whether the equilibrium will shift to the right or to the left on
   a.) lowering the pressure ___________________
   b.) raising the temperature. ___________________