

13. (Acids and bases, amphoterism) **Demonstration:** Three Petri dishes are partially filled with concentrated NaCl solution, concentrated NaOH solution and concentrated HCl solution and placed on an overhead projector. A small piece of aluminum foil is added to each dish. Reaction occurs in the solutions of HCl and NaOH. Which ions appear to react with the Al metal based on this experiment? (The observed induction period with base can also be used to discuss the thin coating of aluminum oxide that must first be dissolved for the reaction with base to occur.)

Na^+ , OH^- , Cl^- , H^+

14. (Redox) $\text{Cu(s)} + 1/2 \text{O}_2 \text{(g)} \rightarrow \text{CuO (s)}$

The oxidation number of copper in the product is

Cu(0) , Cu(I) , Cu(II)

In the reaction, copper metal is

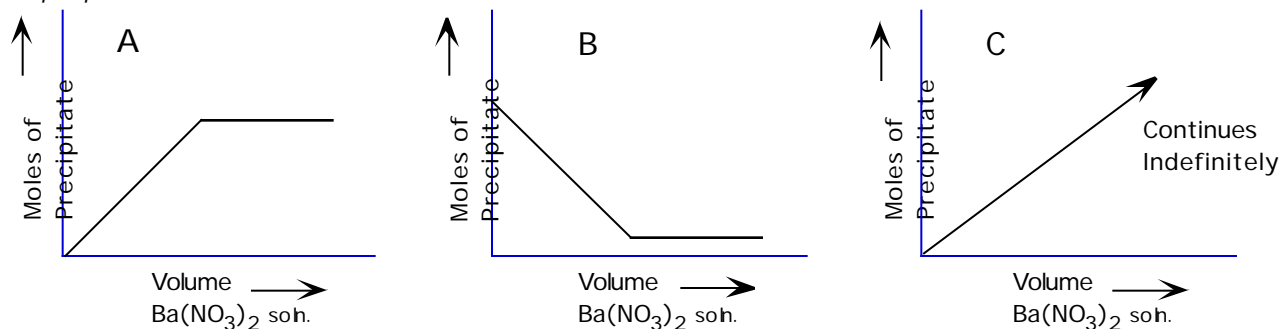
reduced, **oxidized**, unchanged in oxidation state

15. (Limiting reagents, precipitation, solubility) **Demonstration:** A solution of $\text{Ba(NO}_3)_2$ is added to a solution of Na_2SO_4 to make a precipitate. From a table of solubility rules, the product is

barium sulfate, sodium nitrate

The amount of precipitate collected from the fixed amount of Na_2SO_4 solution as the $\text{Ba(NO}_3)_2$ is added indefinitely will look like which graph below?

A, B, C



The break point of the graph will occur when the ratio of moles of Ba^{2+} to moles of SO_4^{2-} is

1:1, 1:2, 2:1

52. (Solid-state synthesis, solid solutions; Ch. 3 & 10 "Companion") Which synthetic methods would intimately mix Si and Ge on the atomic scale to create $\text{Si}_x\text{Ge}_{1-x}$ solid solutions?

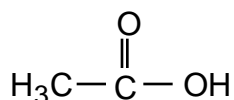
co-grinding, **co-melting and condensing**, **co-vaporizing and condensing**

68. (pH scale) A solution with $\text{pH}=5$ is 100 times more acidic than a solution with a $\text{pH}=?$

7, 3, 0.05

69. (Weak acids) In acetic acid, pictured below, from where will the H^+ come?

O-H or C-H



70. (Weak acids, Le Châtelier's principle) $\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$; $\text{pK}_a=5$

To make more CH_3COOH , add

NaOH, HCl

To make more CH_3COO^- , add

NaOH, HCl

At $\text{pH}=2$, what is the most prevalent species?

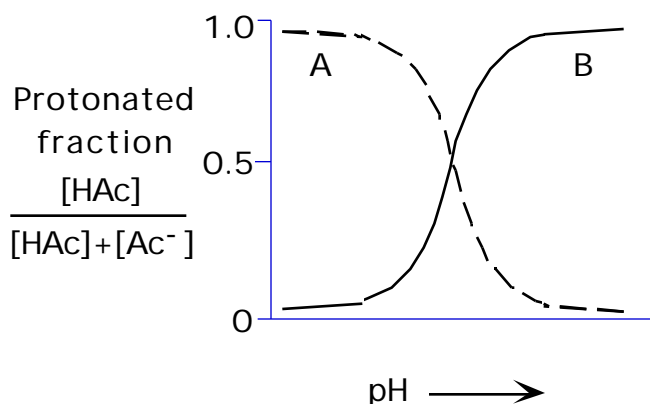
CH_3COOH , CH_3COO^- , equal amounts of the acid and its conjugate base

At $\text{pH}=5$, what is the most prevalent species?

CH_3COOH , CH_3COO^- , equal amounts of the acid and its conjugate base

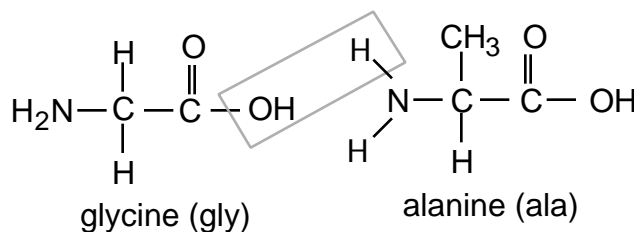
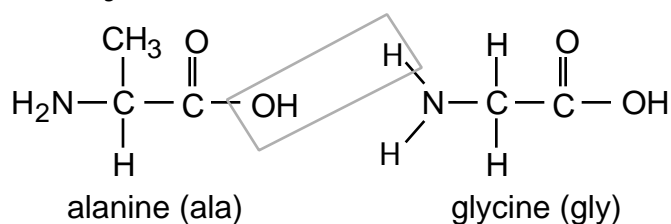
Which plot shows the correct distribution of acetic acid as a function of pH?

A, B

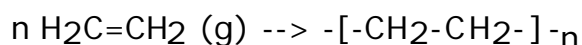


72. (Amino acid sequences) Amino acids are joined by peptide bonds formed through condensation reactions. Is the compound gly-ala the same as ala-gly (see figure below)?

yes, no



75. (Polymers, thermodynamics) Consider the polymerization of ethylene in which, neglecting the ends of the polymer, many $\text{C}=\text{C}$ double bonds worth ~ 600 kJ/mol each are converted to twice as many $\text{C}-\text{C}$ single bonds in polyethylene worth ~ 350 kJ/mol each.



This reaction is

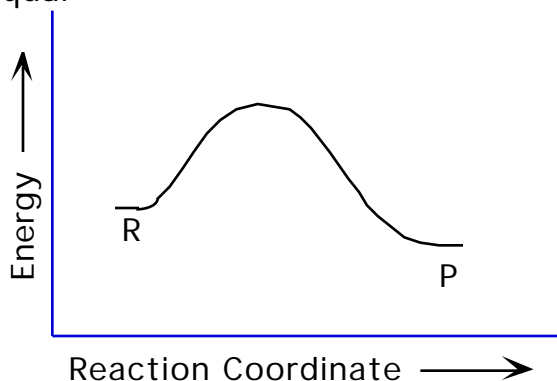
exothermic, endothermic, thermoneutral

What happens to the entropy in this reaction?
increases, **decreases**, remains the same

100. (pH scale) **Demonstration:** Predict a pH value for 0.1 M NaOH.
1, 7, **13**

101. (Buffers) When adding acid to an acetate buffer, H^+ reacts with CH_3COOH , CH_3COO^-

105. (Reaction profiles) Considering the reaction profile below, the activation energy is larger when the reaction proceeds in which direction?
forward, **reverse**, equal



106. (Photosynthesis) $\text{O}_2 + [\text{CH}_2\text{O}] \rightleftharpoons \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$
carbohydrate

Does the forward or reverse reaction represent photosynthesis?
forward reaction, **reverse reaction**

123. (Acids and bases, indicators) **Demonstration:** Strong base is added to a solution containing methyl red indicator, giving a red color; adding strong acid gives a yellow color. The deprotonated form of the methyl red indicator is yellow, **red**

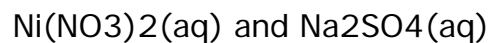
135. (Acids and bases, pH scale) **Demonstration:** The pH of 90 mL of a 0.1 M solution of HCl is measured with a digital pH meter and shown to be about 1. Roughly how many mL of water need to be added to reach a pH of about 2?
10, 100, **1000**

146. (Ions) Solutions of NaNO_3 and K_2SO_4 are dissolved in water and the water then allowed to evaporate. How many possible salts could be recovered?
2, 3, **4**

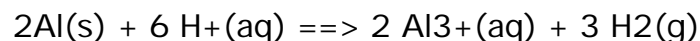
178. A beaker contains 100 mL of salt water. If 100 mL of distilled water is added to the beaker, the number of moles of NaCl

increases by 50%, decreases by 50%, **doesn't change**

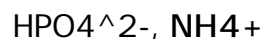
186. To prepare nickel (II) sulfate by combining two reagents and evaporating the resulting solution to dryness, which pair of reagents would you use?



187. Identify the oxidizing agent in the reaction:



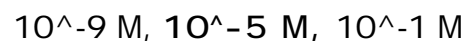
198. In the following reaction, which species is acting as an acid?



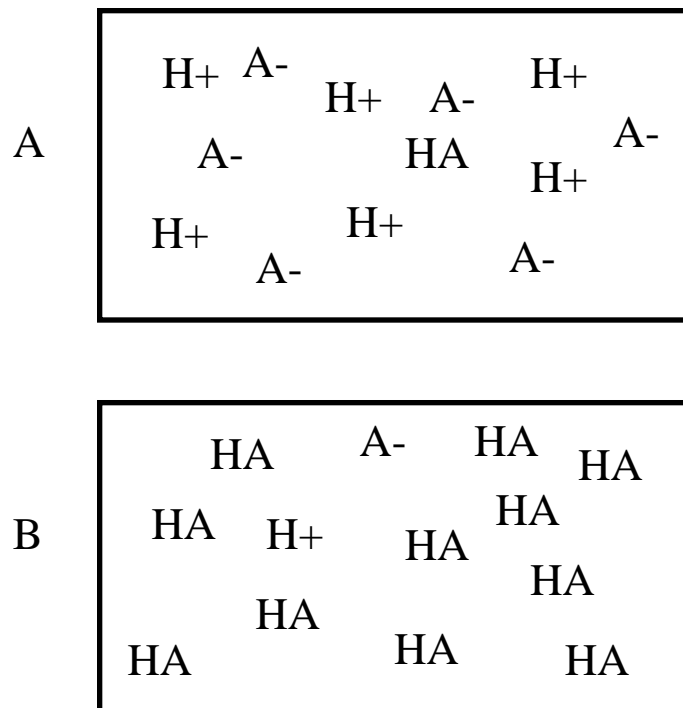
199. Which of the following will act as a Lewis Acid?



200. What concentration of HNO_3 must be added to water to make $[\text{OH}^-] = 10^{-9}\text{M}$?



201. Which of the following "molecular" pictures best represents a concentrated solution of the weak acid HA with $K_a = 10^{-5}$?



A, B

202. When dissolved in water, which of the following salts will produce a basic solution?

KF, KNO_3 , NH_4NO_3

203. What is the correct expression for the solubility product constant for $Mg_3(PO_4)_2$?

$$K_{sp} = [Mg^{2+}] [PO_4^{3-}]$$

$$K_{sp} = [Mg^{2+}]^2 [PO_4^{3-}]^3$$

$$K_{sp} = [Mg^{2+}]^3 [PO_4^{3-}]^2$$