

7th Ed

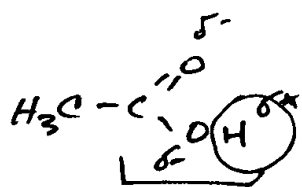
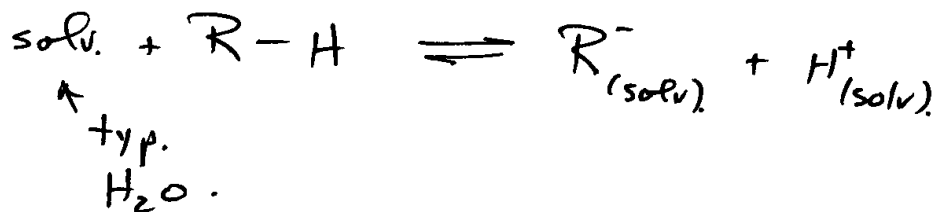
CH 15 Suggested Problems.

29, 37, 41, 43, 47, 53, 61, 65, 67, 75, 77

Others

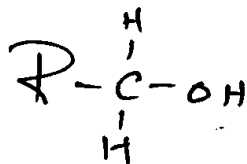
83, 95, 99, 107, 117 (interesting).

ORGANIC ACIDS.

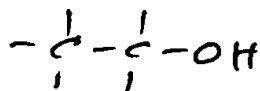
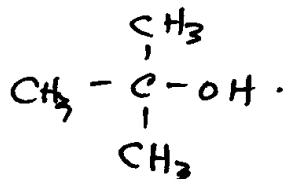


carboxylate $K_2 \sim 10^{-5}$

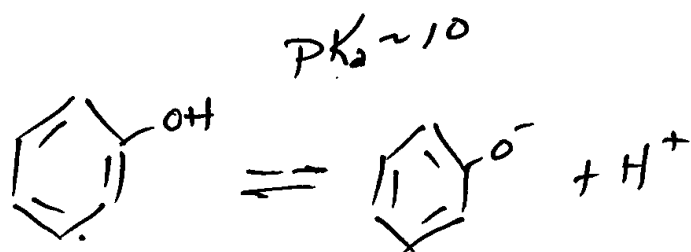
Electronegativity.



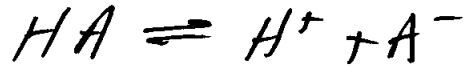
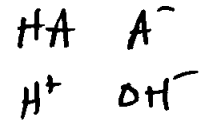
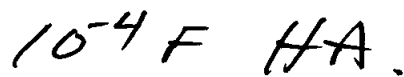
Steric effects.



Resonance



Exact (systematic) treatment.



Equil. ① $K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]} = 10^{-8} \quad \leftarrow$

② $K_w = [\text{H}^+][\text{OH}^-] = 10^{-14}$

charge balance

③ $[\text{H}^+] = [\text{OH}^-] + [\text{A}^-]$

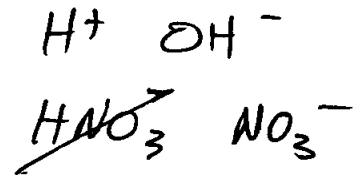
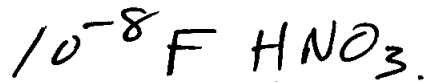
mass balance

④ $C_{\text{HA}}^0 = 10^{-4} = [\text{HA}] + [\text{A}^-]$

③ $[\text{A}^-] = [\text{H}^+] - [\text{OH}^-] = [\text{H}^+] - \frac{K_w}{[\text{H}^+]}$

④ $[\text{HA}] = C_{\text{HA}}^0 - [\text{A}^-] = 10^{-4} - \left\{ [\text{H}^+] - \frac{K_w}{[\text{H}^+]} \right\}$

$$K_a = \frac{[\text{H}^+] \left\{ [\text{H}^+] - \frac{K_w}{[\text{H}^+]} \right\}}{10^{-4} - \left\{ [\text{H}^+] - \frac{K_w}{[\text{H}^+]} \right\}}$$



$K_w = 10^{-14} = [\text{H}^+][\text{OH}^-]$

$K_a = \text{BIG!}$

chg.

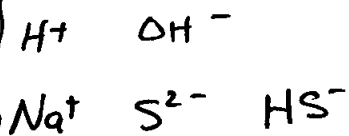
$[\text{H}^+] = [\text{OH}^-] + [\text{NO}_3^-] \leftarrow$

Mass.

$C_{\text{NO}_3}^0 = [\text{NO}_3^-] = 10^{-8}$

$[\text{H}^+] = \frac{K_w}{[\text{H}^+]} + 10^{-8}$

$[\text{H}^+]^2 - 10^{-8}[\text{H}^+] - K_w = 0$

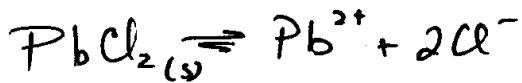


$[\text{H}^+] + [\text{Na}^+] = [\text{OH}^-] + [\text{HS}^-] + \overset{2}{\uparrow} [\text{S}^{2-}] \left\{ \text{H}_2\text{S} \right.$

Solubility



$$K_{sp} = [\text{Ag}^+][\text{Cl}^-]$$



$$K_{sp} = [\text{Pb}^{2+}][\text{Cl}^-]^2$$

in
H₂O



$$K_{sp} = [\text{C}_6\text{H}_6]$$

S Molar solubility

$\frac{\text{moles of solute dissolved}}{\ell \text{ solution}}$

What is S for $\text{AgCl}_{(s)}$?

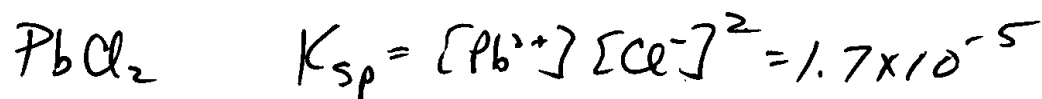


$$K_{sp} = [\text{Ag}^+][\text{Cl}^-] = 1.8 \times 10^{-10}$$

	Ag^+	Cl^-
I	0	0
C	S	S
E	S	S

$$K_{sp} = S^2$$

$$S = \sqrt{K_{sp}} = 1.34 \times 10^{-5}$$



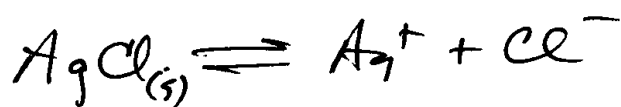
$$[\text{Pb}^{2+}] = s$$

$$[\text{Cl}^-] = 2s$$

$$K_{sp} = s \cdot (2s)^2$$

$$s = \sqrt[3]{\frac{K_{sp}}{4}}$$

Common ion effect.



ADD 0.1 M NaCl.

$$[\text{Ag}^+] = s$$

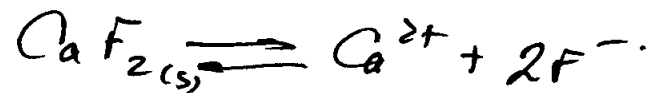
$$[\text{Cl}^-] = \cancel{s} + 0.1$$

$$K_{sp} = s \cdot 0.1$$

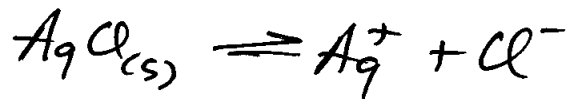
*

← OK

$$s = \frac{1.8 \times 10^{-10}}{0.1} = \underline{\underline{1.8 \times 10^{-9}}}$$



Add ^{HNO₃} any acid?



Add HNO₃ ?