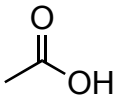
pKa Denksport

Main reference: Evans table

Instructions: Work by yourself and if you are finished early, go back to your lab or eat quietly until 12:40.

1. Anchor pKa's: you should know these and use them as a reference to derive pKa values of protons in your synthetic routes. Mark the most acidic proton and indicate the pKa value.



H_2O

H_3C-OH

H_2O

H_2O

H_2O

H_3O^+

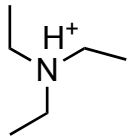
H_2O

HOOH

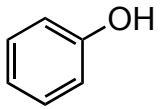
H_2O

NH_3

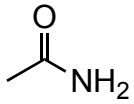
H_2O



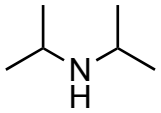
H_2O



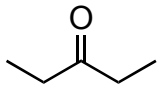
H_2O



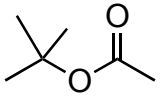
H_2O, DMSO



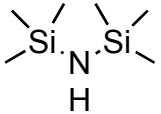
THF



H_2O



H_2O



THF
DMSO

CH_4

H_2O

H_2

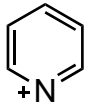
H_2O

H_2O

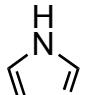
H_2O

2. pKa's of common synthetic interest

H_2O



H_2O

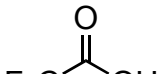


H_2O

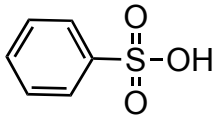
H_2O

$MeNO_2$

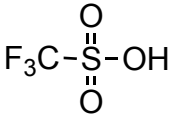
H_2O



H_2O



H_2O



H_2O

H_2SO_4

1st: 2nd:

H_2O

HCN

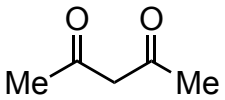
H_2O

HN_3

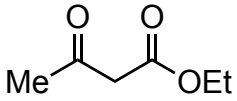
H_2O

HCl

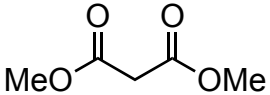
H_2O



H_2O



H_2O



H_2O

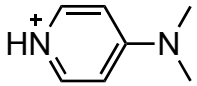
H_2CO_3

1st: 2nd:

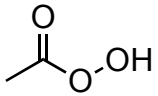
H_2O

NH_4Cl

H_2O



H_2O

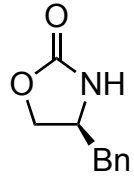


H_2O

DMSO

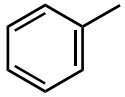
BuSH

H_2O

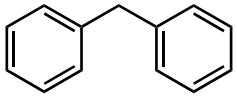


H_2O

DMSO



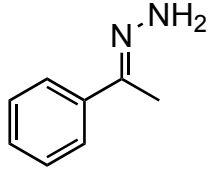
H_2O



H_2O

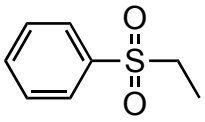
H_2O

H_2O

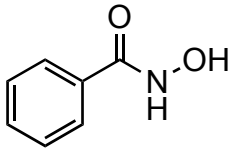


DMSO

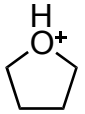
H_2O



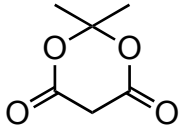
DMSO



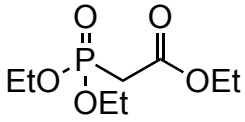
H_2O



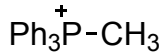
H_2O



H_2O



DMSO

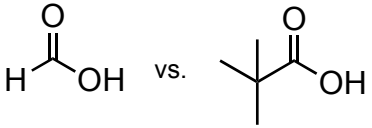


H_2O

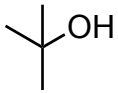
3. On the back of page 4, organize the pKa values of all compounds listed above in the following ranges: <0, 0-4, 4-8, 8-12, 12-20, 20-28, 28-36, >36

4. a) Ester vs. ketone: which is more acidic? Why?

b) Which is more acidic, and why? (Hint: the same reasoning applies to both pairs). Indicate pKa values in H_2O.

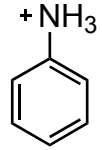


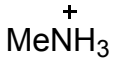
Me–OH vs.



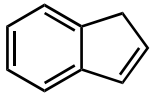
c) If the pH of an aqueous solution is adjusted by a reseracher to be 7.1, and *p*-nitrophenol, triethylamine, and acetic acid are all present in that solution, what are the dominant protonation states of these species?

d) Draw a 3D structure of aniline indicating the precise geometry of the lone pair. From this, infer the pKa value of protonated aniline. How does this value compare to the pKa of protonated methylamine?

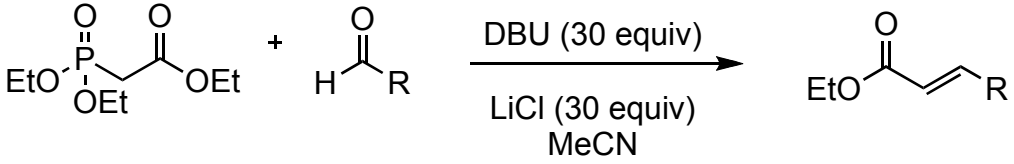




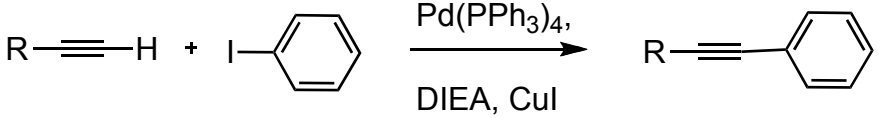
e) The pKa difference between the 2 compounds shown below differs by 5 units. Infer what the values are and why.



f) Shown below are Masamune Roush conditions for the Horner Wadsworth Emmons reaction. Suggest what each reagent is for in a detailed mechanism, taking note of pKa values (use the back of page 1-3 if you need space).

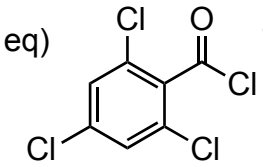


g) Sonogashira coupling again: do you remember the pKa values of the species and why the reaction works?



h) If you have time: draw a detailed mechanism for the Yamaguchi esterification and propose a rate determining step. Hint: acidity is strongly related. In addition to a carboxylic acid and alcohol, the reagents are shown below.

TEA (1.1 equiv), DMAP (6 eq)



1.1 eq)