Weak Electrolyte Solution Properties Analysis

https://gemini.google.com/app/1dbf78f810c6d2c5

Response: To evaluate which statements are **always correct** for an aqueous solution of a weak electrolyte:

Analysis of Statements

- **Statement (a): Incorrect.** The transport number (fraction of current carried by an ion) depends on the ionic mobilities of the cation and anion. For example, H^+ has a significantly higher mobility than most anions due to the Grotthuss mechanism, so in an acid solution like $\mathrm{CH_3COOH}$, the cation carries a larger fraction of the current.
- **Statement (b): Incorrect.** Individual ionic conductivity depends on the specific ion's size, charge density, and hydration sphere radius, not simply whether it is a cation or an anion.
- **Statement (c): Incorrect.** While a weak electrolyte only dissociates partially at moderate concentrations, according to Ostwald's Dilution Law, its degree of dissociation (α) approaches 1 (100%) as dilution approaches infinity ($\lim_{C \to 0} \alpha = 1$). Therefore, it is not *always* a small percentage.
- **Statement (d): Correct.** By Ostwald's Dilution Law ($\alpha \approx \sqrt{K_a/C}$), reducing the concentration C via dilution shifts the dissociation equilibrium forward, thereby increasing the fraction of molecules dissociated.

Summary

- **(a)** False — depends on ionic mobility.
- **(b)** False — depends on the specific ionic species.
- **(c)** False — approaches complete dissociation at infinite dilution.
- **(d) Always Correct** — degree of dissociation (α) increases upon dilution.

Therefore, **statement (d)** (or the combination containing only **(d)**) is correct.
