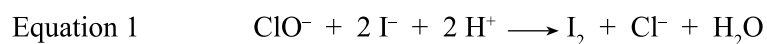


QUESTION 5

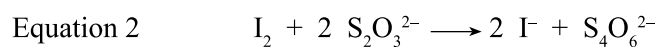
Chlorine and its compounds are used for water purification.

Credit will be given for the correct use of significant figures in answers to part (a). (1 mark)

- (a) Analysis was undertaken to determine the concentration of ClO^- ions in a 200.0 mL sample of swimming-pool water. Excess iodide that was added reacted with ClO^- ions in the sample, as shown in Equation 1 below:



The amount of I_2 produced was determined by titration with $0.00115 \text{ mol L}^{-1} \text{ Na}_2\text{S}_2\text{O}_3$. The reaction that occurred is shown in Equation 2 below:



It was found that 16.25 mL of $\text{Na}_2\text{S}_2\text{O}_3$ solution was required to react with all the I_2 .

- (i) Name the apparatus used to deliver the 16.25 mL of $\text{Na}_2\text{S}_2\text{O}_3$ solution.

_____ (1 mark)

- (ii) Calculate the number of moles of $\text{S}_2\text{O}_3^{2-}$ in the 16.25 mL of $0.00115 \text{ mol L}^{-1} \text{ Na}_2\text{S}_2\text{O}_3$ solution.

(2 marks)

- (iii) Calculate the number of moles of I_2 required to react with the $\text{Na}_2\text{S}_2\text{O}_3$ solution.

(2 marks)

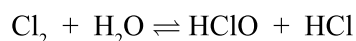
- (iv) Calculate the concentration, in mol L^{-1} , of ClO^- in the swimming-pool water.

(2 marks)

(v) Express the concentration of ClO^- in ppm.

(3 marks)

- (b) Sodium chloride is added to some swimming pools to reduce microbial growth in the water. Electrolytic pool chlorinators are used to produce chlorine gas, which then reacts with water, as shown in the equation below:



A saturated aqueous solution of chlorine was analysed and found to contain the following equilibrium concentrations:

$[\text{Cl}_2] = 0.062 \text{ mol L}^{-1}$, $[\text{H}_2\text{O}] = 55 \text{ mol L}^{-1}$, $[\text{HClO}] = 0.030 \text{ mol L}^{-1}$, and $[\text{HCl}] = 0.030 \text{ mol L}^{-1}$.

- (i) Calculate the K_c value for the saturated solution of chlorine.

(3 marks)

- (ii) Explain the effect that the addition of OH^- to the solution would have on the equilibrium concentration of Cl_2 .

(3 marks)

TOTAL: 17 marks