## **AP MULTIPLE CHOICE QUESTIONS** CH. 16, SET 2

## 1989

55.

- The test for the presence of Ag+ in an unknown solution involves the treatment of the silver-ammonia complex 52. with dilute hydrochloric acid. The appearance of a white precipitate at this point indicates the presence of silver ion in the original sample. The net ionic equation that represents this test is
  - $Ag(NH_4)_4^+ + 4H^+$   $Ag(NH_4)_4^+ + Cl^ Ag(s) + 4NH_4^+$ (A) ⇒  $\begin{array}{rcl} Ag(NH_4)_4^+ + CI^- \rightleftharpoons & AgCl(s) + 4NH_4^+ \\ Ag(NH_3)_4^+ + 4HCl \rightleftharpoons & AgCl(s) + 4NH_4^+ + 3CI^- \\ Ag(NH_3)_2^+ + CI^- \rightleftharpoons & Ag(NH_3)_2Cl(s) \\ Ag(NH_3)_2^+ + 2H^+ + CI^- \rightleftharpoons & AgCl(s) + 2NH_4^+ \end{array}$ **(B)** (C) (D)
  - (E)

$$H_2PO_4^- + HBO_3^{2-} \rightleftharpoons HPO_4^{2-} + H_2BO_3^{--}$$

The equilibrium constant for the reaction represented by the equation above is greater than 1.0. Which of the following gives the correct relative strengths of the acids and bases in the reaction?

(A) $H_2PQ_1^{-2} > H_2BQ_3^{-1}$ $HBQ_2^{-2} > HPQ_4^{-2}^{-2}$ (B) $H_3PQ_3^{-1} > H_2PQ_4^{-1}$ $HBQ_3^{-2} > HPQ_4^{-2}^{-2}$ (C) $H_2PQ_4^{-1} > H_2PQ_3^{-1}$ $HPQ_4^{-2} > HBQ_3^{-2}^{-2}$ (D) $H_3PQ_4^{-1} = H_2PQ_3^{-1}$ $HPQ_4^{-2} > HBQ_3^{-2}^{-2}$ (E) $H_2PQ_4^{-1} = H_2BQ_3^{-1}$ $HPQ_4^{-2} > HBQ_3^{-2}^{-2}$ (B) $2.0 \times 10^{-7}$ (C) $5.0 \times 10^{-6}$ (E) $2.0 \times 10^{-3}^{-3}$ (B) $2.0 \times 10^{-7}$ (D) $5.0 \times 10^{-3}$ (B) $8.10 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (E) $1.62 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (C) $1.35 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (C) $1.60 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (C) $1.60 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (C) $1.60 \times 10^{-2}$ mole (D) $1.50 \times 10^{-2}$ mole (E) $1.62 \times 10^{-2}$ mole (B) $1.10 \text{ may}$ (C) $1 \text{ and III}$ (E) II and III (B) III only (C) $I \text{ and III}$ (E) II and III (B) III only (C) $I \text{ and III}$ (E) II and III (B) III only (C) $1.35 \times 10^{-2}$ (C) $2.8 \times 10^{-2}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ (A) $NaNQ_3$ (B) $Na_2CQ_3$ (C) $NH_4CI$ (D) $NaHSQ_4$ (E) $Na_2SQ_4$			00	Acid	S	0		Bases					
(b) $H_2DO_3^- > H_2PO_4^ HBO_3^{-2} > HPO_4^{2-}$ (C) $H_2PO_4^- > H_3BO_3^ HPO_4^{2-} > HBO_3^{-2-}$ (D) $H_2BO_3^- > H_2PO_4^ HPO_4^{2-} > HBO_3^{-2-}$ (E) $H_2PO_4^- = H_3BO_3^ HPO_4^{2-} > HBO_3^{-2-}$ (E) $H_2PO_4^- = H_3BO_3^ HPO_4^{2-} > HBO_3^{-2-}$ 56. A 0.20-molar solution of a weak monoprotic acid, HA, has a pH of 3.00. The ionization constant of this acid is: (A) $5.0 \times 10^{-7}$ (C) $5.0 \times 10^{-6}$ (E) $2.0 \times 10^{-3}$ (B) $2.0 \times 10^{-7}$ (D) $5.0 \times 10^{-3}$ 67. BrO_3^- + 5Br^- + 6H^+ $\neq$ 3Br <sub>2</sub> + 3H <sub>2</sub> O If 25.0 milliliters of 0.200 molar BrO_3^- is mixed with 30.0 milliliters of 0.450 molar Br^- solution that contains a large excess of H <sup>+</sup> , the amount of Br <sub>2</sub> formed, according to the equation above is (A) $5.00 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (E) $1.62 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole (A) If $HSO_4^+ + H_2O \neq H_3O^+ + SO_4^{-2-}$ In the equilibrium represented above, the species that act as bases include which of the following? I. $HSO_4^-$ II. $H2O_4^-$ III. $SO_4^{-2-}$ (A) II only (C) I and II (E) II and III (B) III only (D) I and III (B) III only (D) I and III (C) $2.8 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> CI (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		(A)		$H_2PO_4^- > H_2PO_4^-$	$\frac{5}{H_2BO_2}$		HB	$\frac{1}{O_2^{2^-}} > HP($	${\Omega_4}^{2-}$				
(C) $H_2PO_4^{-} > H_3BO_3^{}$ $HPO_4^{-2} > HBO_3^{-2}$ (D) $H_2BO_3^{-} > H_2PO_4^{}$ $HPO_4^{-2} > HBO_3^{-2}$ (E) $H_2PO_4^{} = H_2BO_3^{}$ $HPO_4^{-2} > HBO_3^{-2}$ (E) $H_2PO_4^{} = H_2BO_3^{}$ $HPO_4^{-2} > HBO_3^{-2}$ 56. A 0.20-molar solution of a weak monoprotic acid, HA, has a pH of 3.00. The ionization constant of this acid is: (A) $5.0 \times 10^{-7}$ (C) $5.0 \times 10^{-6}$ (E) $2.0 \times 10^{-3}$ (B) $2.0 \times 10^{-7}$ (D) $5.0 \times 10^{-3}$ 67. $BrO_3^{-+} + 5Br^{-+} + 6H^{+} = 3Br_2 + 3H_2O$ If 25.0 millilters of 0.200 molar BrO_3^{} is mixed with 30.0 milliliters of 0.450 molar Br <sup>-</sup> solution that contains a large excess of H <sup>+</sup> , the amount of Br <sub>2</sub> formed, according to the equation above is (A) $5.00 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (E) $1.62 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole 1994 22. $HSO_4^{-+} H_2O \neq H_3O^{+} + SO_4^{-2-}$ In the equilibrium represented above, the species that act as bases include which of the following? I. $HSO_4^{}$ (A) II only (C) I and II (E) II and III (B) III only (D) I and III 31. $H_2C_2O_4 + 2H_2O \neq 2H_3O^{+} + C_2O_4^{-2-}$ Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> CI (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		$(\mathbf{B})$	-	$H_2BO_3^- > 1$	$H_2 P O_4^-$		HB	$O_3^{2^-} > HP($	$D_{4}^{2-}$				
(b) H <sub>1</sub> BO <sub>3</sub> <sup>-&gt;</sup> H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> HPO <sub>4</sub> <sup>2</sup> > HBO <sub>3</sub> <sup>2</sup> . (E) H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> = H <sub>2</sub> BO <sub>3</sub> <sup>-</sup> HPO <sub>4</sub> <sup>2</sup> > HBO <sub>3</sub> <sup>2</sup> . (E) H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> = H <sub>2</sub> BO <sub>3</sub> <sup>-</sup> HPO <sub>4</sub> <sup>2</sup> > HBO <sub>3</sub> <sup>2</sup> . 56. A 0.20-molar solution of a weak monoprotic acid, HA, has a pH of 3.00. The ionization constant of this acid is: (A) 5.0 x 10 <sup>-7</sup> (C) 5.0 x 10 <sup>-6</sup> (E) 2.0 x 10 <sup>-3</sup> (B) 2.0 x 10 <sup>-7</sup> (D) 5.0 x 10 <sup>-3</sup> 67. BrO <sub>3</sub> <sup>-</sup> + 5Br <sup>-</sup> + 6H <sup>+</sup> $\neq$ 3Br <sub>2</sub> + 3H <sub>2</sub> O If 25.0 milliliters of 0.200 molar BrO <sub>3</sub> <sup>-</sup> is mixed with 30.0 milliliters of 0.450 molar Br <sup>-</sup> solution that contains a large excess of H <sup>+</sup> , the amount of Br <sub>2</sub> formed, according to the equation above is (A) 5.00 x 10 <sup>-3</sup> mole (C) 1.35 x 10 <sup>-2</sup> mole (E) 1.62 x 10 <sup>-2</sup> mole (B) 8.10 x 10 <sup>-3</sup> mole (D) 1.50 x 10 <sup>-2</sup> mole 1994 22. HSO <sub>4</sub> <sup>-</sup> + H <sub>2</sub> O $\neq$ H <sub>3</sub> O <sup>+</sup> + SO <sub>4</sub> <sup>2-</sup> In the equilibrium represented above, the species that act as bases include which of the following? I. HSO <sub>4</sub> <sup>-</sup> H <sub>2</sub> O III. SO <sub>4</sub> <sup>2-</sup> (A) II only (C) I and II (E) II and III (B) III only (D) I and III 31. H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\neq$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> , is a diprotic acid with k <sub>1</sub> = 5.36 x 10 <sup>-2</sup> and k <sub>2</sub> = 5.3 x 10 <sup>-5</sup> . For the reaction above, what is the equilibrium constant? (A) 5.36 x 10 <sup>-2</sup> (C) 2.8 x 10 <sup>-6</sup> (E) 1.9 x 10 <sup>-13</sup> 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> C1 (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		$(\mathbf{C})$		$H_2PO_4^- > H_2PO_4^-$	$H_2BO_2^-$		HPO	$D_{4}^{2-} > HB($	$D_{2}^{2}$				
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67. $\begin{array}{cccccccccccccccccccccccccccccccccccc$		(B)	2.0 x 10 <sup>-7</sup>			(D)	5.0 x	10 <sup>-3</sup>					
If 25.0 milliliters of 0.200 molar BrO <sub>3</sub> <sup>-</sup> is mixed with 30.0 milliliters of 0.450 molar Br <sup>-</sup> solution that contains a large excess of H <sup>+</sup> , the amount of Br <sub>2</sub> formed, according to the equation above is (A) 5.00 x 10 <sup>-3</sup> mole (C) 1.35 x 10 <sup>-2</sup> mole (E) 1.62 x 10 <sup>-2</sup> mole (B) 8.10 x 10 <sup>-3</sup> mole (D) 1.50 x 10 <sup>-2</sup> mole (E) 1.62 x 10 <sup>-2</sup> mole <b>1994</b> 22. HSO <sub>4</sub> <sup>-</sup> + H <sub>2</sub> O $\neq$ H <sub>3</sub> O <sup>+</sup> + SO <sub>4</sub> <sup>2-</sup> In the equilibrium represented above, the species that act as bases include which of the following? I. HSO <sub>4</sub> <sup>-</sup> II. H <sub>2</sub> O III. SO <sub>4</sub> <sup>2-</sup> (A) II only (C) I and II (E) II and III (B) III only (D) I and III <b>31.</b> H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\neq$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> , is a diprotic acid with k <sub>1</sub> = 5.36 x 10 <sup>-2</sup> and k <sub>2</sub> = 5.3 x 10 <sup>-5</sup> . For the reaction above, what is the equilibrium constant? (A) 5.36 x 10 <sup>-2</sup> (C) 2.8 x 10 <sup>-6</sup> (E) 1.9 x 10 <sup>-13</sup> (B) 5.3 x 10 <sup>-5</sup> (D) 1.9 x 10 <sup>-10</sup> <b>61.</b> A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>	67.			BrO <sub>3</sub> -	+ 5Br	- + 6H	<sup>+</sup> <b>≠</b> 3B	$r_2 + 3H_2O$					
large excess of H <sup>+</sup> , the amount of Br <sub>2</sub> formed, according to the equation above is (A) $5.00 \times 10^{-3}$ mole (C) $1.35 \times 10^{-2}$ mole (E) $1.62 \times 10^{-2}$ mole (B) $8.10 \times 10^{-3}$ mole (D) $1.50 \times 10^{-2}$ mole <b>1994</b> <b>22.</b> HSO <sub>4</sub> <sup>-</sup> + H <sub>2</sub> O $\neq$ H <sub>3</sub> O <sup>+</sup> + SO <sub>4</sub> <sup>2-</sup> In the equilibrium represented above, the species that act as bases include which of the following? I. HSO <sub>4</sub> <sup>-</sup> II. H <sub>2</sub> O III. SO <sub>4</sub> <sup>2-</sup> (A) II only (C) I and II (E) II and III (B) III only (D) I and III <b>31.</b> H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\neq$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> , is a diprotic acid with k <sub>1</sub> = 5.36 x 10 <sup>-2</sup> and k <sub>2</sub> = 5.3 x 10 <sup>-5</sup> . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ <b>61.</b> A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		If 25.0 milliliters of 0.200 molar BrO <sub>3</sub> is mixed with 30.0 milliliters of 0.450 molar Br solution that contains a											
(A) $5.00 \times 10^{-3} \text{ mole}$ (C) $1.35 \times 10^{-2} \text{ mole}$ (E) $1.62 \times 10^{-2} \text{ mole}$ (B) $8.10 \times 10^{-3} \text{ mole}$ (D) $1.50 \times 10^{-2} \text{ mole}$ (E) $1.62 \times 10^{-2} \text{ mole}$ 1994 22. HSO <sub>4</sub> <sup>-</sup> + H <sub>2</sub> O $\neq$ H <sub>3</sub> O <sup>+</sup> + SO <sub>4</sub> <sup>2-</sup> In the equilibrium represented above, the species that act as bases include which of the following? I. HSO <sub>4</sub> <sup>-</sup> II. H <sub>2</sub> O III. SO <sub>4</sub> <sup>2-</sup> (A) II only (C) I and II (E) II and III (B) III only (D) I and III 31. H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\neq$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\neq$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + a diprotic acid with k <sub>1</sub> = 5.36 \times 10^{-2} and k <sub>2</sub> = 5.3 \times 10^{-5}. For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		large excess of $H_{+}^{+}$ , the amount of Br <sub>2</sub> formed, according to the equation above is											
(B) $8.10 \ge 10^{-3} \mod$ (D) $1.50 \ge 10^{-2} \mod$ <b>1994</b> <b>22.</b> HSO <sub>4</sub> <sup>-+</sup> + H <sub>2</sub> O $\rightleftharpoons$ H <sub>3</sub> O <sup>+</sup> + SO <sub>4</sub> <sup>2-</sup> In the equilibrium represented above, the species that act as bases include which of the following? I. HSO <sub>4</sub> <sup>-</sup> II. H <sub>2</sub> O III. SO <sub>4</sub> <sup>2-</sup> (A) II only (C) I and II (E) II and III (B) III only (D) I and III <b>31.</b> H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> + 2H <sub>2</sub> O $\rightleftharpoons$ 2H <sub>3</sub> O <sup>+</sup> + C <sub>2</sub> O <sub>4</sub> <sup>2-</sup> Oxalic acid, H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> , is a diprotic acid with k <sub>1</sub> = 5.36 x 10 <sup>-2</sup> and k <sub>2</sub> = 5.3 x 10 <sup>-5</sup> . For the reaction above, what is the equilibrium constant? (A) 5.36 x 10 <sup>-2</sup> (C) 2.8 x 10 <sup>-6</sup> (E) 1.9 x 10 <sup>-13</sup> (B) 5.3 x 10 <sup>-5</sup> (D) 1.9 x 10 <sup>-10</sup> <b>61.</b> A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		(A)	5.00 x 10	<sup>3</sup> mole		(C)	1.35 x	$10^{-2}$ mole		(E)	1.62 x	x 10 <sup>-2</sup> m	ole
1994 22. $HSO_4^- + H_2O \neq H_3O^+ + SO_4^{-2-}$ In the equilibrium represented above, the species that act as bases include which of the following? I. $HSO_4^-$ II. $H_2O$ III. $SO_4^{-2-}$ (A) II only (C) I and II (E) II and III (B) III only (D) I and III31. $H_2C_2O_4 + 2H_2O \neq 2H_3O^+ + C_2O_4^{-2-}$ Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ 61.A 1-molar solution of which of the following salts has the highest pH? (A) $NaNO_3$ (B) $Na_2CO_3$ (C) $NH_4C1$ (D) $NaHSO_4$ (E) $Na_2SO_4$		(B)	8.10 x 10	<sup>3</sup> mole		(D)	1.50 x	$10^{-2}$ mole					
22. $HSO_{4}^{-} + H_{2}O \neq H_{3}O^{+} + SO_{4}^{2-}$ In the equilibrium represented above, the species that act as bases include which of the following? I. HSO_{4}^{-} II. H_{2}O III. SO_{4}^{2-} (A) II only (C) I and II (E) II and III (B) III only (D) I and III 31. $H_{2}C_{2}O_{4} + 2H_{2}O \neq 2H_{3}O^{+} + C_{2}O_{4}^{2-}$ Oxalic acid, $H_{2}C_{2}O_{4}$ , is a diprotic acid with $k_{1} = 5.36 \times 10^{-2}$ and $k_{2} = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>	1994												
In the equilibrium represented above, the species that act as bases include which of the following? I. $HSO_4^-$ II. $H_2O_{III.} SO_4^{2^-}$ (A) II only (C) I and II (E) II and III (B) III only (D) I and III <b>31.</b> $H_2C_2O_4 + 2H_2O \neq 2H_3O^+ + C_2O_4^{2^-}$ Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ <b>61.</b> A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>	22.			HSO <sub>4</sub>	$+ H_2$	C <b>≠</b> H <sub>3</sub>	$O^{+} + S$	$5O_4^{2-}$					
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(B) Iff only (D) I and Iff 31. $H_2C_2O_4 + 2H_2O \rightleftharpoons 2H_3O^+ + C_2O_4^{2^2}$ Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant? (A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ 61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		(A) (D)				$(\mathbf{C})$	I and			(E)	II and	1 111	
<ul> <li>31. H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> + 2H<sub>2</sub>O ≈ 2H<sub>3</sub>O<sup>+</sup> + C<sub>2</sub>O<sub>4</sub><sup>2-</sup> Oxalic acid, H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>, is a diprotic acid with k<sub>1</sub> = 5.36 x 10<sup>-2</sup> and k<sub>2</sub> = 5.3 x 10<sup>-5</sup>. For the reaction above, what is the equilibrium constant? (A) 5.36 x 10<sup>-2</sup> (C) 2.8 x 10<sup>-6</sup> (E) 1.9 x 10<sup>-13</sup> (B) 5.3 x 10<sup>-5</sup> (D) 1.9 x 10<sup>-10</sup></li> <li>61. A 1-molar solution of which of the following salts has the highest pH? (A) NaNO<sub>3</sub> (B) Na<sub>2</sub>CO<sub>3</sub> (C) NH<sub>4</sub>Cl (D) NaHSO<sub>4</sub> (E) Na<sub>2</sub>SO<sub>4</sub></li> </ul>		(B)	III only			(D)	1 and	111					
Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above, what is the equilibrium constant?(A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ (E) $1.9 \times 10^{-13}$ 61. A 1-molar solution of which of the following salts has the highest pH?(A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl(D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>	31.			$H_2C_2C_2$	$D_4 + 2I_4$	$H_2O$	⇒	$2H_{3}O^{+} +$	$C_2 O_4^{2-}$				
what is the equilibrium constant?(A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ (E) $1.9 \times 10^{-13}$ 61. A 1-molar solution of which of the following salts has the highest pH?(A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl(D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		Oxalic acid, $H_2C_2O_4$ , is a diprotic acid with $k_1 = 5.36 \times 10^{-2}$ and $k_2 = 5.3 \times 10^{-5}$ . For the reaction above,											
(A) $5.36 \times 10^{-2}$ (C) $2.8 \times 10^{-6}$ (E) $1.9 \times 10^{-13}$ (B) $5.3 \times 10^{-5}$ (D) $1.9 \times 10^{-10}$ (E) $1.9 \times 10^{-13}$ 61.A 1-molar solution of which of the following salts has the highest pH? (A)NaNO3(B)Na <sub>2</sub> CO3(C)NH <sub>4</sub> Cl(D)NaHSO4(E)Na <sub>2</sub> SO4		what is the equilibrium constant?											,
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<b>61.</b> A 1-molar solution of which of the following salts has the highest pH? (A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>		(B)	5.3 x 10 <sup>-5</sup>			(D)	1.9 x	10 <sup>-10</sup>					
(A) NaNO <sub>3</sub> (B) Na <sub>2</sub> CO <sub>3</sub> (C) NH <sub>4</sub> Cl (D) NaHSO <sub>4</sub> (E) Na <sub>2</sub> SO <sub>4</sub>	61.	A 1-m	olar solutio	on of which	of the f	followir	ng salts	has the hig	hest pH?				
		(A)	NaNO <sub>3</sub>	(B)	Na <sub>2</sub> CO	$O_3$	(C)	NH <sub>4</sub> Cl	(D)	NaHS	$O_4$	(E)	$Na_2SO_4$