

1987 B

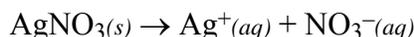


The equation for the reaction between mercuric chloride and oxalate ion in hot aqueous solution is shown above. The reaction rate may be determined by measuring the initial rate of formation of chloride ion, at constant temperature, for various initial concentrations of mercuric chloride and oxalate as shown in the following table

Experiment	Initial [HgCl <sub>2</sub> ]	Initial [C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> ]	Initial Rate of Formation of Cl <sup>-</sup> (mol L <sup>-1</sup> min <sup>-1</sup> )
(1)	0.0836 M	0.202M	0.52×10 <sup>-4</sup>
(2)	0.0836 M	0.404M	2.08×10 <sup>-4</sup>
(3)	0.0418 M	0.404M	1.06×10 <sup>-4</sup>
(4)	0.0316 M	?	1.27×10 <sup>-4</sup>

- According to the data shown, what is the rate law for the reaction above?
- On the basis of the rate law determined in part (a), calculate the specific rate constant. Specify the units.
- What is the numerical value for the initial rate of disappearance of C<sub>2</sub>O<sub>4</sub><sup>2-</sup> for Experiment 1?
- Calculate the initial oxalate ion concentration for Experiment 4.

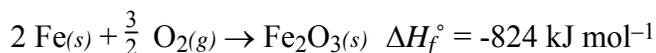
2005



The dissolving of AgNO<sub>3(s)</sub> in pure water is represented by the equation above..

- Is ΔG for the dissolving of AgNO<sub>3(s)</sub> positive, negative, or zero? Justify your answer.
- Is ΔS for the dissolving of AgNO<sub>3(s)</sub> positive, negative, or zero? Justify your answer.

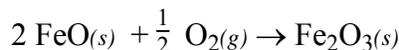
2004 B



Iron reacts with oxygen to produce iron(III) oxide as represented above. A 75.0 g sample of Fe(s) is mixed with 11.5 L of O<sub>2(g)</sub> at 2.66 atm and 298 K.

- Calculate the number of moles of each of the following before the reaction occurs.
  - Fe(s)
  - O<sub>2(g)</sub>
- Identify the limiting reactant when the mixture is heated to produce Fe<sub>2</sub>O<sub>3</sub>. Support your answer with calculations.
- Calculate the number of moles of Fe<sub>2</sub>O<sub>3</sub> produced when the reaction proceeds to completion.
- The standard free energy of formation, ΔG<sub>f</sub><sup>°</sup> of Fe<sub>2</sub>O<sub>3</sub> is -740. kJ mol<sup>-1</sup> at 298 K.
  - Calculate the standard entropy of formation ΔS<sub>f</sub><sup>°</sup> of Fe<sub>2</sub>O<sub>3</sub> at 298 K. Include units with your answer.
  - Which is more responsible for the spontaneity of the formation reaction at 298K, the standard enthalpy or the standard entropy?

The reaction represented below also produces iron(III) oxide. The value of ΔH<sup>°</sup> for the reaction is -280 kJ per mol.



- Calculate the standard enthalpy of formation, ΔH<sub>f</sub><sup>°</sup> of FeO(s).