pH calculation worksheet **Name:** [illegible]

1. 50.0cm^3 of 1.0moldm^{-3} HCl is reacted 25 cm^3 of 1.0 moldm^{-3} NaOH solution. Calculate the pH value of the solution after reaction.

$n_{H^+} = 0.05 \times 1 - 0.025 \times 1 = 0.025$ mol

$[H^+] = \frac{0.025}{0.05+0.025} = \frac{0.025}{0.075} = \frac{1}{3}$ $pH = 0.48$

2. The normal rain water has a pH=5.6. In rainwater that falls close to a coal-burning power plant, [H+]=6.23*10^{-4} moldm^{-3}. Calculate the pH of the rain water. State and explain whether this rainwater is more or less acidic than normal rainwater.

$pH = -\log 6.23 \times 10^{-4} = 3.21 < 5.6$

∴ more acidic

3. The ionic product constant for water is 1.0*10^{-14} at 298K and 3.8*10^{-14} at 313K.

a. Write the self-ionization equation of water.

$H_2O \rightleftharpoons H^+ + OH^-$

b. State and explain whether the self-ionization of water process is exothermic or endothermic.

endothermic because need energy to brake the bonding

c. Calculate the pH of water at 313K. State and explain whether water at this temperature is acidic, neutral or basic.

$\begin{cases} [H^+] \cdot [OH^-] = 3.8 \times 10^{-14} \\ [H^+] = [OH^-] \end{cases}$ $pH = 6.71$

Water is always neutral

4. 50.0cm^3 of 1.0moldm^{-3} NaOH is reacted with 20.0 cm^3 of 1.0 moldm^{-3} H2SO4 solution. Calculate the pH of the solution after reaction.

$n_{OH^-} = (50-40) \times 10^{-3} \times 1.0 = 0.01$ mol

$[OH^-] = \frac{0.01}{0.07} = \frac{1}{7}$ mol/dm^3 $[H^+] = \frac{10^{-14}}{\frac{1}{7}}$ mol/dm^3

$pH = 13.15$

5. The pOH of a solution is 8.5 at 298K. Calculate the concentration of H$^+$ in the solution.

$[H^+] = 10^{-8.5} = 3.16 \times 10^{-9}$ mol/L

6. Calculate the mass of KOH used to prepare 200cm^3 solution with a pH=11.0 at 298K.

$[H^+] = 10^{-11}$ mol/L

$[OH^-] = 10^{-3}$ mol/L

$n_{OH^-} = 0.2 \times 10^{-3} = 2 \times 10^{-4}$

$m_{KOH} = n_{KOH} \cdot M_{KOH} = 2 \times 10^{-4} \cdot 56 = 1.12 \times 10^{-2}$ g.