In video segment 7B, student lab groups were each assigned a different temperature for which they would determine the solubility of potassium chloride in water. They followed this standard procedure:

- To begin, the evaporating dish with a watch glass cover was massed and the mass was recorded in a data table in column #2.

- The students placed 15 milliliters of distilled water into a test tube and then added 10 grams of KCl to the test tube. The test tube was then immersed in the water bath at the group's assigned temperature. Some lab groups, like the one you just watched, were assigned a temperature that required a hot water bath. Other groups were assigned a temperature requiring a cold-water bath.

- The test tube was maintained at the assigned temperature for 10 minutes. The students occasionally stirred the solution to insure saturation.

- After 10 minutes, a small wad of cotton was placed in a funnel, mounted on a ring stand. The evaporating dish which was massed earlier was placed underneath the funnel.

- The test tube was then removed from the water bath, and about one-half of the liquid is decanted into the funnel. The cotton served to filter out any undissolved solids.

- The evaporating dish, now containing some of the KCl solution, was covered with the watch glass. The entire evaporating dish, with watch glass and KCl solution, was then massed, and the mass recorded in the data table, column #3.

- The students then placed the evaporating dish on a hot plate and evaporated the KCl solution to dryness.

- After the dish and dry contents have been allowed to cool, the mass was measured and the data was recorded in the data table, column #4.

Your assignment will be to complete the lab report, calculating the values for data table columns #5, #6 and #7. You will then construct a solubility graph for potassium chloride.

Procedure:

1. Each lab group was assigned a different temperature, calculating the solubility of KCl in water at that temperature. You are to complete columns #5 and #6, using the provided data from each lab group.

Data:

#1	#2	#3	#4	#5	#6	#7
Assigned Temperature °C	Mass of evaporating dish + cover	Mass of evaporating dish + cover + KCl solution	Mass of evaporating dish + cover + dry KCl	Mass of KCl (#4 - #2)	Mass of water (#3 - #4)	Mass of KCl per 100 g of water
10	37.81 g	48.75 g	40.54 g			
20	37.65 g	50.42 g	40.99 g			
30	36.95 g	47.82 g	39.81 g			
40	37.80 g	48.19 g	40.63 g			
50	36.50 g	47.49 g	39.75 g			
60	37.75 g	50.08 g	41.52 g			
70	35.98 g	48.29 g	39.86 g			
80	37.81 g	48.64 g	41.37 g			
90	36.99 g	48.96 g	40.98 g			

2. Column #7 is to be calculated as to express the solubility of KCl in grams per 100 grams of water. Following the equation given, complete column #7 for each group's data.

$$? \, g \, KCl = 100 \, g \, H_2O \times \frac{mass \, of \, KCl}{mass \, of \, water}$$

3. Construct a graph using the vertical axis for grams of solute per 100 g of solvent and the horizontal axis for temperature. Staple your graph to this paper. BE SURE TO USE PROPER SCIENTIFIC GRAPHING TECHNIQUES.

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Conclusion Questions:

1. The solubility of a solute is the maximum mass of the solute that will dissolve in a certain amount of water at a certain _____.

   This is the same as saying that solubility is the concentration of a (unsaturated, saturated) solution of the solute.

2. From your graph, what mass of KCl can be dissolved in 100 g of water at these temperatures? Use dotted lines on your graph to show how you used your graph to determine your answers:

   a) 25 °C _____

   b) 55 °C _____

3. For each of the following, tell whether the solution would be saturated, unsaturated, or *crystallizing. (Hint: Plot the point and see whether it lies above, below, or on the best-fit line. Remember that the line represents a _____ solution.)

   a) 40.0 g of KCl in 100 g of water at 75 °C _____

   b) 34.0 g of KCl in 100 g of water at 55 °C _____

   c) 45.0 g of KCl in 100 g of water at 25 °C _____

   *Normally, crystallization (rather than supersaturation) occurs when more solute is present than what can be dissolved in a given amount of solvent at a given temperature. Crystallization simply refers to the excess solute "crystallizing" and settling out of the solution. Supersaturation is rare.