K_a or K_b values can be found in the "Thermodynamics Charts in Course Documents). Report all numerical answers to correct digits/ sig figs. If you are off by a little from one of my answers... it is probably because one of us used a different K

Name: Key

1.	/hat are the conjugate acids for each of the bases?			
	a) CN⁻HCN	b) OH⁻	_H ₂ O	
	c) (CH ₃) ₂ NH(CH ₃) ₂ NH ₂ ⁺	d) HPO4 ²⁻	H ₂ PO ₄ ⁻	
2.	What are the conjugate bases of the following acids?			
	a) HIO ₂ IO ₂	b) NH4 ⁺	NH3	
	c) H ₃ O ⁺ H ₂ O	d) CH₃CH₂COOH	CH ₃ CH ₂ COO ⁻	

3. Fill in the missing items in the following Table:

	Acid	Base	,	Conjugate Acid	Conjugate Base
(A)	CH₃COOH	H ₂ O	÷	H₃O⁺	CH₃COO ⁻
(B)	NH₃	H ₂ O	÷	H₃O⁺	NH ₂ -
(C)	H ₂ O	F	₹	HF	OH⁻
(D)		H ₂ O	\rightarrow		I-
(E)	C₅H₅NH⁺	H ₂ O	÷		

4. Fill in the missing information in the following table

	[H ⁺]	[OH ⁻]	рН	рОН	Acid, Base or Neutral
(A)	1.0x10 ⁻³ M		3	11	
(B)	2.2x10 ⁻⁷ M	4.5x10 ^{−8} M		7.35	
(C)			9.45	4.55	
(D)	2.14x10 ⁻¹³ M			1.33	

- 5. Calculate the pH of the following aqueous solutions.
- a) 0.0035 M calcium hydroxide pH = 11.85

b) 4.5 grams of HCl(g) bubbled into water to make 100. mL of solution.

pH = -.092

c) 1.00 M HClO₄(aq)

pH = 0

6. From the equilibrium concentrations given, calculate K_a for the weak acid: CH₃CO₂H

 $[H_3O+] = [CH_3CO_2^-] = 1.34 \times 10^{-3} M;$

 $[CH_3CO_2H] = 9.866 \times 10^{-2} M$

 $K_a = 1.82 \times 10^{-5}$

7. What is the pH and percent ionization of a 0.55 M solution of Nitrous acid?

pH = 1.8 2.89 % ionization

8. Calculate the pH of pure water at 50.0 °C. (look up the K_w at this Temperature!)

pH = 6.63

9. What is the pH of a 0.010 M solution of hypoiodous acid?

pH = 6.32

10. What is the pH and percent ionization of a .15 M solution of $C_6H_5NH_2$ (aq)?

pH = 8.88

11. The pH of a 0.20 *M* solution of HF is 1.92. Determine K_a for HF from this information.

 $Ka = 7.2 \times 10^{-4}$

12. Phenyl acetic acid ($HC_8H_7O_2$ - a weak acid) is one of the substances that accumulates in the blood of people with phenylketonuria, a condition that can cause mental retardation and even death. A 0.085 M solution of $HC_8H_7O_2$ has a pH of 2.86. Calculate the K_a and pK_a of $HC_8H_7O_2$.

Ka = 2.3 x 10⁻⁵

13. Pick the stronger acid from each of the following pairs

a) CH₃CH₂OH	or	CH₃COOH
b) HClO	or	HBrO
c) H₃PO₄	or	HPO4 ²⁻
d) H ₂ SO ₃	or	H_2SO_4
e) NH4 ⁺	or	NH_3
f) SO ₄ ^{2–}	or	HSO ₄ ⁻
g) H ₂ S	or	H₂O

14. Determine K_a for hydrogen sulfate ion, HSO₄⁻, if in a 0.10 *M* solution, the acid is 29% ionized.

Ka = 0.012

15. Write the hydrolysis reactions that will occur when then each of the following salts is added to water: NaBr, Na₂CO₃, NH₄NO₃, NaF, and C₅H₅NHCl. (Don't forget to remove the spectator ions.) Predict whether each solution will be acidic, basic, or neutral in each case.

(A) pH = 7

- (B) $CO_3^{2-}(aq) + H_2O(I) \rightleftharpoons HCO_3^{-}(aq) + OH^{-}(aq)$
- (C) $NH_4^+(aq) + H_2O(I) \rightleftharpoons H_3O^+(aq) + NH_3(aq)$

(D)

16. Calculate the ionization constant for each of the following acids or bases from the ionization constant of its conjugate base or conjugate acid:

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(a) HS^{-} (as a base) Kb = 1.1 \times 10^{-7}
(b) (CH_3)_3NH^+ Ka = 1.6 x 10<sup>-10</sup>
(c) HAsO_4^{2-} (as a base) Kb = 5.9 \times 10^{-8}
(d) C_6H_5NH_3^+ Ka = 2.6 x 10^{-5}
(e) HSO_3^{-}(as a base) Kb = 5.9 x 10<sup>-13</sup>
                                                              (you will need the Ka and Kb values)
17. Rank from most acidic to most basic:
          KCN
                               NaOH
                                                   HCN
                                                                        NH₃
                                                                                             HNO<sub>3</sub>
                                                                                                                 NH_4NO_3
                                                                                                                 \mathbf{NH}_{\mathbf{3}}
HNO<sub>3</sub>
                    NH_4NO_3
                                                   HCN
                                                                                  KCN
Most acidic
                                                                                                                                   Most basic
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NaOH

18. Calculate the pH of a 0.10 M solution of NaClO.

pH 10.27

19. Determine whether aqueous solutions of the following salts are acidic, basic, or neutral and calculate the pH.

(a) .15 M FeCl $_3$

pH = 1.55

(b) .750 M K₂CO₃

pH = 12.08

(c) .100 M NH_4Br

pH = 5.12

(d) 1.0 M KClO₄

pH = 7