

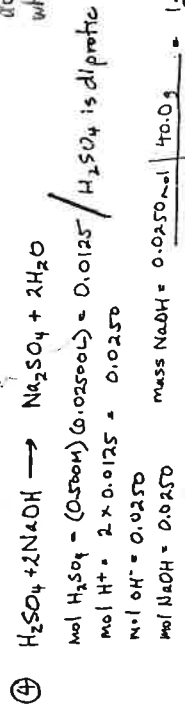
ACID/BASE I REVIEW

KEY

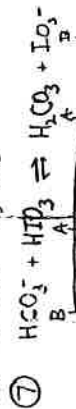
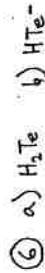
	[H ⁺]	pH	POH	[OH ⁻]	A/B/N?
1)					
a)	3.0 x 10 ⁻² M	1.52	12.48	3.3 x 10 ⁻¹³ M	A
b)	4.6 x 10 ⁻⁸ M	7.34	6.66	2.2 x 10 ⁻⁷ M	B
c)	1.9 x 10 ⁻¹² M	11.72	2.28	5.2 x 10 ⁻³ M	B
d)	5.9 x 10 ⁻⁴ M	8.23	5.77	1.7 x 10 ⁻⁶ M	B
e)	8.0 x 10 ⁻⁵ M	4.10	9.90	1.3 x 10 ⁻¹⁰ M	A
f)	1.0 x 10 ⁻⁷ M	7.00	7.00	1.0 x 10 ⁻⁷ M	N
g)	1.0 x 10 ⁻³ M	3.00	11.00	1.0 x 10 ⁻¹¹ M	A
h)	1.0 M	-1.0	15.0	1 x 10 ⁻¹⁵ M	A
i)	1.1 x 10 ⁻¹² M	11.86	2.06	8.7 x 10 ⁻³ M	B
j)	2.6 x 10 ⁻² M	5.58	8.42	3.8 x 10 ⁻⁷ M	A.

2) [H⁺] = 3.7 x 10⁻⁸ M [OH⁻] = 2.7 x 10⁻⁷ M

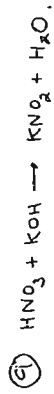
3) a) pH = -0.30 POH = 14.30 b) pH = 10.54, POH = 3.46
 c) 0.70, POH = 13.30.
 (the second proton will be donated to a small degree which we will learn about next unit)



5) M₁V₁ = M₂V₂
 ∴ M₂ = $\frac{M_1 V_1}{V_2}$ = $\frac{(0.15M)(0.02500L)}{0.1000L}$ = 0.0375 M
 [H₃O⁺]_f = 0.0375 M ∴ pH = 1.43



8) Conjugate base: The base produced when an acid reacts with water. A conjugate has one less proton than its corresponding acid.
 b) HCN, CN⁻



mol HNO₃ = (0.35M)(0.25L) = 0.0875

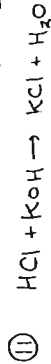
mol H⁺ = 0.0875

mol OH⁻ = 0.0875

mol KOH = 0.0875

Volume KOH = $\frac{\text{mol}}{M} = \frac{0.0875 \text{ mol}}{0.1050M} = 1.75$ or 1.8 L

10) [H₃O⁺] = 6.3 x 10⁻⁵ M [OH⁻] = 1.6 x 10⁻¹⁰ M



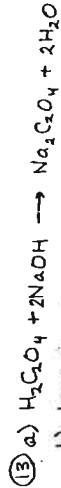
mol H⁺ = (0.150M)(0.0600L) = 0.00900

mol OH⁻ = (0.100M)(0.1400L) = 0.0140

mol OH⁻ in excess = 0.0140 - 0.00900 = 0.0050

[OH⁻] = $\frac{0.0050 \text{ mol}}{0.200L} = 0.025 M$ ∴ pOH = 1.60 ∴ pH = 12.40

12) a) a substance that can act as an acid or a base
 b) H₂PO₄⁻



b) $\frac{1.00g}{100g} = 0.01111 \text{ mol}$ / H₂C₂O₄ is diprotic

mol H⁺ = 2 x 0.01111 = 0.02222 mol

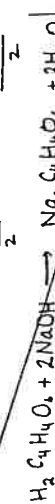
mol OH⁻ = 0.02222 mol [NaOH] = 0.02222 mol

mol NaOH = 0.02222 mol 0.06000L = 0.370 M

14) 9.6×10^{-14}

6.51 x 2 = 13.02 = pK_w
 invlog(13.02) = 9.55 x 10⁻¹⁴

15) Volume NaOH = $\frac{\text{Total} + \text{Tr} \times 1.3}{2} = \frac{11.33 + 11.31}{2} = 11.32 \text{ L}$



moles NaOH = (0.104M)(0.1132L) = 1.177 x 10⁻²

moles H⁺ = 1.177 x 10⁻²

moles H₂C₄H₄O₆ = $\frac{1.177 \times 10^{-2}}{2} = 5.886 \times 10^{-4}$

% of tartaric acid in wine = $\frac{5.886 \times 10^{-4} \times 100}{10.00} = 0.8837$

Item	Value
NaOH	150.0g
Water	1 mol
Total	150.0g
Mass NaOH	5.886 x 10 ⁻⁴ mol
Mass H ₂ O	18.015 g/mol
Total Mass	150.0g
% NaOH	0.8837

16) I 1.0M HBr strong acid / 100% disso. into charges
 II 1.0M CH3COOH weak acid
 III 1.0M HCN weak acid
 The more charge produced in solution, the greater the conductivity.
 17) a) $\text{NH}_4\text{Br} + \text{KHC}_2\text{O}_4 \rightarrow \text{KBr} + \text{NH}_3 + \text{H}_2\text{C}_2\text{O}_4$
 b) $\text{NH}_4^+ + \text{HCO}_3^- \rightleftharpoons \text{NH}_3 + \text{H}_2\text{CO}_3$
 c) reactants H_2CO_3 is the stronger acid + drives the equil. to the left thereby favouring reactants.

18) starting $\text{pH} = 4.50 \therefore [\text{H}_3\text{O}^+] = 3.16 \times 10^{-5} \text{M}$
 $\text{mol H}_3\text{O}^+ = (3.16 \times 10^{-5} \text{M})(140\text{L}) = 0.00443 \text{ mol H}_3\text{O}^+$ in solution
 target $\text{pH} = 7.20 \therefore [\text{H}_3\text{O}^+] = 6.31 \times 10^{-8} \text{M}$
 $\text{mol H}_3\text{O}^+ = (6.31 \times 10^{-8} \text{M})(140\text{L}) = 8.8 \times 10^{-6} \text{ mol}$

mol OH^- needed is difference between starting and target moles of H_3O^+
 $0.00443 - 8.8 \times 10^{-6} = 4.42 \times 10^{-3} \text{ mol OH}^- \rightarrow \text{Ca(OH)}_2 \rightarrow \text{Ca}^{2+} + 2\text{OH}^-$
 $\text{mol Ca(OH)}_2 = \frac{4.42 \times 10^{-3}}{2} = 2.21 \times 10^{-3}$
 $\text{mass Ca(OH)}_2 = 2.21 \times 10^{-3} \text{ mol} \times \frac{74.1 \text{ g}}{1 \text{ mol}} = 1.6 \times 10^{-1} \text{ g}$

19) H_3O^+ is the strongest of any weak acid.
 When any strong acid is reacted with water, it reacts 100% to form H_3O^+
 e.g. $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
 \therefore no strong acids exist in water!

20) $\text{pK}_w = -\log(2.95 \times 10^{-16}) = 14.53$
 a) $\text{pH of pure water} = \frac{14.53}{2} = 7.265$
 b) neutral as $[\text{H}_3\text{O}^+] = [\text{OH}^-]$ and/or $\text{pH} = \text{pOH}$

21) a) $\text{HCO}_3^- + \text{IO}_3^- \rightleftharpoons \text{SO}_3^{2-} + \text{HIO}_3$
 c) reactants. HIO_3 is a stronger acid than H_2SO_3 , thereby driving the equation to the left, favouring reactants.

22) a) $2 \text{H}_2\text{O} + 57 \text{ kJ} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$ b) $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$
 c) $K_w = 1.0 \times 10^{-14}$ $\text{pK}_w = 14$
 d) K_w increases as an increase in temp favours endothermic rxn (fwd rxn) and therefore both $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ increase.

23) a) 7-8 b) 5-7 c) 10-14 d) 1-3 e) 5

24) a) Arrhenius acid: any substance that releases H^+ in water.
 b) Arrhenius base: any substance that releases OH^- in water.
 c) Bronsted-Lowry Acid: a substance that donates a proton to another substance.
 d) Bronsted-Lowry Base: a substance that accepts a proton from another substance.

25) $\text{CO}_3^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{OH}^-(\text{aq})$
 $\text{Al}(\text{H}_2\text{O})_6^{3+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$

26) a) Conductivity test
 The strong acid solution will conduct much better than an equal molar concentration of a weak acid solution
 b) pH meter
 The strong acid solution will have a lower pH than an equal molar concentration of a weak acid solution.