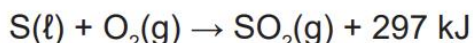


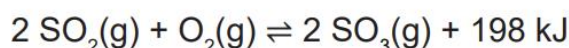
Question 38**(12 marks)**

Sulfuric acid is manufactured by the Contact process, the steps of which are outlined below.

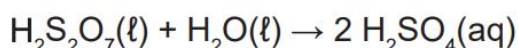
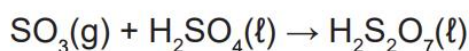
Step One: Molten sulfur is burned in air at approximately 1000 °C:



Step Two: The resulting sulfur dioxide is converted to sulfur trioxide as shown in the following equilibrium reaction. It is conducted at a temperature of about 450 °C with a V_2O_5 catalyst at a pressure of between 100 and 200 kPa:



Step Three: The resulting sulfur trioxide is absorbed into sulfuric acid, producing oleum ($\text{H}_2\text{S}_2\text{O}_7$). Water is added to the oleum, producing 18 mol L^{-1} sulfuric acid:



Use your understanding of collision theory and chemical equilibrium to discuss the reaction conditions for Steps 1 and 2 of the Contact process, given that the aim is to produce the greatest yield in the shortest time. In your discussion, also address economic concerns where appropriate.

