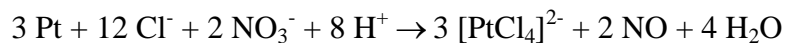


1. a. $E^\circ_{\text{cell}}=0.201$ V for the reaction



What is E° for the reduction of $[\text{PtCl}_4]^{2-}$ to Pt in acidic solution?

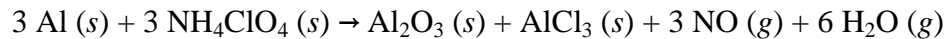
- b. Calculate the pH required to have $E_{\text{cell}}=0.072$ V when $[\text{NO}_3^-]=1.15$ M, $[\text{Cl}^-]=3.22$ M, $[\text{PtCl}_4^{2-}]=0.03$ M, and $P_{\text{NO}}=0.22$ atm.

4. 0.5334 g of ethanol, $\text{C}_2\text{H}_5\text{OH}$, is burned in a bomb calorimeter with a heat capacity of $12.44 \text{ kJ } ^\circ\text{C}^{-1}$. The temperature increased from 17.66°C to 18.93°C .

a. Calculate the *standard molar enthalpy change* for the combustion of ethanol.

b. The heat of formation of Carbon Dioxide is $-393.5 \text{ kJ mol}^{-1}$ and that of liquid water is $-285.840 \text{ kJ mol}^{-1}$. What is the *heat of formation of ethanol in kJ mol^{-1}* ?

5. The solid fuel boosters for the space shuttle utilize the following reaction:



Given:

Substance	ΔG_f° (kJ mol ⁻¹)
NH ₄ ClO ₄ (s)	-89
Al ₂ O ₃ (s)	-1582
AlCl ₃ (s)	-629
NO (g)	52
H ₂ O (g)	-229

Calculate the *thermodynamic equilibrium constant at 25 °C* for the reaction.

6. **Identify** the following substances based on the given results of the chemical tests.

a. A white precipitate forms under slightly basic conditions when Strontium Nitrate is added. A small amount of white precipitate forms slowly with the addition of Silver Nitrate. Addition of Potassium Permanganate and extraction with cyclohexane gives a dark purple aqueous layer and a colorless organic layer. Flame tests give a greenish flame. Under acidic conditions, addition of Thioacetamide gives a black precipitate that dissolves with Nitric acid. The buffered solution gives a maroon precipitate when Potassium Hexacyanoferrate(II) is added.

Unknown "a" is _____ (give the **name** and **formula**)

b. A white precipitate forms with the addition of calcium and silver. Addition of Potassium Permanganate and extraction with cyclohexane gives colorless aqueous and organic layers. Addition of thioacetamide gives a black precipitate. Addition of Ammonium Hydroxide gives a greenish precipitate. This precipitate dissolves in Hydrogen Peroxide to give a yellow solution that has a yellow precipitate with the addition of Lead(II) Nitrate.

Unknown "b" is _____ (give the **name** and **formula**)

c. A solution is known to contain Iron(III) ions and Calcium ions.

i. Give **ONE and only ONE** test that will separate these two ions. Which ion is in the supernatant and which is in the precipitate?

ii. Give **ONE and only ONE** test that will confirm the presence of the Iron(III) ion. Will this test be performed on the supernatant or the precipitate?

iii. Give **ONE and only ONE** test that will confirm the presence of the Calcium ion. Will this test be performed on the supernatant or the precipitate?

6. d. Multiple Choice. Write the letter corresponding to the ***BEST*** choice(s) in the blank provided. Not following direction WILL result in losing points.

_____ i. Which of the following ions will form a red solution with KSCN?
a. Fe^{2+} b. Cu^{2+} c. Fe^{3+} d. Li^+

_____ ii. Which of the following ions requires basic Hydrogen Peroxide for the separation test?
a. Fe^{3+} b. Cu^{2+} c. K^+ d. Cr^{3+}

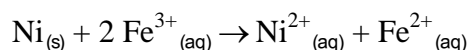
_____ iii. Which of the following ions will give a white precipitate with the addition of thioacetamide?
a. Fe^{3+} b. Zn^{2+} c. Cu^{2+} d. Ag^+

_____ iv. Which of the following ions gives a yellow color in the flame test?
a. Na^+ b. Ca^{2+} c. K^+ d. Li^+

_____ v. Which of the following ions will form a red precipitate with $\text{K}_4\text{Fe}(\text{CN})_6$?
a. Li^+ b. Zn^{2+} c. Cu^{2+} d. Cr^{3+}

7. Use electrode potentials to answer the following questions. Justify your answers with ***calculations***.

a. Is the oxidation of nickel by iron(III) ion a spontaneous reaction under standard reaction conditions?



b. Will iron(III) ion oxidize tin(II) ion to tin(IV) ion under standard conditions?

