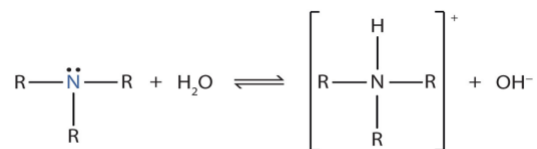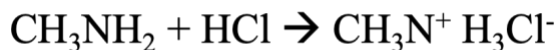Chemistry 2, HW 23

Amines:
Central atom is nitrogen. Amines are derivatives of ammonia (NH3) where carbon atom replaces one, two, or three hydrogen atoms.
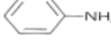Amines are weak bases, they accept proton, they produce hydroxide ions in aqueous solution. Amines react with a strong acid, the products are amine salts.

$$CH_3NH_2 + HCl \rightarrow CH_3N^+ H_3Cl^-$$

Amine table (ignore K and pK values, it shows basically that these substances are week bases):

Amine	Name	Bp, °C	Mp, °C	Water solubility, g/100 ml	K_b in water[a]	pK_a[b]
NH_3	ammonia	−33	−77.7	90[c]	1.8×10^{-5}	9.26
CH_3NH_2	methanamine (methylamine)	−6.5	−92.5	1156	4.4×10^{-4}	10.64
$CH_3CH_2NH_2$	ethanamine (ethylamine)	16.6	−80.6	∞	5.6×10^{-4}	10.75
$(CH_3)_3CNH_2$	1,1-dimethylethanamine (tert-butylamine)	46	−67.5	∞	2.8×10^{-4}	10.45
$(CH_3CH_2)_2NH$	N-ethylethanamine (diethylamine)	55.5	−50	v. sol.	9.6×10^{-4}	10.98
$(CH_3CH_2)_3N$	N,N-diethylethanamine (triethylamine)	89.5	−115	1.5[20]	4.4×10^{-4}	10.64
$(CH_3CH_2CH_2CH_2)_3N$	N,N-dibutylbutanamine (tributylamine)	214		sl. sol.		
⬡NH	azacyclohexane (piperidine)	106	−9	∞	1.6×10^{-3}	11.20
⬡N	azabenzene (pyridine)	115	−42	∞	1.7×10^{-9}	5.23
⬡—NH₂	cyclohexanamine	134	−18	sl. sol.	4.4×10^{-4}	10.64
⬡—NH₂	benzenamine (aniline)	184.4	−6.2	3.4[20]	3.8×10^{-10}	4.58
$H_2NCH_2CH_2NH_2$	1,2-ethanediamine (ethylenediamine)	116	8.5	sol.	8.5×10^{-5}	9.93

[a]Usually at 20–25°.   [b]The pK_a values refer to the dissociation of the conjugate acid $RNH_3^{\oplus}$
$+ H_2O \overset{K_a}{\rightleftharpoons} RNH_2 + H_3O^{\oplus}$, where $pK_a = -\log K_a = 14 + \log K_b$ (see Sections 8-1 and 23-7).

Questions:
1. Name the functional group present in amines.
2. What is the difference between an amine and ammonia?
3. Why are small-chain amines more soluble in water than large-chain amines?
   Hint: slide # 10 and polarity.