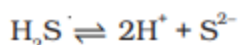


K_{a_1} , K_{a_2} and K_{a_3} are the respective ionisation constants for the following reactions.



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, $\text{H}_2\text{S} \rightleftharpoons \text{H}^+ + \text{HS}^-$

$$K_{a_1} = \frac{[\text{H}^+][\text{HS}^-]}{[\text{H}_2\text{S}]}$$

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

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

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

$$K_{a_3} = \frac{[\text{H}^+]^2[\text{S}^{2-}]}{[\text{H}_2\text{S}]} = K_{a_1} \times K_{a_2}$$

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