

26. When adding a salt to precipitate a cation from a mixture of ions, why must the salt be soluble?
27. What ions could be present in solution if separate samples of it gave a precipitate when:
- (a) either  $\text{SO}_4^{2-}$  or  $\text{OH}^-$  is added?
  - (b)  $\text{SO}_4^{2-}$  is added, but none when  $\text{OH}^-$  is added?
28. A solution contains only one of  $\text{Ag}^+$  or  $\text{Pb}^{2+}$ . Is it possible to use a precipitation procedure based on your Solubility Table to determine which ion is present? If so, how? If not, why?
29. A solution contains  $\text{Al}^{3+}$  and  $\text{Ag}^+$ . What compounds could be added, and in what order, to separate these ions? You must specify the complete compound which will be added, not just the anion contained in the compound. Do not write a complete experimental procedure.

30. A solution contains  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$  and  $\text{Ag}^+$ . What compounds could be added, and in what order, to separate these ions?
31. A solution contains  $\text{Mg}^{2+}$ ,  $\text{Pb}^{2+}$  and  $\text{Zn}^{2+}$ . What compounds could be added, and in what order, to separate these ions?
32. A solution contains  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ag}^+$  and  $\text{Be}^{2+}$ . What compounds could be added, and in what order, to separate these ions?
33. Using your results from Exercise 29, write an experimental procedure for analyzing a solution which can only contain  $\text{Ag}^+$  and  $\text{Al}^{3+}$ , but might contain one, both or neither of these ions.
34. Using your results from Exercise 30, write an experimental procedure for analyzing a solution which can only contain  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$  and  $\text{Ag}^+$ , but might contain any number of these ions.

35. You are asked to identify the ions present in a particular solution. The ions which may be present are:  $\text{I}^-$ ,  $\text{SO}_4^{2-}$ , and  $\text{OH}^-$ .

(a) What is the name given to the process of identifying the chemical substances in a sample?

(b) You are to perform the identification using only the following reagents (that is, test chemicals):  $\text{AgNO}_3$ ,  $\text{Ca}(\text{NO}_3)_2$  and  $\text{Mg}(\text{NO}_3)_2$ . Which reagent must be added first? Explain why.

(c) How would you complete the analysis of the solution?

36. A solution is known to contain one or more of the ions:  $\text{S}^{2-}$ ,  $\text{OH}^-$ ,  $\text{Cl}^-$  and  $\text{CO}_3^{2-}$ . You are to identify the ions present using only the reagents:  $\text{AgNO}_3$ ,  $\text{Ba}(\text{NO}_3)_2$ ,  $\text{Cu}(\text{NO}_3)_2$  and  $\text{Sr}(\text{NO}_3)_2$ . Briefly describe a procedure which could be used to analyze the anions in the solution.

37. You have a sample of a solution which contains  $\text{Ba}^{2+}$ . You add  $\text{Na}_2\text{SO}_4$ , to the sample until no more  $\text{BaSO}_4(\text{s})$  will precipitate, then filter, dry and weigh the precipitate. Your results are as follows.
- volume of sample = 25.0 mL  
mass of filter paper = 1.21 g  
mass of filter paper +  $\text{BaSO}_4$  (dry) = 3.75 g

Calculate:

- (a) the moles of  $\text{BaSO}_4$  produced.
- (b) the concentration of  $\text{Ba}^{2+}$  in the original solution.

38. A solution contains an unknown amount of  $\text{Pb}^{2+}$ . If 4.28 g of  $\text{PbSO}_4(\text{s})$  are obtained from 100.0 mL of the solution, what is the  $[\text{Pb}^{2+}]$  in the solution?
39. Addition of phosphate ions to a 25.00 mL sample of a solution containing  $\text{Ag}^+$  ions produces 1.57 g of  $\text{Ag}_3\text{PO}_4(\text{s})$ . What is the  $[\text{Ag}^+]$  in the original solution?