

Chemistry 2.6 AS 91166 Demonstrate understanding of chemical reactivity

Writing Excellence answers to pH calculations questions

pH calculations QUESTION 1	
<p>Question: In a solution of potassium hydroxide, KOH, the pH is found to be 12.8.</p> <p>(i) Calculate the hydronium ion concentration, $[\text{H}_3\text{O}^+]$, and the hydroxide ion concentration, $[\text{OH}^-]$, in the solution. $K_w = 1 \times 10^{-14}$</p> <p>(ii) Calculate the pH of a $2.25 \times 10^{-4} \text{ mol L}^{-1}$ sodium hydroxide, NaOH, solution.</p>	
ANSWER	
<p>STEP 1. Calculate H_3O^+ for <u>KOH</u> $[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ (units and 3sgf)</p>	$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ $[\text{H}_3\text{O}^+] = 1.58 \times 10^{-13} \text{ molL}^{-1}$
<p>STEP 2. Calculate OH^- for <u>KOH</u> $[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ ($K_w = 1 \times 10^{-14}$) (units and 3sgf)</p>	$[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ $[\text{OH}^-] = 0.0633 \text{ molL}^{-1}$
<p>STEP 1. Calculate pOH for <u>NaOH</u> $\text{pOH} = -\log[\text{OH}^-]$ (3sgf)</p>	
<p>STEP 2. Calculate pH for <u>NaOH</u> $\text{pH} = 14 - \text{pOH}$ (3sgf)</p>	$\text{pOH} = -\log[\text{OH}^-]$ $\text{pOH} = 3.60$ $\text{pH} = 14 - \text{pOH}$ $\text{pH} = 14 - 3.60$ $\text{pH} = 10.4$
pH calculations QUESTION 2	
<p>Question: (i) A solution of nitric acid, $\text{HNO}_3(\text{aq})$, has a hydronium ion, H_3O^+, concentration of $0.0243 \text{ mol L}^{-1}$. Determine, by calculation, the pH and the concentration of hydroxide ions, OH^-, in this solution. $K_w = 1 \times 10^{-14}$</p> <p>(ii) Determine the hydroxide ion concentration, $[\text{OH}^-]$, of a solution of potassium hydroxide, $\text{KOH}(\text{aq})$, with a pH of 11.8.</p>	
ANSWER	
<p>STEP 1. Calculate pH for <u>HNO_3</u> $\text{pH} = -\log[\text{H}_3\text{O}^+]$ (3sgf)</p>	$\text{pH} = -\log[\text{H}_3\text{O}^+]$ $\text{pH} = 1.61$
<p>STEP 2. Calculate OH^- for <u>HNO_3</u> $[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ ($K_w = 1 \times 10^{-14}$) (units and 3sgf)</p>	$[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ $[\text{OH}^-] = 4.12 \times 10^{-13} \text{ molL}^{-1}$
<p>STEP 1. Calculate H_3O^+ for <u>KOH</u> $[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ (units and 3sgf)</p>	
<p>STEP 2. Calculate OH^- for <u>KOH</u> $[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ ($K_w = 1 \times 10^{-14}$) (units and 3sgf)</p>	$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ $[\text{H}_3\text{O}^+] = 1.58 \times 10^{-12} \text{ molL}^{-1}$ $[\text{OH}^-] = K_w / [\text{H}_3\text{O}^+]$ $[\text{OH}^-] = 6.31 \times 10^{-3} \text{ molL}^{-1}$

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.