Solubility Worksheet #2 Level 2

Name _____ Date_____

We have considered some conditions that allow solutes to dissolve in solvents, but we have not yet considered the solubility of a solute. **Solubility is defined as the maximum mass of solute that can dissolve in a certain quantity of solvent <u>at a specified temperature</u>**. Below is a data table that shows the solubility of ammonium chloride (NH_4Cl) at various temperatures. Use the data table to construct a line graph. Remember to set up your axes and label appropriately.

Water Temperature (°C)	Maximum Mass of Ammonium Chloride that can be dissolved in a 100 grams of water (g)
0	30
20	37
40	46
60	55
80	65
100	76

1. We want to know how many grams of ammonium chloride can dissolve in water at various temperatures. In this case, what are the independent and dependent variables?

   Independent variable _____

   Dependent variable _____

2. When making a graph of data, the independent (manipulated) variable is represented on the x-axis and the dependent (responding) variable is represented on the y-axis. Label your x and y axes.

3. An appropriate scale and increments should be chosen. You may use increments of 5, 10, 20 or whatever you think is appropriate

   The x values range from _____

   The y values range from _____

4. Plot the data points and draw s best-fit line through the data points.

5. Add a title to the graph

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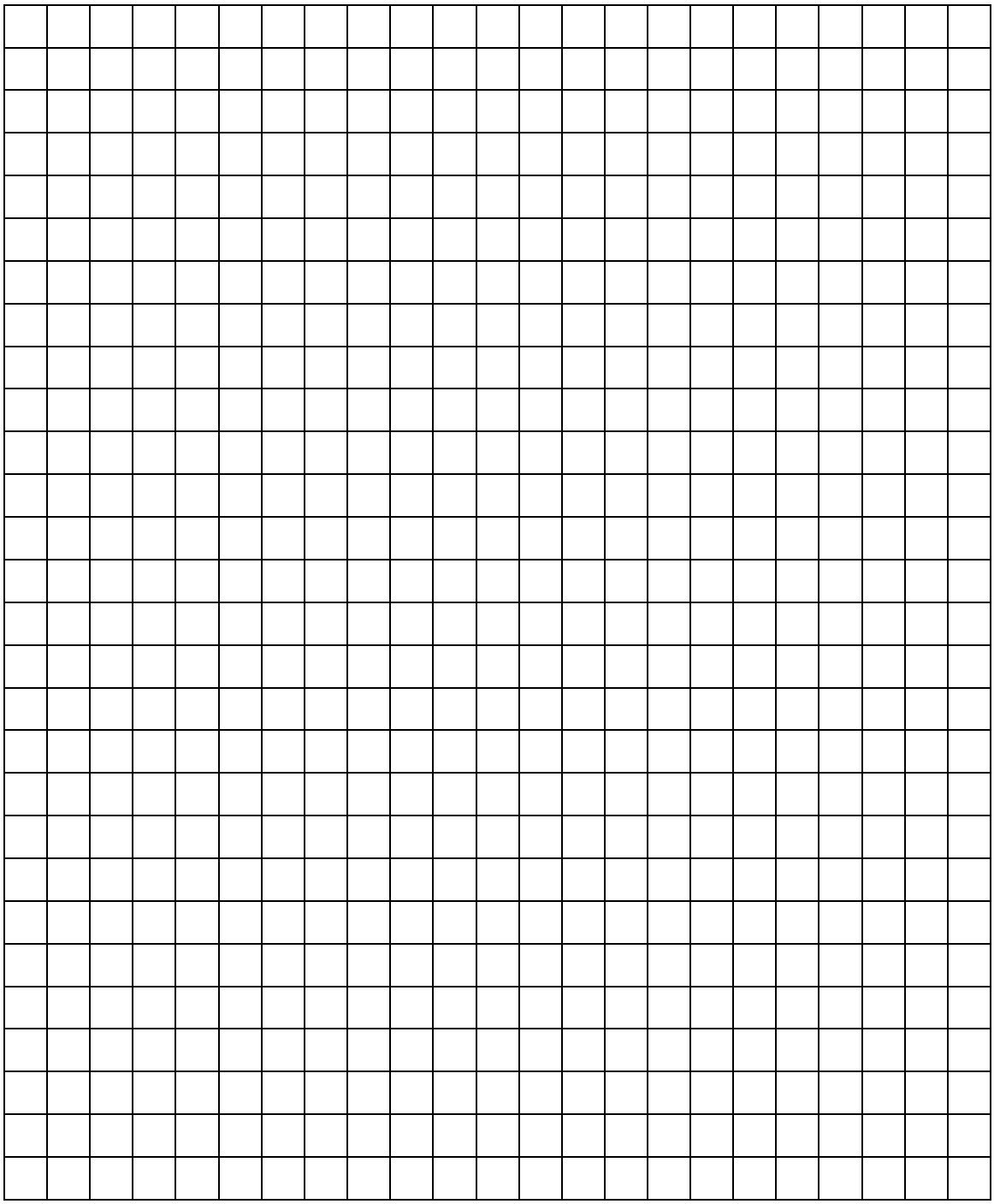

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Analysis

1. Using the graph, determine ow many grams of ammonium chloride will dissolve at a temperature of 70°C _____ grams

2. What temperature would be necessary to dissolve 50 grams of ammonium chloride? _____ °C

3. On your graph, as the temperature increases from 20°C to 100°C, the mass of the solute dissolved in grams increases by _____.

4. The unit rate of change is the change in the maximum amount of ammonium chloride in grams that can be dissolved for every 1°C change in temperature.

$$\text{Rate of Change} = \frac{\Delta \text{ Grams of Solute Dissolved}}{\Delta \text{ Temperature}}$$

   Use the data table to calculate the unit rate of change in dissolved ammonium chloride between 20°C and 100°C.

$$\text{Rate of Change} = \frac{(\text{grams at } 100°C - \text{grams at } 20°C)}{(100°C - 20°C)} = \_\_\_\_\_ = \_\_\_\_\_$$

5. You can also calculate the unit rate of change using the graph by calculating

$$\text{Unit Rate of Change (slope)} = \frac{\Delta \text{ y (grams)}}{\Delta \text{ x } (°C)}$$

   Pick an ordered pair on your best-fit line and calculate the unit rate of change. Use the chart on the next page.

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Ordered Pair used for calculation (x_1, y_1) (x_2, y_2)	Δ grams of solute dissolved Δ y	Δ temperature (°C) Δ x	**Unit Rate of Change (slope)** Δ y/Δ x

6. Use the information <u>from the data table</u> to calculate the rate of change between 20°C and 40°C. Show formula and work.

7. Use the information <u>from the data table</u> to calculate the rate of change between 60°C and 80°C. Show formula and work.

8. Are your calculated rates of change for the two temperature ranges (20°C – 40°C) and (60°C - 80°C) the same or different? _____

   What does this suggest?

   _____

   _____

   _____

   _____

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9. Suppose you tested a different salt (for example potassium nitrate) and found that more of that salt could dissolved in 100ml of water at 50°C. Does that necessarily mean that more potassium nitrate would dissolve in 100 ml of water at 10°C?. _____ Explain your answer.

_____

_____

_____

_____

_____

_____

10. Suppose you tested a different salt (for example potassium chloride and found that less of that salt could dissolved in 100ml of water at every temperature tested. Add a line on your graph representing the solubility curve of this salt. (Use a different color.) Is the line representing the solubility curve of this salt necessarily parallel to that of ammonium chloride? _____ Explain your answer.

_____

_____

_____

_____

_____

_____