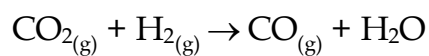


1. Calculate the *temperature, in °C*, at which Dinitrogen Tetroxide decomposes into Nitrogen Dioxide. You have the following thermodynamic data to use as you see fit:

Compound	ΔH°_f (kJ/mol)	S° (J/mol-K)
Dinitrogen Tetroxide	9.08	304.38
Nitrogen Dioxide	33.1	240.03

2. The reaction



is nonspontaneous at room temperature but becomes spontaneous at a much higher temperature. What can you conclude from this about the *sign* of ΔH° and ΔS° , assuming that the enthalpy and entropy changes are not greatly affected by the temperature change? Explain your reasoning.

3. A bumper has a surface area of 1524 cm². You wish to plate it with Chromium starting with Chromium(III) Chloride. The thickness of the plating must be 0.025 cm. How much *current* should you use so that the bumper is plated in 15.0 hours? The density of Chromium is 7.14 g/cm³

- Using the information from problem 1, calculate the *total pressure and the partial pressure of Nitrogen Dioxide* at equilibrium at 60.0°C when the reaction starts with 1.00 atm of Dinitrogen Tetroxide at 60.0°C.

5. Give 1 test (and **ONLY** 1 test) to determine which ion in the following pairs is present. State what results would be expected for each ion in that test. No points if more than one test is given.

(a) Cl^- and SO_4^{2-}

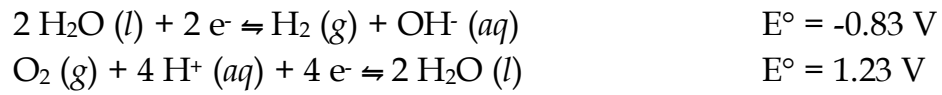
(b) Fe^{3+} and Ag^+

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

A white precipitate forms under slightly basic conditions when Strontium Nitrate is added. A white precipitate forms 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 is _____
(give the **name** and **formula**)

7. (a) Calculate the *equilibrium constant* for the fuel cell reaction used in the Apollo space missions. The cell consisted of the following half-reactions:



- (b) If the pressure of Hydrogen gas is 1.50 atm and the pressure of Oxygen gas is 10.00 atm at 600.0 K, what is the *potential given by this cell*?