pH and pKa calculations

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| pH = - log [H3O+]  Calculate the pH of 10 mL of 0.015M HNO3 if 20 mL of water is added to it.  The concentration of diluted HNO3 is 1/3rd of 0.015 = 0.015/3 = 5 x 10-3  pH = - log [5 x 10-3] = 2.30 |
| Kw = 1 x 10-14 = [H3O+] [OH-]  Calculate [OH-] of the diluted HNO3 solution  [H3O+] is the concentration in mol L-1 of the strong acid  [OH-] = 1 x 10-14 = 2.00 x 10-12 mol L-1  5 x 10-3 |

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| Ka = [H3O+] [A-]  [HA]  pKa = - log Ka  Calculate the pH of 20 mL of 0.05M ethanoic acid if 20 mL of water is added to it.  Ka(CH3COOH) = 1.78 x 10-5  *Ka value describes the extent that the acid will react with water.*  *CH3COOH is a weak acid so the Ka value is low, indicating that it is only slightly reactive with water so the Ka value must be used in the calculation*  The concentration of diluted ethanoic acid is 1/2 of 0.05 = 0.05/3 = 0.025 mol L-1  **CH3COOH + H2O ⇌ CH3COO- + H3O+**  Ka = [CH3COO-] [H3O+]  [CH3COOH]  1.78 x 10-5 = x . x  0.025  √ (1.78 x 10-5) (0.025) = x  6.67 x 10-4 = x (this is the concentration of H3O+)  pH = - log (6.67 x 10-4)  pH = 3.175  **The answer is 3.18** *to 3 sig figs* | Kb = [H3O+] [A-]  [HA]  Kb = Kw  Ka  Calculate the pH of a 0.55M solution of ammonia  Ka (NH4+) = 5.75 x 10-10  Kb = Kw =1 x 10-14  = 1.739 x 10-5  Ka  5.75 x 10-10  **NH3 + H2O ⇌ NH4+ + OH-**  Kb = [NH4+] [OH-]  [NH3]  1.739 x 10-5 = x . x  0.55  √ (1.739 x 10-5) (0.55) = x  3.092 x 10-3 = x (this is the concentration of OH-)  [H3O+] = 1 x 10-14  3.092 x 10-3  [H3O+] = 3.233 x 10-12  pH = - log 3.23 x 10-12  = 11.49  **The answer is 11.5** *to 3 sig figs*  © <https://www.chemical-minds.com> |

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