Question 34 **(9 marks)**

Sorbic acid is a monoprotic weak acid that occurs widely in nature and is used as a food preservative due to its antimicrobial properties. The ionisation of sorbic acid in water to the sorbate ion and hydronium ion is shown in the equation below:

$$CH_3(CH)_4COOH(aq) + H_2O(\ell) \leftrightharpoons CH_3(CH)_4COO^-(aq) + H_3O^+(aq)$$

(a) Write the equilibrium constant K expression for the ionisation of sorbic acid in water. (2 marks)

(b) Under certain conditions, a 0.250 mol L^{-1} aqueous solution of sorbic acid has a pH of 2.23. Calculate the concentration of H_3O^+ to determine the percentage yield of the sorbate ion at equilibrium in 1.00 L of the solution. (4 marks)

(c) Explain the classification of sorbic acid as a weak acid with reference to **both** your answer to part (b) above and its acidity constant value $K_a = 1.73 \times 10^{-5}$ (20 °C). (3 marks)

_____

_____