**p$K_a$ Review and Practice**

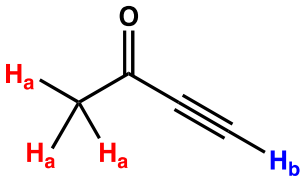
p$K_a$ is the negative base-10 log of the ratio of the product of the free ions (proton and conjugate base) to the acid. It is summarized in the following equation (note that the log is positive since the inverse ratio is used).

$$\mathrm{p}K_\mathrm{a} = -\log_{10} K_\mathrm{a} = \log_{10} \frac{[\mathrm{HA}]}{[\mathrm{A}^-][\mathrm{H}^+]}$$

For the following molecules,

1. label the chemically distinct hydrogens,
2. using a p$K_a$ table, estimate the p$K_a$ associated with those hydrogens, and
3. determine which hydrogens are the most acidic.

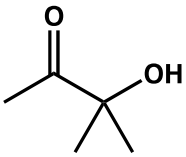
*example*

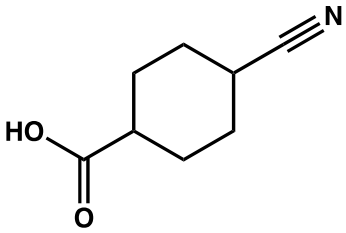


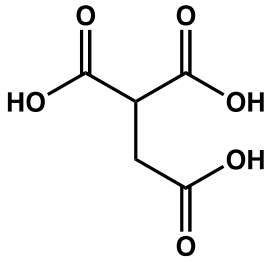

**$H_a$: p$K_a$ ~ 20–24**

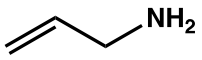
**$H_b$: p$K_a$ ~ 25**

*$H_a$ is more acidic*

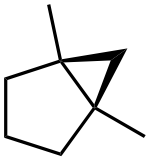




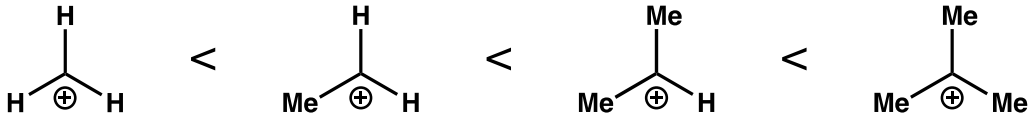




*bonus*



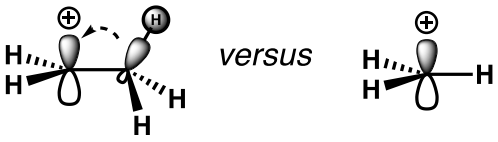
**Carbocation Stability**

More substituted carbon leads to a more stabilized carbocation. The following order of stability therefore arises:



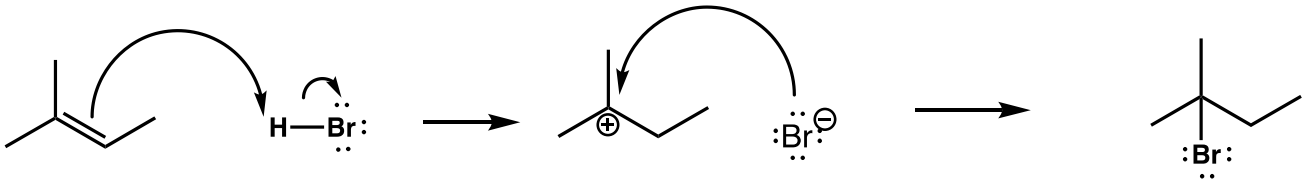

*Why is that the case?*

Substituents adjacent to cation help stabilize it through <u>hyperconjugation</u>.



**Practice Applying Carbocation Stability: Alkene Protonation**

Show the arrow-pushing mechanisms for the following reactions.




2-bromo-2-methylbutane