

1. Calculate the pOH of limes which have a $[H_3O^+]_{(aq)}$ of 1.3×10^{-2} mol/L.

$$pH = -\log [H_3O^+]$$

$$= -\log (1.3 \times 10^{-2})$$

$$= 1.8860\dots$$

$$pOH = 14 - pH$$

$$= 12.11$$

2. A strontium hydroxide solution is prepared by dissolving 5.00 g to make 200 mL of solution. Calculate the pH.

$$Sr(OH)_2(s) \rightarrow Sr^{2+}_{(aq)} + 2OH^-_{(aq)}$$

$$m = 5.00g$$

$$M = 121.64g/mol$$

$$n = \frac{m}{M}$$

$$= 0.04110\dots mol$$

$$V = 0.200L$$

$$[Sr(OH)_2] = 0.2055\dots mol/L$$

$$[OH^-] = \frac{2}{1} \times 0.2055\dots$$

$$= 0.41104\dots mol/L$$

$$pOH = -\log [OH^-]$$

$$= 0.3861\dots$$

$$pH = 14 - pOH$$

$$= 13.614$$

3. A vinegar solution has a hydrogen ion concentration of 1.5×10^{-3} mol/L. Calculate the pH of the solution.

$$[H^+] = [H_3O^+]$$

$$pH = -\log [H^+]$$

$$= -\log (1.5 \times 10^{-3})$$

$$= 2.82$$

4. A cleaning solution has a pH of 2.92. What is the pOH of the solution? Is this solution acidic or basic?

$$pOH = 14 - 2.92$$

$$= 11.08$$

acidic

5. Milk has a pOH of 6.55. Is this acidic, basic or neutral? Calculate the hydronium ion concentration of the milk?

$$pH = 14 - pOH$$

$$= 14 - 6.55$$

$$= 7.45$$

basic

$$[H_3O^+] = 10^{-pH}$$

$$= 10^{-7.45}$$

we get 3.5×10^{-8} mol/L

$$= 3.6 \times 10^{-8} mol/L$$

6. A solution of magnesium hydroxide is prepared and has a pOH of 2.25. If 300mL of the solution is made, what mass of magnesium hydroxide was used to make the solution?

$$\text{Mg}(\text{OH})_2 \rightarrow \text{Mg}^{2+} + 2\text{OH}^-$$

$$[\text{Mg}(\text{OH})_2] = \frac{1}{2} \times 0.005623 = 0.0028115 \text{ mol/L}$$

$$V = 0.300 \text{ L}$$

$$n = 0.0008435 \text{ mol}$$

$$M = 58.33 \text{ g/mol}$$

$$m = 0.049 \text{ g}$$

7. What volume of 1.5 mol/L NaOH is needed to provide 0.75 mol of NaOH?

$$C = \frac{n}{V} \quad 1.5 \text{ mol/L} = \frac{0.75 \text{ mol}}{V} \quad \boxed{V = 0.50 \text{ L}}$$

8. The following table has 5 solution that are made with different solutes. Complete the following table by filling in the expected results for each diagnostic test done for each solution.

Solute dissolved in H ₂ O(l)	Conductivity Test (Yes or No)	Red Litmus Test (Red or Blue)	Blue Litmus Test (Red or Blue)
potassium chloride	YES	RED	BLUE
barium hydroxide	YES	BLUE	BLUE
propanol	NO	RED	BLUE
hydrogen chloride (gas)	YES	RED	RED
ammonium nitrate	YES	RED	BLUE

9. A student has a cylinder which contains 3.00 L of hydrogen chloride gas at a pressure of 100 kPa at 25°C. All of the gas is emptied from the cylinder and dissolved to make 2.00 L of solution. What is the pH of the solution that was made? (hint: use your knowledge from the gases unit)

$$\text{HCl}_{(g)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{H}_3\text{O}^+_{(aq)} + \text{Cl}^-_{(aq)}$$

$$PV = nRT$$

$$(100 \text{ kPa})(3.00 \text{ L}) = n \left(8.31 \frac{\text{J}}{\text{mol}\cdot\text{K}} \right) (298 \text{ K})$$

$$n = 0.12114 \text{ mol}$$

$$V = 2.00 \text{ L}$$

$$[\text{HCl}] = 0.06057 \text{ mol/L}$$

$$[\text{H}_3\text{O}^+] = 0.06057 \text{ mol/L}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

$$= 1.2177$$

$$\boxed{= 1.218}$$