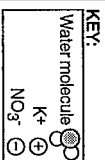
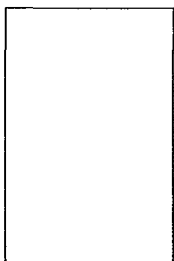


Name: _____

- 1) The equation for the saturated solution equilibrium of potassium nitrate (KNO_3) is shown below.



- (a) Using the key below, diagram the products in the given box. [Indicate the exact arrangement of the particles you diagram.]



- (b) Compare the rate of dissolving KNO_3 with the rate of recrystallization of KNO_3 for the saturated solution.

- 2) Show a correct numerical setup for determining how many liters of a 1.2 M solution can be prepared with 0.50 mole of $\text{C}_6\text{H}_{12}\text{O}_6$.

Questions 3 through 5 refer to the following:

A student is instructed to make 0.250 liter of a 0.200 M aqueous solution of $\text{Ca}(\text{NO}_3)_2$.

- 3) What is the gram-formula mass of $\text{Ca}(\text{NO}_3)_2$?
- 4) Show a correct numerical setup for calculating the total number of moles of $\text{Ca}(\text{NO}_3)_2$ needed to make 0.250 liter of a 0.200 M calcium nitrate solution.
- 5) In order to prepare the described solution in the laboratory, two quantities must be measured accurately. One of these quantities is the volume of the solution. What other quantity must be measured to prepare this solution?

Questions 6 and 7 refer to the following:

Two alcohols that are used in our everyday lives are rubbing alcohol and ethylene glycol. Rubbing alcohol is used as an antiseptic. Ethylene glycol is the main ingredient in antifreeze, which is used in automobile cooling systems.

- 6) Explain, in terms of molecular polarity, why rubbing alcohol, 2-propanol, is soluble in water.
- 7) Show a correct numerical setup for calculating the total number of moles of ethylene glycol needed to prepare 2.50 liters of a 10.0 M solution.

- 8) Ethanol, $\text{C}_2\text{H}_5\text{OH}$, is a volatile and flammable liquid with a distinct odor at room temperature. Ethanol is soluble in water. The boiling point of ethanol is 78.2DC at 1 atmosphere. Ethanol can be used as a fuel to produce heat energy, as shown by the balanced equation below.



At 1 atmosphere, compare the boiling point of pure ethanol to the boiling point of a solution in which a nonvolatile substance is dissolved in ethanol.

- 9) Sulfur dioxide, SO_2 , is one of the gases that react with water to produce acid rain. According to the *Solubility Curves* chemistry reference table, describe how the solubility of sulfur dioxide in water is affected by an increase in water temperature.
- 10) According to the *Solubility Curves* chemistry reference table, how many grams of KClO_3 must be dissolved in 100 grams of H_2O at 10DC to produce a saturated solution?

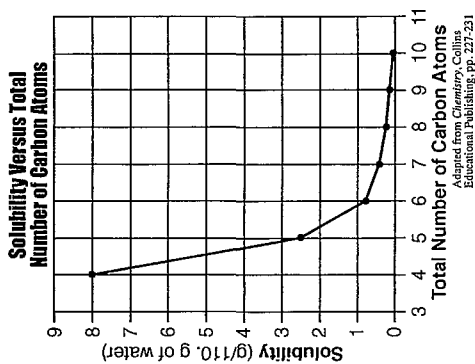
Questions 11 through 13 refer to the following:

A student uses 200 grams of water at a temperature of 60DC to prepare a saturated solution of potassium chloride, KCl .

- 11) Identify the solute in the solution described.
- 12) According to the *Solubility Curves* chemistry reference table, how many grams of KCl must be used to create the saturated solution described?
- 13) The solution described is cooled to 10DC and the excess KCl precipitates (settles out). The resulting solution is saturated at 10DC. How many grams of KCl precipitated out of the original solution?

Questions 14 and 15 refer to the following:

The graph below shows the relationship between the solubility of a sequence of primary alcohols in water and the total number of carbon atoms in a molecule of the corresponding alcohol at the same temperature and pressure. A primary alcohol has the #OH group located on an end carbon of the hydrocarbon chain.

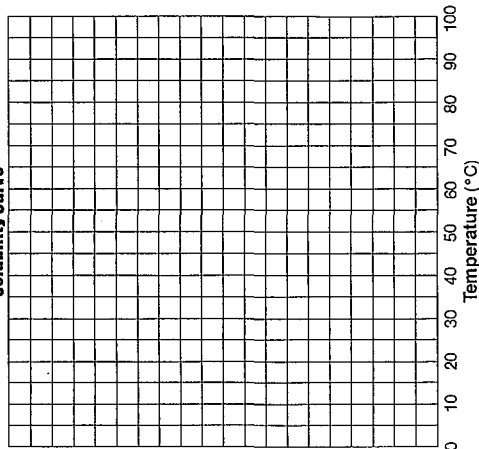


- 14) Based on the information shown, describe the relationship between the solubility of a primary alcohol in water and the total number of carbon atoms in the primary alcohol.
- 15) Based on the information shown, determine the total mass of 1-pentanol that will dissolve in 110. grams of water to produce a saturated solution.

Questions 16 and 17 refer to the following:

The data table below shows the solubility of a solid solute.

Solubility Curve

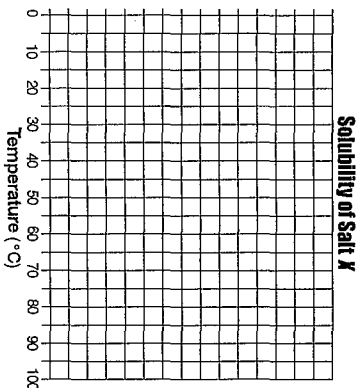


Temperature (°C)	Solute per 100 g of H ₂ O(g)
0	18
20	20
40	24
60	29
80	36
100	49

- 16) (a) On the given grid, mark an appropriate scale on the axis labeled "Solute per 100 g of H₂O(g)." [An appropriate scale is one that allows a trend to be seen.]
- (b) On the same grid, plot the data from the data table. Circle and connect the points.
- EXAMPLE:**
- 17) Based on the given data table, if 15 grams of solute is dissolved in 100 grams of water at 40°C, how many more grams of solute can be dissolved in this solution to make it saturated at 40°C?

- 18) Given the data table below showing the solubility of salt X:

Temperature (°C)	Mass of Solute per 100 g of H ₂ O (g)
10	22
25	40
30	48
80	107
70	135



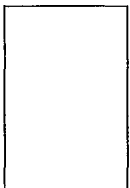
- (a) Which salt on the *Solubility Curves* chemistry reference table is most likely to be salt X?
- (b) On the graph above, scale and label the y-axis including appropriate units.
- (c) Plot the data from the data table. Surround each point with a small circle and draw a best-fit curve for the solubility of salt X.
- (d) Using the graph drawn in *part (b)*, predict the solubility of salt X at 50°C.
- (e) If the pressure on the salt solution was increased, what effect would this pressure change have on the solubility of the salt?

Questions 19 through 21 refer to the following:

A safe level of fluoride ions is added to many public drinking water supplies. Fluoride ions have been found to help prevent tooth decay. Another common source of fluoride ions is toothpaste. One of the fluoride compounds used in toothpaste is tin (II) fluoride.

A town located downstream from a chemical plant was concerned about fluoride ions from the plant leaking into its drinking water. According to the Environmental Protection Agency, the fluoride ion concentration in drinking water cannot exceed 4 ppm. The town hired a chemist to analyze its water. The chemist determined that a 175-gram sample of the town's water contains 0.000 250 gram of fluoride ions.

- 19) In the box below, draw a Lewis electron-dot diagram for a fluoride ion.



- 20) What is the chemical formula for tin (II) fluoride?

- 21) (a) How many parts per million of fluoride ions are present in the given analyzed sample?

(b) Is the town's drinking water safe to drink? [Support your decision using information in the passage and your calculated fluoride level in *part (a)*.]

Questions 22 through 24 refer to the following:

FIZZIES - A SPLASH FROM THE PAST

The '70s haack... a splash from the past! Fizzes instant sparkling drink tablets, popular in the 1950s and 1960s, are now back on the market. What sets them apart from other powdered drinks is that they bubble and fizz when placed in water, forming an instant carbonated beverage.

The fizz in Fizzes is caused by bubbles of carbon dioxide (CO₂) gas that are released when the tablet is dropped into water. Careful observation reveals that these bubbles rise to the surface because CO₂ gas is much less dense than water. However, not all of the CO₂ gas rises to the surface, some of it dissolves in the water. The dissolved CO₂ can react with water to form carbonic acid, H₂CO₃.



The pH of the Fizzes drink registers between 5 and 6, showing that the resulting solution is clearly acidic. Carbonic acid is found in other carbonated beverages as well. One of the ingredients on any soft drink label is carbonated water, which is another name for carbonic acid. However, in the production of soft drinks, the CO₂ is pumped into the solution under high pressure at the bottling plant.

##Bhan Rohitg, Excerpted from "Fizzes ## A Splash from the Past," *Chem Matters*, February 1998

- 22) What is the *only* positive ion in an aqueous solution of carbonic acid?
- 23) CO₂ is pumped into the soft drink solution under high pressure. Why is high pressure necessary?

- 24) (a) Describe the solubility of CO₂ gas in water.

(b) Explain your response to *part (a)* in terms of the molecular polarities of CO₂(g) and H₂O(l).

- 25) Which of the following compounds is *least* soluble in water?
- A) potassium sulfate B) iron (III) hydroxide C) aluminum acetate D) copper (II) chloride

