

Rank: $K_{a1} > K_{a2} > K_{a3} > K_{a4} > K_{a5}$.

At pH = 10 the acid be fully protonated or fully deprotonated?

a) protonated

b) deprotonated

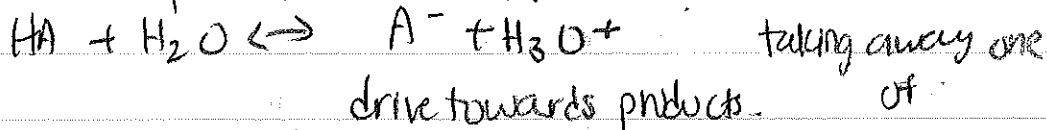
c) cant tell.

$$K_{a1} = 7.4 \times 10^{-4} \approx 4 \text{ pKa}$$

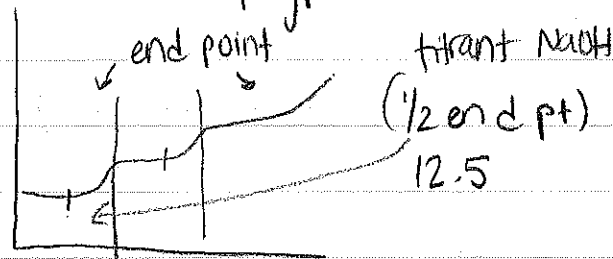
$$K_{a2} = 1.7 \times 10^{-5} \approx 5$$

$$K_{a3} = 4.0 \times 10^{-7} \approx 7$$

$$\text{pH} = 10 > K_{a1}, K_{a2}, K_{a3}$$



Titration of a polyprotic



Phenolphthalein

Colorless.
protonated

pink
deprotonated form.

for weak acid $K < 1$.

$$\Delta G^\circ = -RT \ln K$$

$\Delta G^\circ > 0$ nonspontaneous
reactant favored.

Stress by adding OH^-

Add OH^-

H_3O^+ goes down, shift to products.

protonated form
yellow

deprotonated form
blue.

egg - the protein part turns clear.
protein in egg full of amino acid.

$\text{pH} < \text{pK}_a$ - drive back those protonated
side chains give tertiary structure, if mess up the side
chains \rightarrow denature the protein.

proteins = polypeptides = covalently linked amino acid.
Buffer in our bodies.