

Solutions Review

1) What is a solution?

2) How does a solution form?

3) What is solubility?

4) Fill in the chart below with either increases, decreases, or remains the same for changing the following factors on the SOLUBILITY of the solute in water:

Solute	Increasing Temperature	Decreasing Temperature	Increasing Pressure	Decreasing Pressure
CO ₂ (g)				
NaCl (s)				

5) Using Reference Table D, determine the solubility of:

a) NaNO ₃ in 100 g of water at 30°C		c) KNO ₃ in 100 g of water at 40°C	
b) NaNO ₃ in 200 g of water at 30°C		d) KNO ₃ in 50 g of water at 40°C	

6) Using Reference Table D, determine if the following solutions are saturated, unsaturated or supersaturated. If they are anything but saturated, list two things you can do to make them saturated (include numbers).

Solution (in 100g H ₂ O)	Sat, Unsat, Supersat	What to do with temp. to make sat.	What to do with amt. Of solute to make sat.
40 g of KClO ₃ at 50°C			
110 g NaNO ₃ at 45°C			
70 g KNO ₃ at 60°C			
70 g NH ₄ Cl at 70°C			

7) Calculate the molarities of the following solutions:

a) 120 g NaOH in 500. mL of solution

b) 3.0 moles NaCl in 750. mL of solution

c) 50.0 g of NaNO_3 in 2.5 L of solution

8) Calculate the number of grams of solute needed to make the following solutions:

a) 2.00 L of 0.50 M NaBr (aq)

b) 250. mL of 3.0 M KNO_3 (aq)

c) 350. mL of 0.10 M HCl

9) Calculate the following concentrations:

a) In ppm, of 0.044 grams of mercury ions in 200. g of solution

b) In % by mass, 3.88 grams of NaCl in 10.0 g of solution

c) In % by volume, 5.63 mL of ethyl acetate in 7.89 mL of solution

Student Name: _____ Grades: _____

1) Solutions and Solubility Homework

A) Multiple Choice Questions: Place your answer in the space in front of each question.

_____ 1) Which of the following solutes will dissolve in water (H_2O , a VERY polar solvent)?

- a) CH_4 b) H_2 c) NH_3 d) O_2

_____ 2) Which of the following solutes will dissolve in benzene (C_6H_6 , a VERY nonpolar solvent)

- a) NH_3 b) CH_4 c) HCl d) H_2O

_____ 3) Which statement can explain why oil does not dissolve in water?

- a) Oil is nonpolar, and water is polar. b) Oil is polar, and water is nonpolar.
c) Oil is nonpolar, and water is nonpolar. d) Oil is polar, and water is nonpolar.

_____ 4) At which temperature will sugar ($C_6H_{12}O_6$ (s)) dissolve best in water?

- a) 300 K b) 320 K c) 340 K d) 350 K

_____ 5) At what pressure will CO_2 (g) dissolve worst in water?

- 0.5 atm b) 1.0 atm c) 1.5 atm d) 2.0 atm

B) Complete the following chart:

For the solutes below, dissolved in water:	If temperature is increased, the solubility of this solute will:	If temperature is decreased, the solubility of this solute will:	If surface area is increased, the solubility of this solute will:
NH_3 (g)			
KCl (s)			

C) Complete the following chart:

For the solutes listed below:	Is the solute polar or nonpolar or ionic?	Will this solute dissolve in water or benzene?
CH_4		
KBr		
H_2S		

D) Hydrochloric acid is actually hydrogen chloride gas dissolved in water. The solubility of hydrogen chloride in water at 298 K and 1 atm is 12.1 moles (442 grams) per liter of solution. In what two ways can the solubility of hydrogen chloride in water be increased to make the solution more concentrated?

a) _____

b) _____

E) Use Reference Table G to answer the following:

_____ 1) As the temperature decreases, the solubility of gases

_____ 2) As the temperature decreases, the solubility of solids in liquids

_____ 3) Which of the **salts** on Table G is the *least* soluble at 90°C

_____ 4) Which gas on Table G is *most* soluble at 60°C?

_____ 5) Which salt on Table G shows the *least* change in solubility between 30°C and 70°C?

For # 6-8, determine whether the following solutions are unsaturated, saturated or supersaturated:

_____ 6) 108 g of KNO_3 at 60°C

_____ 7) 20 g of NH_4Cl at 30°C

_____ 8) 50 g of KCl at 60°C

_____ 9) What is the **solubility** of NaNO_3 in 100 grams of water at 40°C?

_____ 10) How many **grams** of KClO_3 can be dissolved in 1000 g of water at 30°C?

_____ 11) What is the **solubility** of NaCl in 50 grams of water at 70°C?

_____ 12) How many **grams** of solute must be added to a solution containing 30 g of NH_4Cl at 90°C in order to make it a saturated solution?

_____ 13) A solution contains 80 g of KNO_3 at 80°C. To what **temperature** must the solution be lowered in order to make it a saturated solution?

_____ 14) Consider a saturated solution of NaNO_3 at 70°C. If the solution is cooled to 20°C, how many **grams** of solute will precipitate?

_____ 15) How many **grams** of solute will precipitate if a saturated solution of NaNO_3 in 50. g of water at 30°C is evaporated to dryness?

_____ 16) At what **temperature** do KCl and HCl have the same solubility?

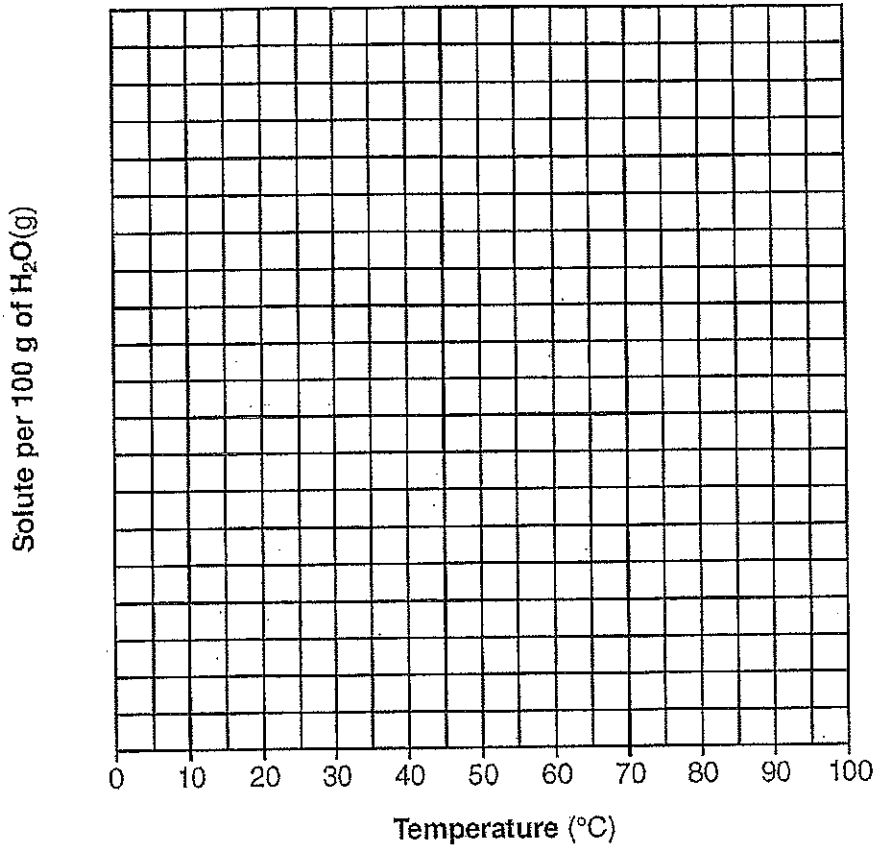
Name _____

Solubility Constructed Response

Date _____

Base your answers to questions 1 through 4 on the data table below, which shows the solubility of a solid solute.

Solubility Curve



The Solubility of the Solute at
Various Temperatures

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

1. On the grid provided, 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.
2. According to Reference Table G, how many grams of KClO₃ must be dissolved in 100 grams of H₂O at 10°C to produce a saturated solution?
3. On the same grid, plot the data from the data table. Circle and connect the points.
4. Based on the 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?

Base your answer to the following question on the information below.

When cola, a type of soda pop, is manufactured, CO₂(g) is dissolved in it.

5. A capped bottle of cola contains CO₂(g) under high pressure. When the cap is removed, how does pressure affect the solubility of the dissolved CO₂(g)?

Solubility

Base your answers to questions 6 and 7 on the information below.

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

6. Identify the solute in this solution.

7. According to Reference Table G, how many grams of KCl must be used to create this saturated solution?

8. Base your answers to the following questions on the information below.

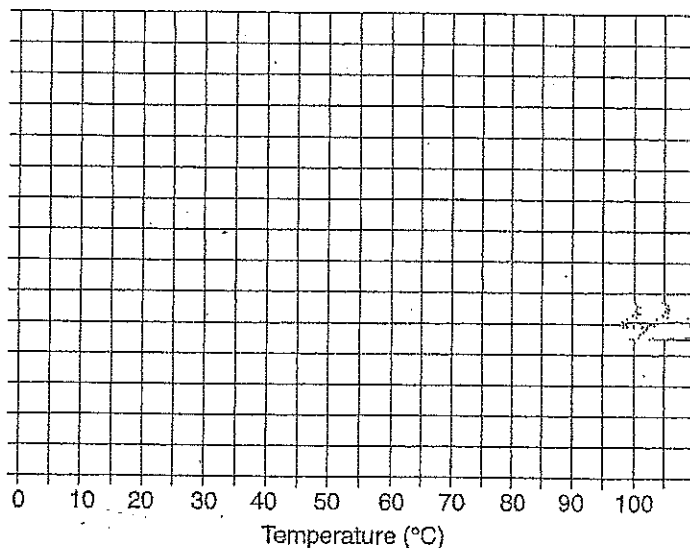
Most commercial dry cleaning is done with a chemical called Perc (perchloroethylene- C_2Cl_4) a non-polar liquid.

a What advantage does Perc have over water in dissolving greasy stains?

9. Given the data table below showing the solubility of salt X:

Temperature ($^{\circ}\text{C}$)	Mass of Solute per 100 g of H_2O (g)
10	22
25	40
30	48
60	107
70	135

Solubility of Salt X



a Which salt on Table G is most likely to be salt X?

b 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 your graph, 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?