Name _____ Class _____ Date _____

9

Determining Solubility

Background Information

Several factors affect the rate at which solids dissolve in liquids. These factors include the nature of the solute and solvent, the temperature, and the degree of fineness to which the solute has been ground. There is no general rule to predict how much solute will dissolve in a given solvent, but you can determine the effect certain variables have on the rate of solution.

In this investigation, you will determine the amount of potassium nitrate that can be dissolved in 10 mL of water at a given temperature.

Problem

How can you determine the solubility of a substance in water?

Materials *(per group)*

25 mL potassium nitrate
Water
100-mL graduated cylinder
250-mL beaker
Celsius thermometer
Bunsen burner
2 test tubes
Laboratory balance
1 test-tube holder
Ice
Glass stirring rod
Safety goggles

Procedure

1. Place a small sheet of plain paper on the laboratory balance. Record the mass of the paper. Adjust the balance so that it registers 25 g more than the mass of the paper alone.
2. Slowly and carefully add potassium nitrate to the paper until the balance is again level. In this way, you have poured out 25 g of potassium nitrate.

3. Pour 10 mL of water into one test tube. Warm the test tube over the Bunsen burner until the first temperature assigned to you by your teacher is reached. Try to maintain this temperature throughout the next step.

4. Pour a small amount of potassium nitrate into the test tube. Stir carefully. If the potassium nitrate dissolves completely, add a little more. Continue until no more dissolves and a few small grains settle to the bottom of the test tube.

5. Record the exact temperature of the solution.

6. Find the mass of the paper and the remaining potassium nitrate again. Determine the amount of potassium nitrate you used by subtracting this amount from the original mass.

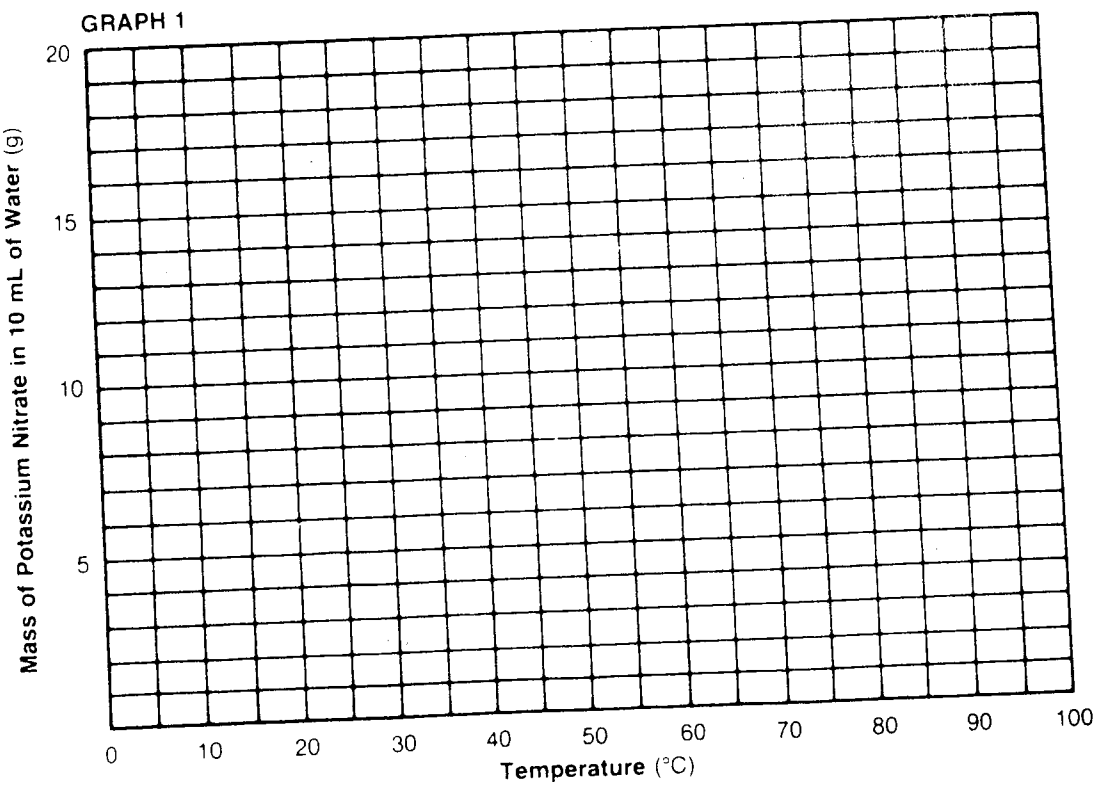
7. Repeat the procedure with another 10 mL of water. However, this time cool the water in ice until the second temperature assigned to you by your teacher is reached. Again determine the amount of potassium nitrate that dissolves in the water. Record the exact temperature.

8. Report your information to your teacher. He or she will compile all the information obtained by the class. In this way, you will find out how much potassium nitrate dissolves in 10 mL of water over a wide temperature range.

9. Graph your results and the results of your classmates in Graph 1.

Observations

GRAPH 1



Conclusions

1. What effect does temperature have on the amount of potassium nitrate that can be dissolved in a given amount of water? _____

2. From the graph, predict how much potassium nitrate would dissolve in 10 mL of water at 60°C. _____

3. How much potassium nitrate do you think would dissolve in 100 mL of water at 60°C? _____

4. To what temperature would 10 mL of water have to be heated to completely dissolve 14 g of potassium nitrate? _____

Critical Thinking and Application

1. If the temperature of a saturated solution of potassium nitrate were to drop, what would you notice? _____

2. If 10 mL of a saturated solution of potassium nitrate were to cool from 60°C to 10°C, how much potassium nitrate would be found on the bottom of the test tube? _____

3. Suppose you had measured the solubility of KNO_3 only at 10°C and 90°C. How might your solubility graph be inaccurate? _____

4. Based on the graph, how much KNO_3 do you think would dissolve in 10 mL of water at 100°C? _____