pH, pOH & Strong Acids/Bases

INSTRUCTOR / SELF-STUDY ANSWER KEY

Answers and reasoning appear in red. Use these to discuss why incorrect choices are incorrect.

Part A — Concept checks

1. **A 0.010 M HCl solution has approximate pH…**

   Answer: B. 2.00 — $-\log(10^{-2}) = 2$.

2. **At 25 °C, a solution with pH 9.00 has pOH…**

   Answer: A. 5.00 — pOH = 14.00 − 9.00 = 5.00.

3. **Which solution has greater [H_3O^+]?**

   Answer: B. pH 5 — Lower pH means higher hydronium concentration.

4. **A one-unit decrease in pH corresponds to how much increase in [H_3O^+]?**

   Answer: C. 10× — Because pH is logarithmic, one unit is a factor of 10.

5. **0.0010 M NaOH at 25 °C has approximate pH…**

   Answer: C. 11.00 — pOH ≈ 3.00 and pH ≈ 11.00.

6. **Which is a strong monoprotic acid in water?**

   Answer: C. HCl — HCl ionizes essentially completely in dilute water.

Part B — Application and explanation

7. What is the pH of 0.0010 M HCl at 25 °C?

   Model solution: [H_3O^+] ≈ 1.0×10^{-3} M, so pH = $-\log_{10}(1.0 \times 10^{-3}) = 3.00$. Final answer: pH 3.00

8. Explain why this guideline matters, with an example of what could go wrong if you ignore it: Do not assume that pH + pOH = 14 at every temperature; 14.00 is the standard classroom approximation at 25 °C.

   Model explanation: Do not assume that pH + pOH = 14 at every temperature; 14.00 is the standard classroom approximation at 25 °C. Example/check: A difference of one pH unit corresponds to a tenfold change in hydronium concentration; smaller pH means larger [H_3O^+].

REFERENCE RELATIONSHIP

pH = $-\log_{10}[H_3O^+]$; at 25 °C, pH + pOH = 14.00