Cells under non-standard conditions

Challenge questions

BrO_3 (aq) + $6H^+$ (aq) + 3 e^- → Br^- (aq) + 3 H_2O (ℓ) E° = +1.44 V

(1) a) What is the **pH** of this half-cell under standard conditions?

b) Follow-up: What would be the pH of a **basic** half-cell under standard conditions?

(2) If the BrO_3/Br^- were connected to the following half-cell, which species would undergo **reduction** under standard conditions?

Pt^{2+} (aq) + 2 e^- → Pt (s) E° = +1.20 V

a. Pt (s)
b. Pt^{2+} (aq)
c. BrO_3 (aq)
d. Br^- (aq)
e. H^+ (aq)

BrO_3 (aq) + $6H^+$ (aq) + 3 e^- ⟶ Br^- (aq) + 3 H_2O (ℓ) E° = +1.44 V

(3) If the **pH is increased** in this half-cell, what happens to the reduction potential (measured relative to SHE)?

a. E increases
b. E decreases
c. E stays the same
d. More information is needed

(4) At what **pH** will this cell become the anode when paired with the Pt^{2+}/Pt half-cell to make a voltaic cell? Assume all non [H^+] concentrations are still at standard conditions.

Pt^{2+} (aq) + 2 e^- ⟶ Pt (s) E° = +1.20 V

Answers

1. a) pH 0
   b) pH 14
2. C
3. A
4. pH > 2.03