K_{a_1}, K_{a_2} and K_{a_3} are the respective ionisation constants for the following reactions.

$H_2S \rightleftharpoons H^+ + HS^-$

$HS^- \rightleftharpoons H^+ + S^{2-}$

$H_2S \rightleftharpoons 2H^+ + S^{2-}$

The correct relationship between K_{a_1}, K_{a_2} and K_{a_3} is

(i) $K_{a_3} = K_{a_1} \times K_{a_2}$

(ii) $K_{a_3} = K_{a_1} + K_{a_2}$

(iii) $K_{a_3} = K_{a_1} - K_{a_2}$

(iv) $K_{a_3} = K_{a_1} / K_{a_2}$

(a) For the reaction, $H_2S \rightleftharpoons H^+ + HS^-$

$$K_{a_1} = \frac{[H^+][HS^-]}{[H_2S]}$$

For the reaction, $HS^- \rightleftharpoons H^+ + S^{2-}$

$$K_{a_2} = \frac{[H^+][S^{2-}]}{[HS^-]}$$

When the above two reactions are added, their equilibrium constants are multiplied. Thus

$$K_{a_3} = \frac{[H^+]^2[S^{2-}]}{[H_2S]} = K_{a_1} \times K_{a_2}$$

Hence, $K_{a_3} = K_{a_1} \times K_{a_2}$