Supporting Information to

Surface pK\textsubscript{a} of octanoic, nonanoic, and decanoic fatty acids at the air-water interface:

Applications to atmospheric aerosol chemistry

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Figure S1. Surface tension vs. concentration of nonanoic acid at pH 2.
**Figure S2.** Surface tension vs. concentration of nonanoic acid at pH 12.

**Figure S3.** Weak acid-strong base titration of 1 mM C₉ in water. The volume at the equivalence point was determined by the first derivative of the titration data.
Figure S4. Generalized $\Delta \gamma$ vs pH plot from the surface activity model.

Under the two pH regimes indicated in Fig. S4, and by using eqn. (A8), the following can be deduced. At low pH, $\Delta \gamma \sim \Delta \gamma_{\text{max}}$. At low pH, it is assumed that the majority of the fatty acid molecules exist in their protonated state ($f_{LH} = 1$).

\[
\frac{(\Delta \gamma_{\text{max}} - \Delta \gamma)}{\Delta \gamma_{\text{max}}} = a_{L-}f_{L-} + a_{LH}f_{LH}
\]

\[
0 = a_{L-}(0) + a_{LH}(1)
\]

\[
a_{LH} = 0
\]

The same approach can be taken for the high pH regime where $\Delta \gamma \sim 0$ mN/m, and $f_{LH} = 0$.

\[
\frac{(\Delta \gamma_{\text{max}} - \Delta \gamma)}{\Delta \gamma_{\text{max}}} = a_{L-}f_{L-} + a_{LH}f_{LH}
\]

\[
1 = a_{L-}(1) + a_{LH}(0)
\]

\[
a_{L-} = 1
\]
Figure S5. IRRAS spectra of 1 mM C9 at pH 2 compared against a C18 monolayer spread to the untilted condensed phase (18.5 Å²/molecule).

Figure S6. Surface tension titration of 1 mM acetic acid.