Hanson Activity 5-3

- Discuss Key Questions 1-4 of Activity 5-3, page 83, with your partner for five minutes.
- The clicker quiz will commence at 1:20 PM sharp.

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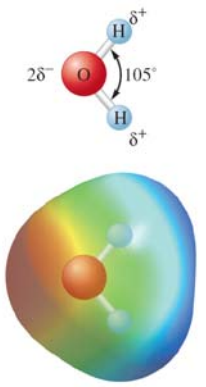
Clicker quiz

- You may refer to your Hanson workbook
- Answer the questions individually
- In each case indicate the best answer
- No paper responses will be accepted

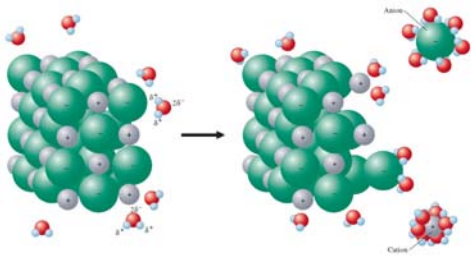
Solution concentration and dilution (continued)

Ch 4 of Zumdahl

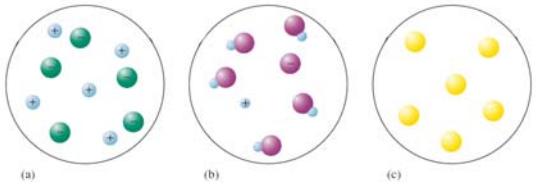
Water is bent and polar



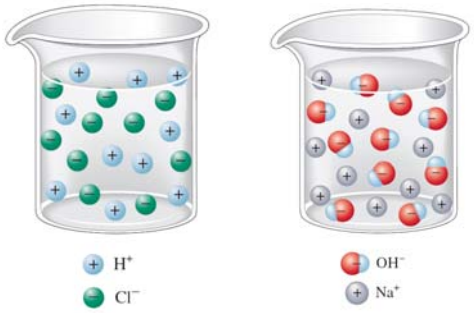
Water dissolves many salts



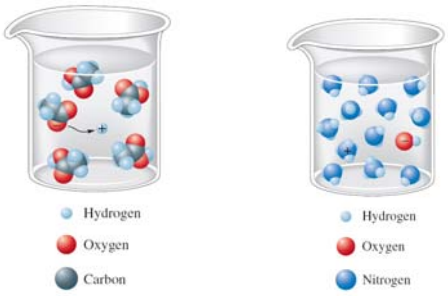
Strong and Weak electrolytes



Strong Acids and Bases



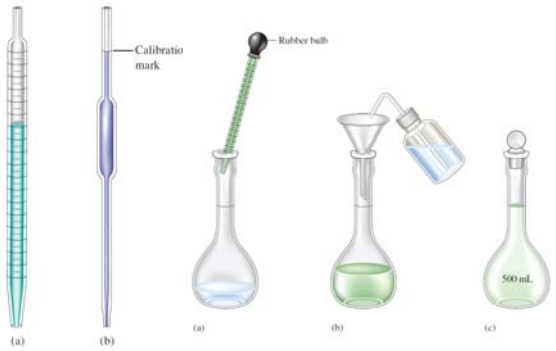
Weak Acids and Bases



Acetic Acid

Ammonia in water

Dilution: how to measure volumes



Model (p.82)at Projector (without X's)

Calculate the mass of $Ag_2CO_3(s)$ produced by mixing 125 mL of 0.315 M $Na_2CO_3(aq)$ with 75.0 mL of 0.155 $AgNO_3(aq)$.

- Write the balanced net ionic reaction
- Determine initial ion amounts
- Determine the limiting reactant
- Calculate the amount of $Ag_2CO_3(s)$ produced.

Ex 1(p.84)at Projector (without X's)

Calculate the mass of $Fe(OH)_3(s)$ produced by mixing 50.0 mL of 0.153 M KOH(aq) with 25.0 mL of 0.255 $Fe(NO_3)_3(aq)$ and the moles of excess reactant

- Write the balanced net ionic reaction
- Determine initial ion amounts
- Determine the limiting reactant
- Calculate the amount of $Fe(OH)_3(s)$ produced.

Ex 2(p.85) (without X's)

Do Exercise 2 with your partner

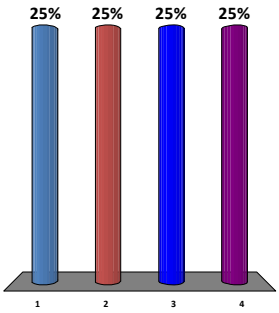
What is the balanced equation

$HCl(aq) + NaOH(aq) = NaCl(aq) + H_2O(l)$

Determine the initial amounts of the reactants

The initial amount of HCl is:

1. 0.25 mol
2. 0.375 mol
3. 0.0375 mol
4. 37.5 mmol



Ex 2(p.85) Which is the excess reactant?

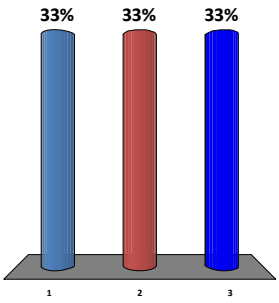
33% 1. HCl

33% 2. NaOH

33% 3. NaCl

What is the final concentration of NaOH?

1. 0.0174 mol/L
2. 0.0087 mol/L
3. 8.7 mmol/mL



Problem (p.86) (without X's)

Do Problem on page 86 with partner outside of class.
You need to know:

- Sulfuric acid is diprotic in this reaction $H_2SO_4(aq) \rightarrow 2H^+(aq) + SO_4^{2-}(aq)$
- NaOH(aq) completely reacts with the sulfuric acid to form $Na_2SO_4(aq)$ and water.
- What is the concentration of NaOH solution?

Problem 4-26

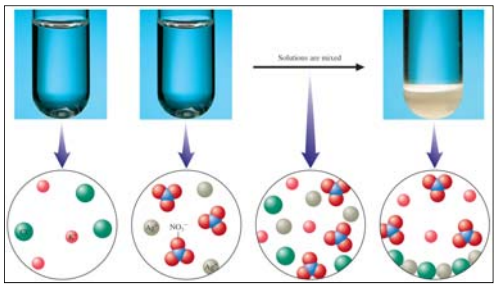
- 1.584 g of Mn(s) is dissolved in nitric acid and diluted to 1.000 L. (*stock solution)*
- *2.883×10^{-2} M Mn^{2+}*
- Solution A: 50.00 mL of stock solution is diluted to 1000.0 mL
- Solution B: 10.00 mL of A is diluted to 250.0 mL
- What are these concentrations?
- 1.442×10^{-3}M; 5.768×10^{-5} M

Hanson Activity 4-2

- Discuss Key Questions 1-4 of Activity 4-2, page 59, with your partner for five minutes.
- The clicker quiz will resume in 5 minutes

Questions about Key Questions on page 59 ?

Precipitation Reaction of KCl(*aq*) with $AgNO_3$(*aq*)



KCl solution $AgNO_3$ solution Solid AgCl
Note: dissociated ions. and dissolved KNO_3

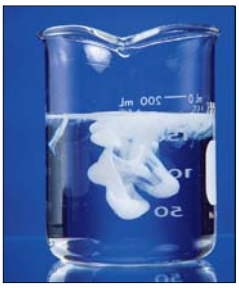
Precipitation of Silver Chloride, AgCl(s)

aq= aqueous (soluble) KNO_3 (aq)

s = solid (or Insoluble) AgCl (s)

l = liquid

g = gas



KCl mixed with $AgNO_3$

- Complete ionic equation
  $K^+(aq) + Cl^-(aq) + NO_3^-(aq) + Ag^+(aq) \rightarrow$
  $K^+(aq) + NO_3^-(aq) + AgCl(s)$
- Net Ionic equation
  $Cl^-(aq) + Ag^+(aq) \rightarrow AgCl(s)$
- Balanced Molecular Equation
  $AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$

"Simple" Solubility Rules (Zumdahl Table 4.1)

1. Most nitrate (NO_3^-) salts are soluble.
2. Most alkali metal (group 1A) salts and NH_4^+ are soluble.
3. Most Cl^-, Br^-, and I^- salts are soluble (except Ag^+, Pb^{2+}, Hg_2^{2+}).
4. Most sulfate salts are soluble (except $BaSO_4$, $PbSO_4$, Hg_2SO_4, $CaSO_4$).
5. Most OH^- are only slightly soluble (NaOH, KOH are soluble, $Ba(OH)_2$, $Ca(OH)_2$ are marginally soluble).
6. Most S^{2-}, CO_3^{2-}, CrO_4^{2-}, PO_4^{3-} salts are only slightly soluble, except for those containing the cations in Rule 2.

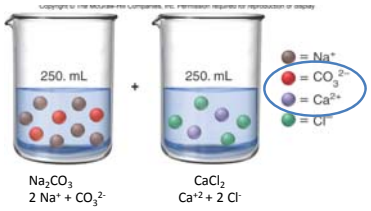
Simpler Solubility Rules

1. Most nitrate (NO_3^-), acetate ($C_2H_3O_2^-$) and perchlorate (ClO_4^-) salts are soluble.
2. Most alkali metal (Li^+, Na^+, K^+, etc.) and NH_4^+ salts are soluble.
3. Most Cl^-, Br^-, and I^- salts are soluble (except Ag^+, Pb^{2+}, Hg_2^{2+}).
4. Most sulfate (SO_4^{2-})salts are soluble (except $BaSO_4$, $PbSO_4$, Hg_2SO_4, $CaSO_4$).
5. $Ba(OH)_2$ and $Ca(OH)_2$ are marginally soluble
6. Most other salts are insoluble.

A-B(aq) + C-D(aq) → A-D + C-B

Method to predict insoluble product: Consider dissociated ions A^+(aq), B^-(aq) & C^+(aq), D^-(aq)

Exchange partners and ask is A-D or C-B insoluble?



Questions about Key Questions on p. 59?

- With Partner, do Ex 1 on p. 59

HA 4-2, Ex 2a, p. 60

2a) Lead(II) acetate and sodium carbonate (note: you should know the ions and how to write the formulas or have them on your card)
Write these steps in your workbook!!

ii. Write formulas for reactants and write the ions that they dissociate into:

$Pb(C_2H_3O_2)_2$ (aq) + Na_2CO_3 (aq) dissociate into

Pb^{2+}(aq) + 2 $C_2H_3O_2^-$(aq) + $2Na^+$ (aq) + CO_3^{2-}(aq)

iii. Will precipitation occur? (solubility rules, exchange partners between anions and cations)

→ $2Na(C_2H_3O_2)$(aq - soluble) + $PbCO_3$(s - insoluble)

04-2 Precipitation Reactions

iv. Total Ionic Equation: includes spectator ions

Pb^{2+}(aq) + $2C_2H_3O_2^-$(aq) + $2Na^+$(aq) + CO_3^{2}(aq)

→ $2C_2H_3O_2^-$(aq) + $2Na^+$ (aq) + $PbCO_3$(s)

04-2 Precipitation Reactions

v) Net Ionic Equation omits spectator ions:

Pb^{2+}(aq) + CO_3^{2-}(aq) → $PbCO_3$(s)

vi) Formula Equation (also called Molecular Equation) has formulas:

$Pb(C_2H_3O_2)_2$ (aq) + Na_2CO_3 (aq)

→ $2Na(C_2H_3O_2)$(aq) + $PbCO_3$(s)

Hanson 04-2

- With partner, do Ex 2b and 2c following the example Ex 2a that we did in class

Problem 4-33b

- Write all three types of reaction for:
- Lead(II) nitrate and sodium chloride
- Consider mixing *exactly* stiochiometric amounts of lead nitrate and sodium chloride

$Pb^{2+}(aq) + 2\ Cl^{-}(aq) \rightarrow PbCl_2(s)$

If *exactly* stoichiometric amounts of reactants are mixed, will the resulting solution conduct electricity after the precipitate settles to the bottom?

1. Yes
2. No

Problem 4-41

- What mass of Na_2CrO_4 (s) is needed to precipitate all of Ag^+ ions 75.00 mL of 0.100 M $AgNO_3$ solution?
- 0.607 g

Problem 4-47

- 1.42 g of M_2SO_4 was dissolved and treated with *excess* $CaCl_2$(aq), precipitating *all* of the sulfate as 1.36 g of $CaSO_4$(s).
- What element is M?
- How to begin? What do we know?
- Same amount of sulfate in both samples.
- Calculate the mass of sulfate in the precipitate

1.42 g of M_2SO_4 was dissolved and treated with *excess* $CaCl_2$(aq), precipitating *all* of the sulfate as 1.36 g of $CaSO_4$(s).

- Calculate the mass of sulfate in the precipitate
- How?

$$\text{mass sulfate} = \text{mass sample} \times \left(\frac{\text{MW of } SO_4^{2-}}{\text{MW of } CaSO_4} \right)$$

$$\text{mass sulfate} = 1.36\ \text{g} \times \left(\frac{96.07\ \text{g/mol}}{136.15\ \text{g/mol}} \right) = 0.960 g$$

1.42 g of M_2SO_4 was dissolved and treated with *excess* $CaCl_2(aq)$, precipitating *all* of the sulfate as 1.36 g of $CaSO_4(s)$.

- How much sulfate in original sample?
- 0.960 g
- How much M in original sample?
- 0.460 g
- What do we need to determine M?
- Moles of M

$$\text{mass sulfate} = 1.36\text{ g} \times \left(\frac{96.07\text{ g/mol}}{136.15\text{ g/mol}} \right) = 0.960 g$$

From 1.42 g of M_2SO_4 is formed 1.36 g of $CaSO_4(s)$. Which is true?

3% 1. Moles of M = Moles of sulfate
3% 2. Moles of M = 2 x Moles of sulfate
3% 3. Moles of M = Moles of Ca

Thursday, Feb 7, Ch 4 cont'd

Hanson Activity 4-3

- Discuss Key Questions 1-4 of Activity 4-3, page 63, with your partner for five minutes.
- The clicker quiz will commence at 8:50 sharp

Clicker quiz

- You may refer to your Hanson workbook
- Answer the questions individually
- In each case indicate the best answer
- No paper responses will be accepted

Exercises 1-2, p. 63

- Reaction 1:
  $HCl(aq) + NH_3(aq) \rightarrow NH_4^+(aq) + Cl^-(aq)$
- Reverse of Reaction 1:
  $HCl(aq) + NH_3(aq) \leftarrow NH_4^+(aq) + Cl^-(aq)$
  acid base

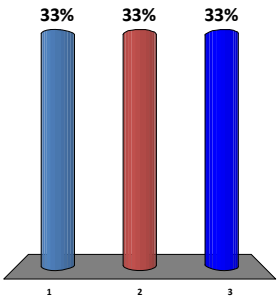
Continue with your partner

Exercise 3, p. 63

- Ammonia plus nitrous acid with partner

For reaction of NH_3 and HNO_2, what is the *base* on the *product* side:

1. $NO_2^-(aq)$
2. $NH_4^+(aq)$
3. $NH_3(aq)$



- Complete Ex 4, p.64 – already done
- Skip Exercises 5 – 7
- Do the first part of Ex 8 question

Ex 8, page 65 of Hanson: Which reactant is a base?

50% 1. H_2SO_4

50% 2. HPO_4^{2-}

Hanson Activity 4-4

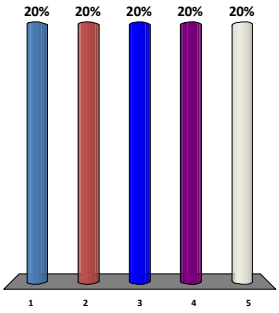
- Discuss Key Questions 1-4 of Activity 4-4, page 68, with your partner for five minutes.
- The clicker quiz will resume in 5 minutes

Exercise 1, page 69, using Model 1

- At the projector: O_2, H_2O, CH_4, CO_2, and SF_6
- With your partner complete Ex 1

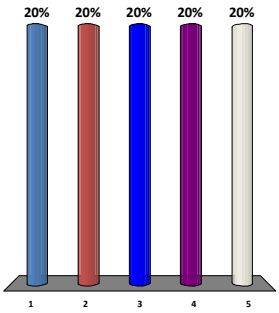
In SO_4^{2-}, the oxidation number of S is:

1. +2
2. +4
3. +6
4. -2
5. -4



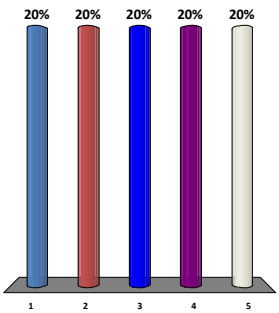
In H_2S, the oxidation number of S is:

1. +2
2. +4
3. +6
4. -2
5. -4



In Na_2SO_3, the oxidation number of S is:

1. +2
2. +4
3. +6
4. -2
5. -4



Model 2, p. 70 Key Questions

$2\ Cu(s) + O_2(g) \rightarrow 2\ CuO(s)$

5. How many electrons are transferred from one copper atom to one oxygen atom?
6. What are the oxidation numbers in all three species?
7. What species is oxidized? What species is reduced?

Model 2, p. 70 Key Questions

$2\ Cu(s) + O_2(g) \rightarrow 2\ CuO(s)$

8. What is the oxidizing agent? The reducing agent?
9. If a species has an increase in oxidation number, is it an oxidizing agent or reducing agent?
10. How can we distinguish redox reactions from the other types.

Model 2, p. 70 Key Questions

- Exercise 2 a at projector
  $FeO(s) + CO(g) = Fe(s) + CO_2(g)$
- Is it balanced?
- Can you tell from the number of electrons transferred?
- Do Exercises 2b-2f with partner. (2f is unbalanced)

Problem 4-69c to balance:

- $C_3H_8(g) + O_2(g) = CO_2(g) + H_2O(l)$

  -8/3 +1 0 +4 -2 +1 -2

Can be done by inspection

$C_3H_8(g) + O_2(g) = 3\ CO_2(g) + H_2O(l$

$C_3H_8(g) + O_2(g) = 3\ CO_2(g) + 4\ H_2O(l)$

$C_3H_8(g) + 5\ O_2(g) = 3\ CO_2(g) + 4\ H_2O(l)$

Do the electrons exchanged balance?

C: 3 atoms from -8/3 to +4 = 3 x (20/3) = 20

O: 10 atoms from 0 to -2 = 10 x (2) = 20

Problem 71-a in acid soln

- $Cu(s) + NO_3^-(aq) = Cu^{2+}(aq) + NO(g)$
- 0 +5 -2 +2 +2 -2
- Each copper atom loses 2 electrons (0 -> +2)
- Each nitrogen atom gains 3 electrons (+5 -> +2)
- What must be the ratio of N to Cu atoms?
- 3 Cu: 2 N
- $3\ Cu(s) + 2\ NO_3^-(aq) = 3Cu^{2+}(aq) + 2\ NO(g)$
- Hydrogen ions are available to balance charge, yielding water as needed.
- $3\ Cu(s) + 2\ NO_3^-(aq) + 8H^+ = 3Cu^{2+}(aq) + 2\ NO(g) + 4H_2O$