2023 Ch H1 Q14

Section: Chemical Changes and Structure

Topic: Redox

Question Summary

During a redox process in acid solution, iodate ions are converted into iodine.
$2\ IO_3^-(aq) + 12\ H^+(aq) + x\ e^- \rightarrow I_2(aq) + 6\ H_2O(\ell)$
What value of x is required to balance the equation?
A: 12
B: 11
C: 10
D: 6

Worked Solution

Step 1: Balance iodine atoms. On the left, 2 IO_3^- ions contain 2 iodine atoms. On the right, I_2 has 2 iodine atoms. Iodine is balanced.

Step 2: Balance oxygen atoms. Left side: $2 \times 3 = 6$ O atoms. Right side: 6 H_2O molecules contain 6 O atoms. Oxygen is

balanced.

Step 3: Balance hydrogen atoms. Right side: 6 H_2O molecules have 12 H. Left side: 12 H^+ provides 12 H. Hydrogen is balanced.

Step 4: Balance charge. Left side: 2 IO_3^- contributes –2 charge, plus 12 H^+ gives +10 overall. To balance with neutral right side, add 10 e^-. Therefore x = 10.

Final Answer

C — 10

Revision Tips

• Balance atoms first (except hydrogen and oxygen).
• Then balance oxygen with H_2O, hydrogen with H^+, and charges with e^-.
• Redox balancing in acidic solution always follows this systematic process.