pH Calculations

For each of the following, calculate $[H_3O^+]$, $[OH^-]$, pH, and pOH.

1. $[H_3O^+] = 1.56 \times 10^{-3}$ mol/L — **ACIDIC**
   - pH = -log$[H_3O^+]$ — pH = -log(1.56×10^{-3} mol/L) = **2.81**
   - pOH = 14 – pH — pOH = 14 – 2.81 = **11.2**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-11.2) = **6.41×10^{-12} mol/L**

2. $[H_3O^+] = 0.125$ M — **ACIDIC**
   - pH = -log$[H_3O^+]$ — pH = -log(0.125 mol/L) = **0.903**
   - pOH = 14 – pH — pOH = 14 – 0.903 = **13.1**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-13.1) = **8.00×10^{-14} mol/L**

3. $[OH^-] = 4.12 \times 10^{-4}$ mol/L — **BASIC**
   - pOH = -log$[OH^-]$ — pOH = -log(4.12×10^{-4} mol/L) = **3.39**
   - pH = 14 – pOH — pH = 14 – 3.39 = **10.6**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-10.6) = **2.43×10^{-11} mol/L**

4. $[OH^-] = 0.0250$ M — **BASIC**
   - pOH = -log$[OH^-]$ — pOH = -log(0.0250 mol/L) = **1.60**
   - pH = 14 – pOH — pH = 14 – 1.60 = **12.4**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-12.4) = **4.00×10^{-13} mol/L**

5. pH = 3.45 — **ACIDIC**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-3.45) = **3.55×10^{-4} mol/L**
   - pOH = 14 – pH — pOH = 14 – 3.45 = **10.6**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-10.6) = **2.82×10^{-11} mol/L**

6. pH = 9.76 — **BASIC**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-9.76) = **1.74×10^{-10} mol/L**
   - pOH = 14 – pH — pOH = 14 – 9.76 = **4.24**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-4.24) = **5.75×10^{-5} mol/L**

7. pOH = 2.45 — **BASIC**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-2.45) = **3.55×10^{-3} mol/L**
   - pH = 14 – pOH — pH = 14 – 2.45 = **11.6**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-11.6) = **2.82×10^{-12} mol/L**

8. pOH = 12.5 — **ACIDIC**
   - $[OH^-]$ = antilog(-pOH) — $[OH^-]$ = antilog(-12.5) = **3.16×10^{-13} mol/L**
   - pH = 14 – pOH — pH = 14 – 12.5 = **1.5**
   - $[H_3O^+]$ = antilog(-pH) — $[H_3O^+]$ = antilog(-1.5) = **0.0316 mol/L**