Topic 8 Review

8.1

1 See notes / reading

2. NaOH ← in water

Na^+ OH^- will accept a H from water, which makes it a base

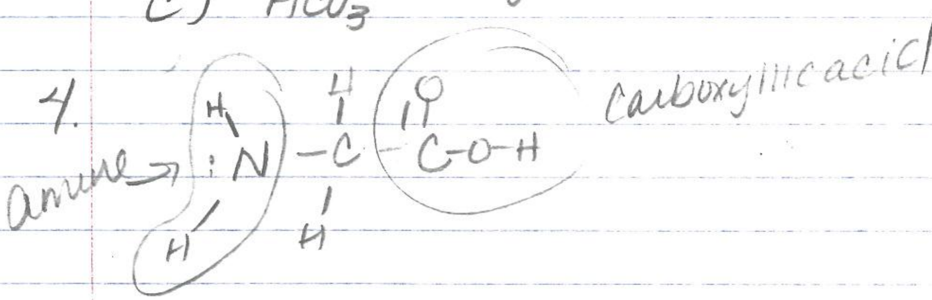
HOH

$\ddot{N}H_3$ will take / bond with a H^+ in water, which makes it a base.

3. a) OH^- are resulting in solution, making it alkaline

b) HCO_3^- behaves as a base, because it is accepting an H^+.

c) HCO_3^-

4. 

c. $[NH_3CH_2COOH]^+$

5. a) $NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

base₁, acid₂, conjugate acid₁, conjugate base₂

b) $CO_3^{2-} + H_2O \rightarrow HCO_3^- + OH^-$

base₁, acid₂, conjugate acid₁, conjugate base₂

c) $HNO_3 + H_2O \rightarrow NO_3^- + H_3O^+$

acid₁, base₂, conj. base₁, conjugate acid₂

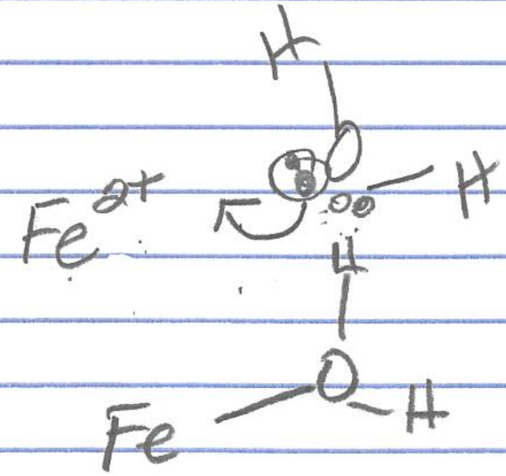
CONJ. ACID   CON BASE

6.

	CONJ. ACID	CON BASE
A.	CH_4	CH_3^-
B.	NH_4^+	NH_3
C.	NH_4^+	NH_3
D.	H_2O	OH^-
	(H_3O^+ or	OH^-
	H_3O^+	H_2O)

7. I + II

8. B. (should be Fe^{2+} not Ni^{2+})



8.2

1. Reading
2. D
3. B. * all others are bases.
4. a) $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

   b) $PbCO_3 + 2HNO_3 \rightarrow Pb(NO_3)_2 + CO_2 + H_2O$

   c) $ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$

   d) $Ca(OH)_2 + 2HNO_3 \rightarrow Ca(NO_3)_2 + 2H_2O$

5. a) See reading handout 8.2

   b) Na_2O ↓ basic; P_4O_{10} or P_4O_6 — Acidic; SO_2 or SO_3 ↓ Acidic

   c) $Na_2O + H_2O \rightarrow 2NaOH$

   $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$

   $SO_2 + H_2O \rightarrow H_2SO_3$

6. Amphoteric - both acid & base

   Al_2O_3 (acid) $+ 2NaOH$ (base) $\rightarrow Al(OH)_4^- + H_2O$

   Al_2O_3 (base) $+ 6HCl$ (acid) $\rightarrow 2AlCl_3 + 3H_2O$

8.2

#4

CO_3^{-2}

e) $NaHCO_3 + H_2SO_4 \rightarrow Na^+ + H_2CO_3 + HSO_4^-$

HCO_3^-

7. $H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4 + 2H_2O$

$\frac{.02851 dm^3 \mid .0404 mol}{\mid 1 dm^3} = .0011$ mol H_2SO_4

$\times 2 = .0022$ moles NH_3

mass $NH_3 = .0022(14+3) = .03925$ g

$\frac{.03925}{2.447 g} = 1.64$ %

8. Base → Acid as move across the period

$MgO + H_2O \rightarrow Mg(OH)_2$ ← base

$SO_3 + H_2O \rightarrow H_2SO_4$ ← acid

9. a) left (Na, Mg, Al) = ionic
Si = giant covalent

P, S - simple covalent

b)

8.3 - Strong & Weak Acids & Bases

1. Strong acid = virtually complete/very dissociation, good conductors, reactive w/ metals/bases
   weak acid = limited dissociation

See reading packet.

$$HCl + H_2O \rightarrow H^+ + Cl^-$$

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$$

2. K_a = acid dissociation constant
   ↳ equilibrium constant expression in regards to the dissociation
   Kc ↓ but for dissociation

   Strong acid's K_a is much greater than 1.
   Weak acid $K_a < 1$

3. See reading
4. K_b = Base dissociation constant (similar relationship as K_a)
5. Strength = amount of dissociation (relate to K_a & K_b)
   Concentration = amount (moles) of acid/base in solution. Independent of strength

6. a) $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$
   b) NH_3 is a weak base because a very limited # of those molecules react w/ water to produce OH^-

lower pH

c) $\frac{0.1 mol}{1 dm^3}$ NH_3 ← very little of this dissociates & "acts" as a base

$\frac{0.1 mol}{dm^3}$ NaOH → stronger base = ↑er amount of OH^- so ↑er pH

7. a)

$$HCN + H_2O \longrightarrow CN^- + H^+$$

$$K_a(HCN) = \frac{[H^+][CN^-]}{[HCN]} \quad mol\ dm^{-3}$$

b) ↓ pH so weakest acid to strongest acid

HCN, CH_3COOH, HF, HCl

c) increasing concentration of molecules of <u>acid</u> present in solution originally have the <u>same</u> concentrations!

<u>but</u> after having reached equilibrium, fewest molecules of acid remaining would be the <u>strongest acid</u>.

d) $CH_3COOH_{(aq)}$ H_2O

CH_3COO^- H^+ (H_3O^+)

8.(9) HCl = strong
CH_3COOH = weak
experimental - pH probe
- conduction of electricity
- reactivity)
↳ ΔT (ΔH) of neutraliz. rxn
rxn w/ equal types/volumes of metal.

8.4 The pH Scale

1. D

2. pH = $-\log_{10}[H^+]$
Q = $-\log_{10}(0.9 \times 10^{-3})$ = 3
S = $-\log_{10}(2 \times 10^{-7})$ = 6.7
~~acidic~~ P < S < R < Q (A)

3. 4 → 567
10^3 = 1000 ↓ (D)

4. (D)

5. I < II < IV < III

6.

$2H_2O \rightarrow H_3O^+ + OH^-$

$K_c = \frac{[H_3O^+][OH^-]}{[H_2O]}$ (@ 25°C

$K_c < K_{c_{35°}}$

warmer ⇒ shifts to the right = more dissociation

(D) ↑ temperature shifts to endothermic side (right)

7. a) HCl is a stronger acid than CH_3COOH so there will be a greater concentration of H^+ in solution leading to a lower pH

b) 2 → 4
Y = 100 times lower H^+ concentration than solution X

8. a) NaOH = stronger base so greater dissociation so more Na^+ & OH^- in solution which leads to greater conductivity (more charged particles moving around)

b) The pH of 0.1 M NaOH solution would be higher as there would be more OH^- ions in solution (b/c stronger base).