

Review Problems: Solutions

1. What is the concentration (in moles L^{-1}) of a solution that contains 39.2 g of H_3PO_4 in 500.0 cm^3 of water? (**Answer** 0.800 moles L^{-1})
2. Sodium phosphate, Na_3PO_4 (known commercially as TSP), is used for cleaning grease and oil spills. Describe precisely how you would prepare 250.0 mL of a 0.320 mol/L solution of TSP. (*hint: you are writing a procedure here*). (**Answer** You would need to mass out 13.1 g of TSP)
3. What volume of 0.95 mol/L solution Na_2SO_4 would be required to prepare 200 mL of a 0.15 mol/L solution of Na_2SO_4 ? (**Answer** 32 mL)
4. What is the final concentration of a solution prepared by adding 50.0 mL of 1.50 M HNO_3 to a flask and bringing the volume up to 1.0 L? (**Answer** 0.075 M)
5. How many grams of $\text{Ca}(\text{NO}_3)_2$ can be prepared by reacting 125 mL of 5.00 M HNO_3 with an excess of $\text{Ca}(\text{OH})_2$? (*Hint: recall the products of a neutralization reaction-reacting an acid with a base*) (**Answer** 51.3 g)
6. What is the molarity of a NaOH solution if 50.0 mL is required to react exactly with 38.2 mL of 0.100 M HCl? Write a balanced molecular equation, the total ionic equation, and the net ionic equation for the neutralization of NaOH with HCl.
7. What mass of AgCl forms from reacting 25.0 dm^3 of 1.5 mol dm^{-3} $\text{AgNO}_{3(\text{aq})}$ with 50 dm^3 of a 0.20 mol dm^{-3} solution of BaCl_2 ? Write a balanced molecular equation and the net ionic equation.
8. What is the mass of solid KOH required to prepare 250.0 cm^3 of 0.5322 mol dm^{-3} solution? Describe how you would prepare such a solution.
9. Magnesium hydroxide, $\text{Mg}(\text{OH})_{2(\text{aq})}$, and phosphoric acid, $\text{H}_3\text{PO}_{4(\text{aq})}$, react to form magnesium phosphate, $\text{Mg}_3(\text{PO}_4)_2$ (aq), and water, $\text{H}_2\text{O}_{(\text{l})}$. What mass of magnesium phosphate is produced when 22.5 dm^3 of 0.220 mol dm^{-3} of magnesium hydroxide reacts with 32.3 dm^3 of 0.155 mol dm^{-3} phosphoric acid?
10. (a) What mass of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, must be dissolved in water to prepare 0.250 dm^3 of a 0.100 mol dm^{-3} solution?
(b) What volume of the resulting solution contains 0.010 mol of glucose?
11. Calculate the number Cl^- ions in each of the following aqueous solutions:
a) 0.10 M NaCl b) 0.05 M MnCl_2 c) 0.03 M AlCl_3 d) 0.02 M SnCl_4
12. A stock hydrochloric acid solution 1.00 M HCl. A student needed to prepare 250.0 mL of 0.100 M HCl (and had access to a wide range of pipettes and volumetric flasks). Describe how the more dilute solution can be prepared from the more concentrated one.

13. A student found that by diluting 10.00 mL of sulphuric acid solution to a final volume of 100.0 mL the concentration of the new solution was 0.00100 M. What was the concentration of the initial solution?

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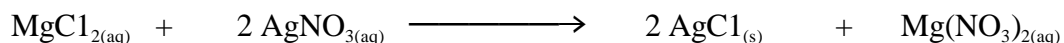
15. Calcium Phosphate Ca_3PO_4 , forms as a precipitate when aqueous solutions of sodium phosphate, Na_3PO_4 , and calcium nitrate, $\text{Ca}(\text{NO}_3)_2$ are mixed. The other product, sodium nitrate, NaNO_3 , remains dissolved.

a) Write a balanced reaction for the reaction described (include state symbols)

b) What mass $\text{Ca}_3(\text{PO}_4)$ will form when 48.4 mL of 0.212 M $\text{Ca}(\text{NO}_3)_2$ is reacted with 25.2 mL of 0.485 M Na_3PO_4

15. When 20g of the compound XY is dissolved in water to make 250 mL of a solution, a 0.500 M solution is obtained. What is the molar mass of XY?

16. In aqueous solution, magnesium chloride, MgCl_2 , reacts completely without any side reactions with silver nitrate, AgNO_3 , as follows:



In an experiment 19.50 mL of magnesium chloride solution reacted completely with 25.8 mL of silver nitrate solution, and 0.696 g of silver chloride was collected. Determine the concentration of the magnesium chloride solution.

17. 10.6 g of $\text{Na}_2\text{CO}_{3(\text{s})}$ reacts with exactly 50.0 cm^3 of 4.00 mol dm^{-3} $\text{HCl}_{(\text{aq})}$ to produce 11.7 g $\text{NaCl}_{(\text{aq})}$ and 4.40 g of $\text{CO}_{2(\text{g})}$. Calculate the equation for the reaction.

18. A student is asked to prepare some copper (II) nitrate by reacting nitric acid with copper (II) oxide.

a. Write a balanced equation for this reaction.

b. The student carries out this reaction by adding 0.0345 mol of copper (II) oxide to 36.0 cm^3 of 1.15 mol dm^{-3} nitric acid solution. Calculate the amount (in mol) of nitric acid.

c. Use the information in (a) and (b) to identify the limiting reagent and determine the amount (in mol) of copper (II) nitrate formed.

d. The product of this reaction is isolated as copper (II) nitrate trihydrate. Calculate the molar mass of copper (II) nitrate trihydrate and the mass of the product obtained.