Question 29 (8 marks)
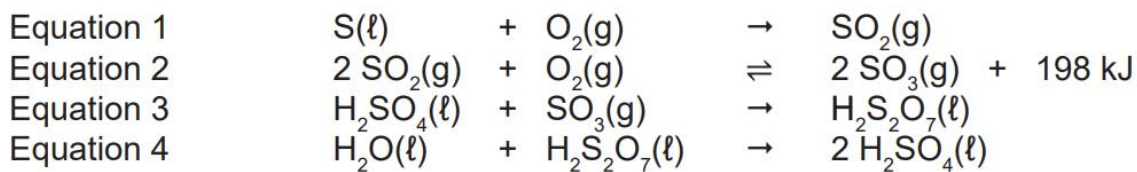
Sulfuric acid is a very useful chemical that is produced industrially by a multi-stepped process. These steps are summarised by the following equations.

Equation 1 $S(\ell)$ $+$ $O_2(g)$ $\rightarrow$ $SO_2(g)$

Equation 2 $2\ SO_2(g)$ $+$ $O_2(g)$ $\rightleftharpoons$ $2\ SO_3(g)$ $+$ $198\ kJ$

Equation 3 $H_2SO_4(\ell)$ $+$ $SO_3(g)$ $\rightarrow$ $H_2S_2O_7(\ell)$

Equation 4 $H_2O(\ell)$ $+$ $H_2S_2O_7(\ell)$ $\rightarrow$ $2\ H_2SO_4(\ell)$

When dihydrogen sulfate, $H_2SO_4(\ell)$, is mixed with water, it produces sulfuric acid, $H_2SO_4(aq)$.

(a) Combine these equations to produce an overall equation for the production of dihydrogen sulfate, $H_2SO_4(\ell)$, from sulfur dioxide, $SO_2(g)$. (2 marks)

(b)   Complete the following table by listing the advantages and disadvantages of using high
       temperatures and high pressures for the reaction represented by Equation 2 above.
       Consider yield, rate, cost and safety.   (6 marks)

	Advantage/s	Disadvantage/s
High temperature		
High pressure		