

Chemistry: pH, pOH, Neutralization

→ Find molarity.

1) If 28.0 grams of KOH are added to H₂O to create 2.5 liters of solution, what is the [H⁺] and [OH⁻] of the solution? What is the pH and pOH of this solution?

([H⁺] = 5.0 × 10⁻¹⁴ : [OH⁻] = 2.0 × 10⁻¹)

[H⁺][OH⁻] = 1.0 × 10⁻¹⁴
 [H⁺][0.20] = 1.0 × 10⁻¹⁴

1 mol KOH	28.0 g KOH	=	0.20 M KOH = [OH ⁻]	[0.20]	[0.20]
56.11 g KOH	2.5 L KOH				

pH = -log[H⁺] = -log(5.0 × 10⁻¹⁴) = 13.3 = pH

pOH = -log[OH⁻] = -log(0.20) = 0.70 = pOH

2) To make 500 mL of a NaOH solution that has a pH of 11, what mass of NaOH is required?
 (2 × 10⁻² g)

pH = 11, pOH = 3 [OH⁻] = 10⁻³ = 0.001 M

40.00 g NaOH	0.001 mol NaOH	1 L NaOH	500 mL NaOH	= 0.02 g NaOH
1 mol NaOH	1 L NaOH	1000 mL NaOH		

3) A student found that it required 48.0 mL of 0.03 M NaOH to neutralize 72.0 mL of HCl. What was the concentration of the HCl? (0.02 M)

→ $\frac{0.03 \text{ mol NaOH}}{1 \text{ L NaOH soln}}$



1 mol HCl	0.03 mol NaOH	1 L NaOH	48.0 mL NaOH	1000 mL HCl
1 mol NaOH	1 L NaOH	1000 mL NaOH	72.0 mL HCl	1 L HCl

→ $\frac{0.006 \text{ mol NaOH}}{1 \text{ L NaOH soln}}$

= 0.02 M HCl

4) How many mL of 0.006 M NaOH are required to neutralize 80.0 mL of 0.04 M HCl?
 (530 mL)



1000 mL NaOH	1 L NaOH	1 mol NaOH	0.04 mol HCl	1 L HCl	80.0 mL HCl
1 L NaOH	0.006 mol NaOH	1 mol HCl	1 L HCl	1000 mL HCl	

= 530 mL NaOH

5) Write the equation for the neutralization of the strong acid HNO_3 with the strong base KOH .



6) How many mL of 0.0006 M KOH would be required to neutralize 80.0 mL of 0.04 M HNO_3 according to the equation in #5? (5330 mL)

$\xrightarrow{\frac{0.0006 \text{ mol KOH}}{1 \text{ L KOH Soln.}}}$
 $\xrightarrow{\frac{0.04 \text{ mol HNO}_3}{1 \text{ L HNO}_3}}$

1000 mL KOH	1 L KOH	1 mol KOH	0.04 mol HNO₃	1 L HNO₃	80.0 mL HNO₃
1 L KOH	0.0006 mol KOH	1 mol HNO₃	1 L HNO₃	1000 mL HNO₃	

= 5330 mL KOH

7) What is the pH of a solution made by combining 0.001 moles of KOH and 0.002 moles of HCl and diluting to a final volume of 100 mL? What is the pOH of this solution? (pH = 2; pOH = 12)

8) 1.40 grams of a solid unknown acid are dissolved in 100 mL of H_2O . It takes 112 mL of 0.2 M NaOH to neutralize this acid. What is the molecular mass of the unknown acid (62.5 g/mole)

(Assume a 1 to 1 mole ratio.)

$\xrightarrow{\frac{0.2 \text{ mol NaOH}}{1 \text{ L NaOH}}}$

1.40 g Acid	1000 mL NaOH	1 L NaOH	1 mol NaOH	= 62.5 g/mol Acid
112 mL NaOH	1 L NaOH	0.2 mol NaOH	1 mol Acid	