

(14) a)  $pH = 7$   $pH = -\log[H^+]$   
 $-7 = \log[H^+]$   
 $[H^+] = 10^{-7} \leftarrow 10^{-7} = \log[H^+]$   
 $[OH^-] = \frac{K_w}{[H^+]} = \frac{1 \times 10^{-14}}{10^{-7}} = 1 \times 10^{-7} M$

(b)  $pH = 11.00 = -\log[H^+]$   
 $10^{-11} = [H^+]$   
 $[OH^-] = \frac{K_w}{[H^+]} = \frac{1 \times 10^{-14}}{10^{-11}} = 1 \times 10^{-3} M$

(c)  $pH = 4.0$   
 $(+)$   $pH + pOH = 14.00$   
 $-4$   $pOH = 10.0$   
 $-\log[OH^-] = pOH$   
 $\log[OH^-] = -10$   
 $[OH^-] = 10^{-10} M$

(d)  $pH = 6.00$   $pH + pOH = 14$   
 $6 + pOH = 14$   
 $pOH = 8 = -\log[OH^-]$   
 $10^{-8} M = [OH^-]$

(15) (a)  $-4.23 = pH$   
 $10$   
 $5.89 \times 10^{-5} M = [H_3O^+]$

(b)  $10^{-7.65} = pH$   
 $2.2 \times 10^{-8} M = [H_3O^+]$

(c)  $-9.48 = pH$   
 $10$   
 $3.31 \times 10^{-10} M = [H_3O^+]$

(16)  $HNO_3 \rightarrow H^+ + NO_3^-$   $pH = 2.70$   $[H^+] = 10^{-2.70} = 10^{-2.70} = 1.99 \times 10^{-3} M = [H_3O^+]$

(b)  $[OH^-] = \frac{K_w}{[H^+]} = \frac{1 \times 10^{-14}}{1.99 \times 10^{-3}} = 5.03 \times 10^{-12} M$

(c)  $M = \frac{mol}{L}$   $1.99 \times 10^{-3} = \frac{mol}{5.50 L}$   $mol = 0.0109 mol$

(d)  $0.0109 mol HNO_3 \times \frac{63.02 g}{1 mol} = 0.690 g HNO_3$

challenge problem  $\rightarrow$  (e) assume 100 g soln.  $\rightarrow 0.5 g HNO_3 \times \frac{1 mol}{63.02 g} = \frac{mol}{L}$   
 $d = \frac{m}{V}$   
 $1.42 g/mL = \frac{100}{x mL}$   
 $x mL = \frac{100 g}{1.42 g/mL} = 70.4 mL$   $M = 15.7 M HNO_3$

$M_1 V_1 = M_2 V_2$

$(15.7 M)(V_1) = (1.99 \times 10^{-3} M)(5.50 L)$

$V_1 = 7.0 \times 10^{-4} L$  concentrated Acid.