These problems are intended to ***supplement*** the problems in the textbook, not ***replace*** them.

Data:

Acids				
Name	*Formula*	K_{a1}	K_{a2}	K_{a3}
acetic acid	$HC_2H_3O_2$	1.8×10^{-5}	x	x
ascorbic acid	$H_2C_6H_6O_6$	8.0×10^{-5}	1.6×10^{-12}	x
benzoic acid	$HC_7H_5O_2$	6.3×10^{-5}	x	x
carbonic acid	H_2CO_3	4.3×10^{-7}	5.6×10^{-11}	x
citric acid	$H_3C_6H_5O_7$	7.4×10^{-4}	1.7×10^{-5}	4.0×10^{-7}
cyanic acid	HCNO	3.5×10^{-4}	x	x
hydrocyanic acid	HCN	4.9×10^{-10}	x	x
hydrofluoric acid	HF	6.8×10^{-4}	x	x
hypochlorous acid	HClO	3.0×10^{-8}	x	x
hypobromous acid	HBrO	2.5×10^{-9}	x	x
hypoiodous acid	HIO	2.3×10^{-11}	x	x
lactic acid	$HC_3H_5O_3$	1.4×10^{-4}	x	x
oxalic acid	$H_2C_2O_4$	5.9×10^{-2}	6.4×10^{-5}	x
phosphoric acid	H_3PO_4	7.5×10^{-3}	6.2×10^{-8}	4.2×10^{-13}
sulfurous acid	H_2SO_3	1.7×10^{-2}	6.4×10^{-8}	x

Bases		
Name	*Formula*	K_b
ammonia	NH_3	1.8×10^{-5}
aniline	$C_6H_5NH_2$	4.3×10^{-10}
butylamine	$C_4H_9NH_2$	5.9×10^{-4}
dimethylamine	$(CH_3)_2NH$	5.4×10^{-4}
ethylamine	$C_2H_5NH_2$	6.4×10^{-4}
hydroxylamine	NH_2OH	1.1×10^{-8}
methylamine	CH_3NH_2	4.4×10^{-4}
pyridine	C_5H_5N	1.7×10^{-9}
trimethylamine	$(CH_3)_3N$	6.4×10^{-5}

Questions

Indicate whether the following aqueous salt solutions are acidic, basic, or neutral:

1. potassium fluoride, KF
2. ammonium bromide, NH_4Br
3. sodium lactate, $NaC_3H_5O_3$
4. aluminum nitrate, $Al(NO_3)_3$
5. anilinium hypobromite, $C_6H_5NH_3BrO$
6. sodium hydrogen oxalate, $NaHC_2O_4$
7. iron(III) chloride, $FeCl_3$
8. methylammonium perchlorate, $CH_3NH_3ClO_4$
9. dimethylammonium cyanide, $(CH_3)_2NH_2CN$
10. potassium iodide, KI

Calculate the pH for the following aqueous salt solutions:

11. 0.350 M sodium hypochlorite, NaClO
12. 0.0621 M potassium benzoate, $KC_7H_5O_2$
13. 0.566 M sodium oxalate, $Na_2C_2O_4$
14. 0.775 M butylammonium chloride, $C_4H_9NH_3Cl$
15. 0.00215 M trimethylammonium nitrate, $(CH_3)_3NHNO_3$
16. 0.0543 M anilinium bromide, $C_6H_5NH_3Br$

Answer the following questions.

17. What concentration of sodium cyanate, NaCNO gives a solution with pH = 8.19?

18. What concentration of potassium hypobromite, KBrO gives a solution with pH = 10.46?

19. What concentration of ammonium chloride, NH_4Cl gives a solution with pH = 4.88?

20. What concentration of ethylammonium iodide, $C_2H_5NH_3I$ gives a solution with pH = 5.12?

21. A 0.18 M solution of the sodium salt of a certain acid (NaX) has a pH of 9.05. What is K_a for the acid (HX)?

22. A weak base, B, forms the salt BHCl (BH^+ and Cl^-). A 0.15 M solution of this salt has a pH of 4.28. What is K_b for the base?

23. Liquid chlorine bleach is typically an aqueous solution of sodium hypochlorite, NaClO. Usually, the concentration is approximately 5% NaClO by weight. Calculate the approximate pH of a bleach solution. Assume no other solutes are present in the solution, and that the density of the solution is 1.0 g/mL.

<u>Answers</u>

If you cannot figure out how to get the correct answer, go to your instructor, Science Tutoring Center, etc.

Note: minor differences in the final answer may be due to different ways of solving the problems and are not a cause for concern.

1. basic
2. acidic
3. basic
4. acidic
5. acidic (K_a for cation > K_b for anion)
6. acidic (K_a for $HC_2O_4^-$ > K_b for $HC_2O_4^-$)
7. acidic
8. acidic
9. basic (K_b for anion > K_a for cation)
10. neutral
11. 10.53
12. 8.51
13. 8.98
14. 5.44
15. 6.23
16. 2.96
17. 0.078 M NaCNO
18. 0.021 M KBrO
19. 0.30 M NH_4Cl
20. 3.6 M $C_2H_5NH_3I$
21. 1.5×10^{-5}
22. 5.6×10^{-7}
23. 10.7