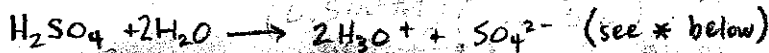


$\text{mol H}_2\text{SO}_4 = MV = (0.500\text{M})(0.025\text{L}) = 0.0125 \text{ mol H}_2\text{SO}_4$

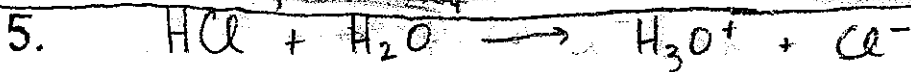


$0.0125 \text{ mol H}_2\text{SO}_4 \mid 2 \text{ mol H}_3\text{O}^+$

$\mid 1 \text{ mol H}_2\text{SO}_4 = 0.0250 \text{ mol H}_3\text{O}^+ = 0.0250 \text{ mol OH}^- = \text{mol NaOH}$

$0.0250 \text{ mol NaOH} \mid 40.0 \text{ g NaOH} \mid 1 \text{ mol NaOH} = \boxed{1.00 \text{ g NaOH}}$

* H_2SO_4 will dissociate BOTH protons in presence of strong Arrhenius base.



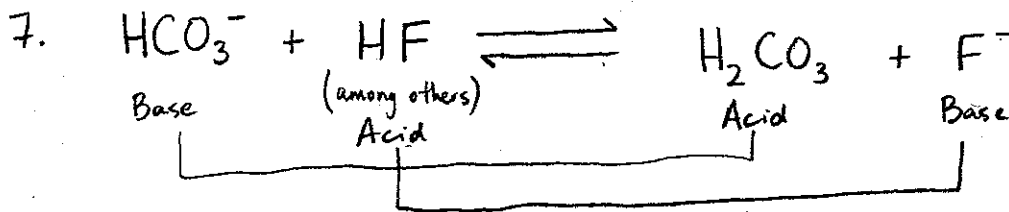
$\text{mol HCl} = MV = (0.15\text{M})(0.02500\text{L}) = 0.00375 \text{ mol HCl} = 0.00375 \text{ mol H}_3\text{O}^+$

$[\text{H}_3\text{O}^+] = \frac{\text{mol}}{V} = \frac{0.00375 \text{ mol}}{0.100 \text{ L}} = 3.75 \times 10^{-2} \text{ M}$ OR $M_f = \frac{M_i V_i}{V_f}$

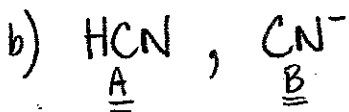
$\text{pH} = -\log(3.75 \times 10^{-2} \text{ M}) = \boxed{1.43}$

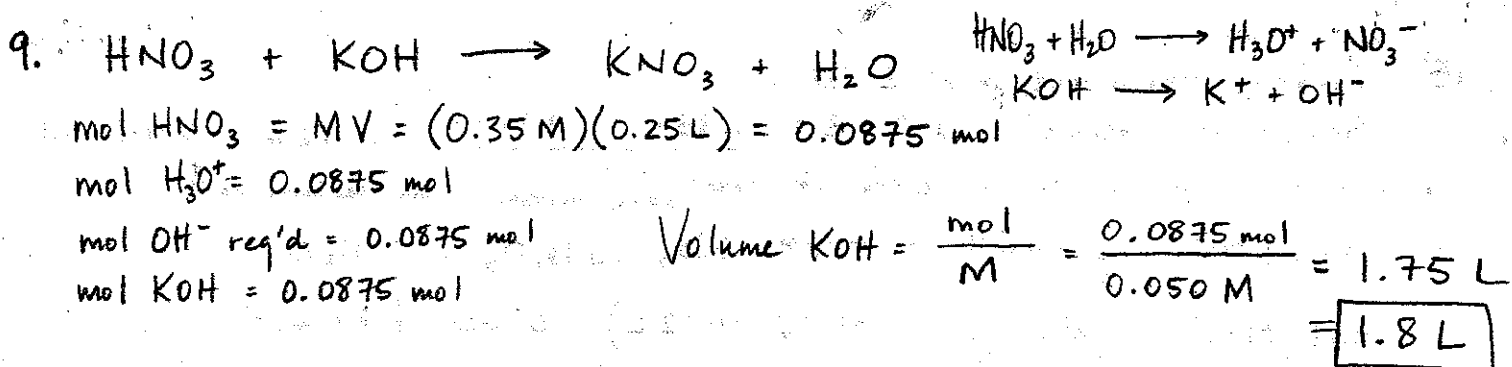
6. a) H_2S and H_2Te are the acids but since REACTANTS are favoured, H_2Te must be the stronger acid.

b) Since H_2Te is the stronger acid, its conjugate base must be weaker (HTe^-).

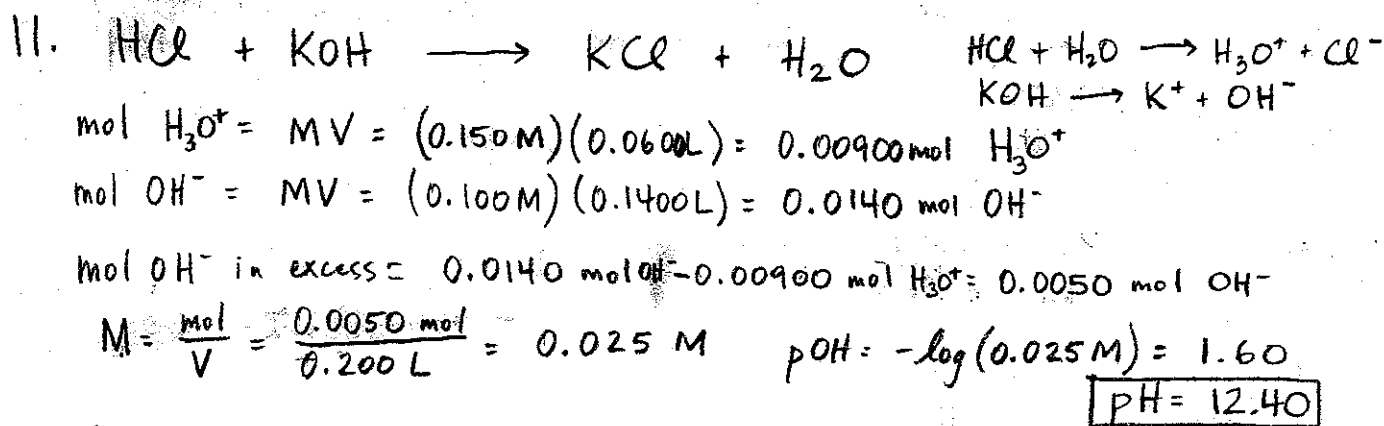


8. a) CONJUGATE BASE - The species A^- formed by loss of H^+ from the acid HA .



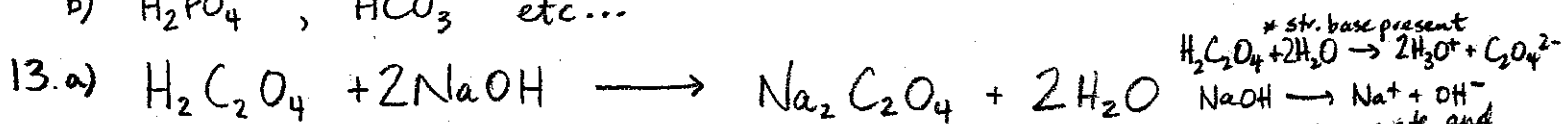


10. $[\text{H}_3\text{O}^+] = \text{inv log}(-4.20) = \boxed{6.3 \times 10^{-5} \text{ M}}$
 $[\text{OH}^-] = \frac{K_w}{[\text{H}_3\text{O}^+]} = \frac{1.0 \times 10^{-14}}{6.3 \times 10^{-5}} = \boxed{1.6 \times 10^{-10} \text{ M}}$



12.a) Amphiprotic - A substance that can act as either an acid or a base.

b) H_2PO_4^- , HCO_3^- etc...



b) $\frac{1.00 \text{ g oxalic}}{90.0 \text{ g oxalic}} \Big| \frac{1 \text{ mol oxalic}}{90.0 \text{ g oxalic}} = 0.01111 \text{ mol H}_2\text{C}_2\text{O}_4 \Big| \frac{2 \text{ mol H}_3\text{O}^+}{1 \text{ mol H}_2\text{C}_2\text{O}_4} = 0.02222 \text{ mol H}_3\text{O}^+$
strong base will dissociate and take both protons.

mol OH^- req'd = 0.02222 mol $\text{OH}^- = 0.02222 \text{ mol NaOH}$

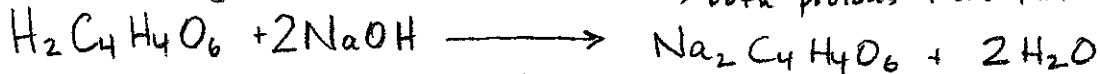
$[\text{NaOH}] = \frac{\text{mol}}{V} = \frac{0.02222 \text{ mol}}{0.06000 \text{ L}} = \boxed{0.370 \text{ M}}$

14. $\text{inv log}(-6.51) = 3.090 \times 10^{-7} \text{ M} = [\text{H}_3\text{O}^+] = [\text{OH}^-]$ * Water is NEUTRAL
 $K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = (3.090 \times 10^{-7} \text{ M})^2 = \boxed{9.5 \times 10^{-14}}$

15. Firstly, throw out trial 2 data.

Secondly, average trial 1 + 3: $\frac{11.33 \text{ mL} + 11.31 \text{ mL}}{2} = 11.32 \text{ mL NaOH added}$

* NaOH is a strong base that will dissociate (take) both ² protons from tartaric acid.



$$\text{mol NaOH} = MV = (0.104 \text{ M})(0.01132 \text{ L}) = 0.0011773 \text{ mol}$$

$$\text{mol OH}^- = 0.0011773 \text{ mol}$$

$$\text{mol H}_3\text{O}^+ \text{ req'd} = 0.0011773 \text{ mol}$$

$$\text{mol H}_2\text{C}_4\text{H}_4\text{O}_6 = \frac{0.0011773 \text{ mol H}^+}{2 \text{ mol H}_3\text{O}^+} \times \frac{1 \text{ mol H}_2\text{C}_4\text{H}_4\text{O}_6}{1 \text{ mol H}_2\text{C}_4\text{H}_4\text{O}_6} = 5.8864 \times 10^{-4} \text{ mol tartaric acid.}$$

$$\frac{5.8864 \times 10^{-4} \text{ mol tartaric acid}}{1 \text{ mol tartaric acid}} \times \frac{150.0 \text{ g tartaric acid}}{1 \text{ mol tartaric acid}} = 8.8296 \times 10^{-2} \text{ g tartaric acid (PURE)}$$

$$\frac{10.00 \text{ mL}}{1 \text{ mL}} \times \frac{1.0 \text{ g}}{1 \text{ mL}} = 10.0 \text{ g tartaric (IMPURE)}$$

2 sig figs!

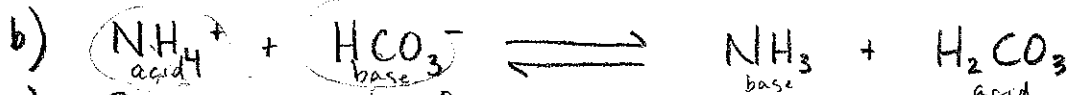
$$\% \text{ PURITY} = \frac{\text{PURE MASS}}{\text{IMPURE MASS}} = \frac{8.8296 \times 10^{-2} \text{ g}}{10.0 \text{ g}} = \boxed{0.88 \%}$$

(2 sig figs due to DENSITY value)

16. ① HBr (STRONG ACID = 100% dissociation).

② CH₃COOH (higher than HCN in acid column)

③ HCN → greater dissociation.



c) Reactants are favoured b/c H₂CO₃ is a stronger acid than NH₄⁺.

18. * H₃O⁺ is the DOMINANT species; focus calcs. on it!

pH 4.50: $[\text{H}_3\text{O}^+] = \text{inv log}(-4.50) = 3.1623 \times 10^{-5} \text{ M H}_3\text{O}^+$

$$\text{mol H}_3\text{O}^+ = MV = (3.1623 \times 10^{-5} \text{ M})(140 \text{ L}) = 4.427 \times 10^{-3} \text{ mol H}_3\text{O}^+$$

pH 6.80: $[\text{H}_3\text{O}^+] = \text{inv log}(-6.80) = 1.5849 \times 10^{-7} \text{ M H}_3\text{O}^+$

$$\text{mol H}_3\text{O}^+ = MV = (1.5849 \times 10^{-7} \text{ M})(140 \text{ L}) = 2.2189 \times 10^{-5} \text{ mol H}_3\text{O}^+$$

$$\text{mol OH}^- \text{ req'd} = 4.427 \times 10^{-3} \text{ mol H}_3\text{O}^+ - 2.2189 \times 10^{-5} \text{ mol H}_3\text{O}^+$$

$$(\text{= mol H}_3\text{O}^+ \text{ added}) = 4.4048 \times 10^{-3} \text{ mol OH}^-$$

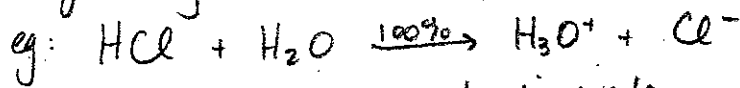
DIPROTIC BASE
 $\text{Ca(OH)}_2 \longrightarrow \text{Ca}^{2+} + 2\text{OH}^-$

$$\frac{4.4028 \times 10^{-3} \text{ mol OH}^-}{2 \text{ mol OH}^-} \times \frac{1 \text{ mol Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} \times \frac{74.1 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = \boxed{1.6 \times 10^{-1} \text{ g Ca(OH)}_2}$$

$$= \boxed{0.16 \text{ g Ca(OH)}_2}$$

19. H_3O^+ is the strongest weak acid.

When any strong acid reacts w/ water, it dissociates 100% to form H_3O^+



\therefore no strong acids exist in water.

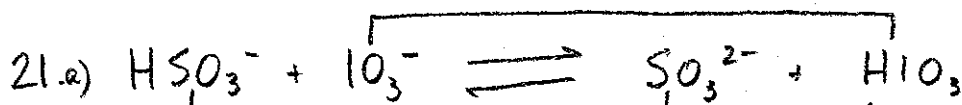
20.a) $K_w = 2.95 \times 10^{-15} = [\text{H}_3\text{O}^+][\text{OH}^-] \quad * \quad [\text{H}_3\text{O}^+] = [\text{OH}^-] \Rightarrow \text{WATER!}$

$$2.95 \times 10^{-15} = [\text{H}_3\text{O}^+]^2$$

$$[\text{H}_3\text{O}^+] = 5.4314 \times 10^{-8} \text{ M} \quad \text{pH} = -\log(5.4314 \times 10^{-8} \text{ M})$$

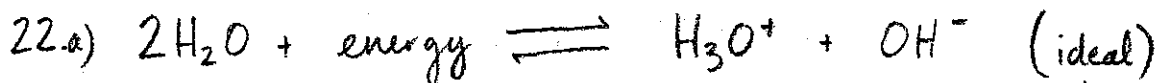
$$\boxed{7.265}$$

b) Water is NEUTRAL! $[\text{H}_3\text{O}^+] = [\text{OH}^-]$

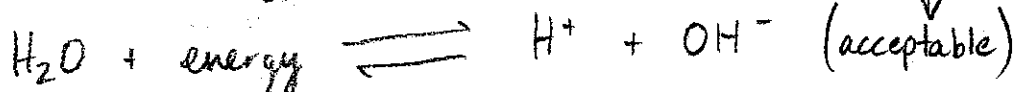


b) Acid Base Base Acid

c) Reactants are favoured b/c HIO_3 is higher than HSO_3^- in acid column on table



OR



b) $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$

c) $K_w = 1.0 \times 10^{-14} \quad \text{p}K_w = 14$

d) If temp is increased, K_w increases and $\text{p}K_w$ decreases.

23.a) Blood = 7-8 b) Rainwater = 5-7 c) Household cleaning products = 10-14

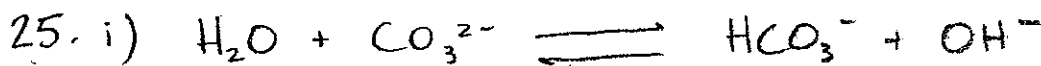
d) Battery Acid = 1-3 e) Coffee = 4-6

24.a) Arrhenius Acid - Any substance that releases H^+ in water.

b) Arrhenius Base - Any substance that releases OH^- in water.

c) B-L Acid - A substance that donates a proton (H^+) to another substance.

d) B-L Base - A substance that accepts a proton (H^+) from another substance.



26. i) Measure electrical conductivity \rightarrow Strong acid conducts better due to 100% dissociation.

ii) Measure the pH \Rightarrow Lower pH = Strong acid due to higher $[\text{H}_3\text{O}^+]$.