

## Solubility Curves Worksheet

(K<sub>sp</sub>)

1. Using a solubility curve, determine the amount of each solute that can dissolve in 100g of water at the given temperature

- (a) KNO<sub>3</sub> at 70°C *130g*  
 (b) NH<sub>4</sub>Cl at 90°C *70g*  
 (c) NaCl at 100°C *40g*  
 (d) NaNO<sub>3</sub> at 35°C *100g*  
 (e) NH<sub>3</sub> at 20°C *53g*  
 (f) KClO<sub>3</sub> at 65°C *30g*  
 (g) NH<sub>4</sub>Cl at 65°C *55g*  
 (h) NaNO<sub>3</sub> at 70°C *135g*  
 (i) KNO<sub>3</sub> at 10°C *20g*  
 (j) Ce<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> at 15°C *13g*

2. Solubility data for four different salts in water at 60°C are shown in the table below.

Salt	Solubility in Water at 60°C
A	10 g/50 g H <sub>2</sub> O
B	20 g/60 g H <sub>2</sub> O
C	30 /120 g H <sub>2</sub> O
D	40 g/80 g H <sub>2</sub> O

$\frac{10}{50} = \frac{x}{100} \quad x = 20g$   
 $\frac{20}{60} = \frac{x}{100} \quad x = 33.3g$   
 $\frac{30}{120} = \frac{x}{100} \quad x = 25g$   
 $\frac{40}{80} = \frac{x}{100} \quad x = 50$

Which salt is most soluble at 60°C?

SALT **(D)**

3. When cola, a type of soda pop, is manufactured, CO<sub>2</sub>(g) is dissolved in it.
- (a) A capped bottle of cola contains CO<sub>2</sub>(g) under high pressure. When the cap is removed, how does pressure affect the solubility of the dissolved CO<sub>2</sub>(g)? *The CO<sub>2</sub> wants to come out of solution.*
- (b) A glass of cold cola is left to stand 5 minutes at room temperature. How does temperature affect the solubility of the CO<sub>2</sub>(g)? *it will warm up, so there will be less CO<sub>2</sub> able to dissolve.*

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

- (a) Identify the solute in this solution. *KCl*
- (b) How many grams of KCl must be used to create this saturated solution? *@ 60°C  $\frac{43g KCl}{100g H_2O} = \frac{x}{200}$*
- (c) This solution is cooled to 10°C and the excess KCl precipitates (settles out). The resulting solution is saturated at 10°C. How many grams of KCl precipitated out of the original solution?  *$x = 86g$*
- $\frac{30g KCl}{100} = \frac{60g}{200}$        $86 - 60 = 26g KCl$  will settle out.*

X 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. Explain, in terms of molecular polarity, why rubbing alcohol, 2-propanol, is soluble in water.

6. The following data table shows the solubility of a solid solute.

Temperature (°C)	Solute/100 g of H <sub>2</sub> O
0	18
20	20
40	24
60	29
80	39
100	49

- ✓ (a) Graph the data from the data table. Connect the points.
- (b) 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? <sup>9g</sup>
- (c) How many grams of KClO<sub>3</sub> must be dissolved in 100 grams of H<sub>2</sub>O at 10°C to produce a saturated solution? <sup>≈ 19g</sup>
7. A saturated solution of NaNO<sub>3</sub> is prepared at 60.°C using 100. grams of water. As this solution is cooled to 10.°C, NaNO<sub>3</sub> precipitates (settles) out of the solution. The resulting solution is saturated. Approximately how many grams of NaNO<sub>3</sub> settled out of the original solution?

@ 10° 80g

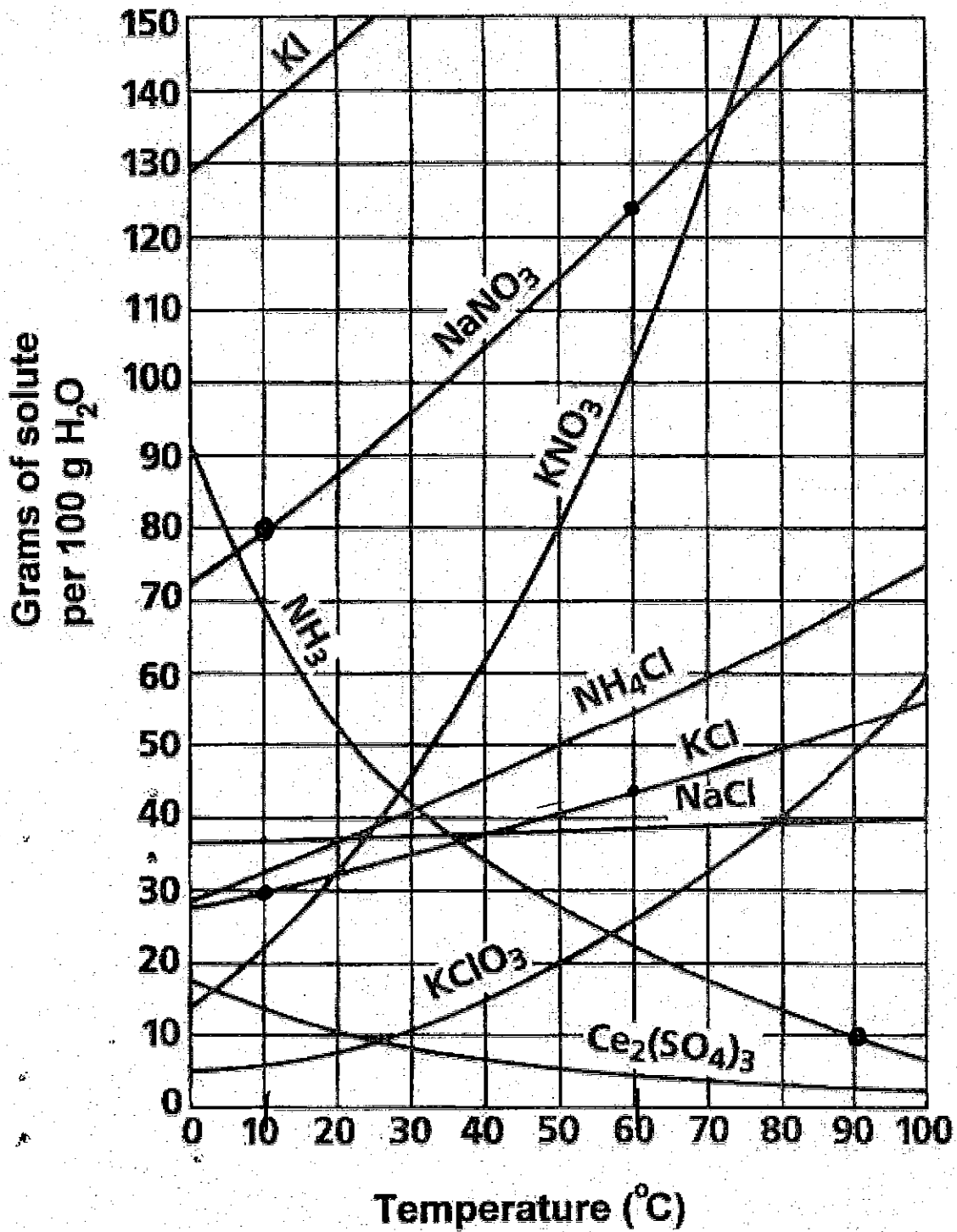
@ 60° 123g

$$123 - 80 =$$

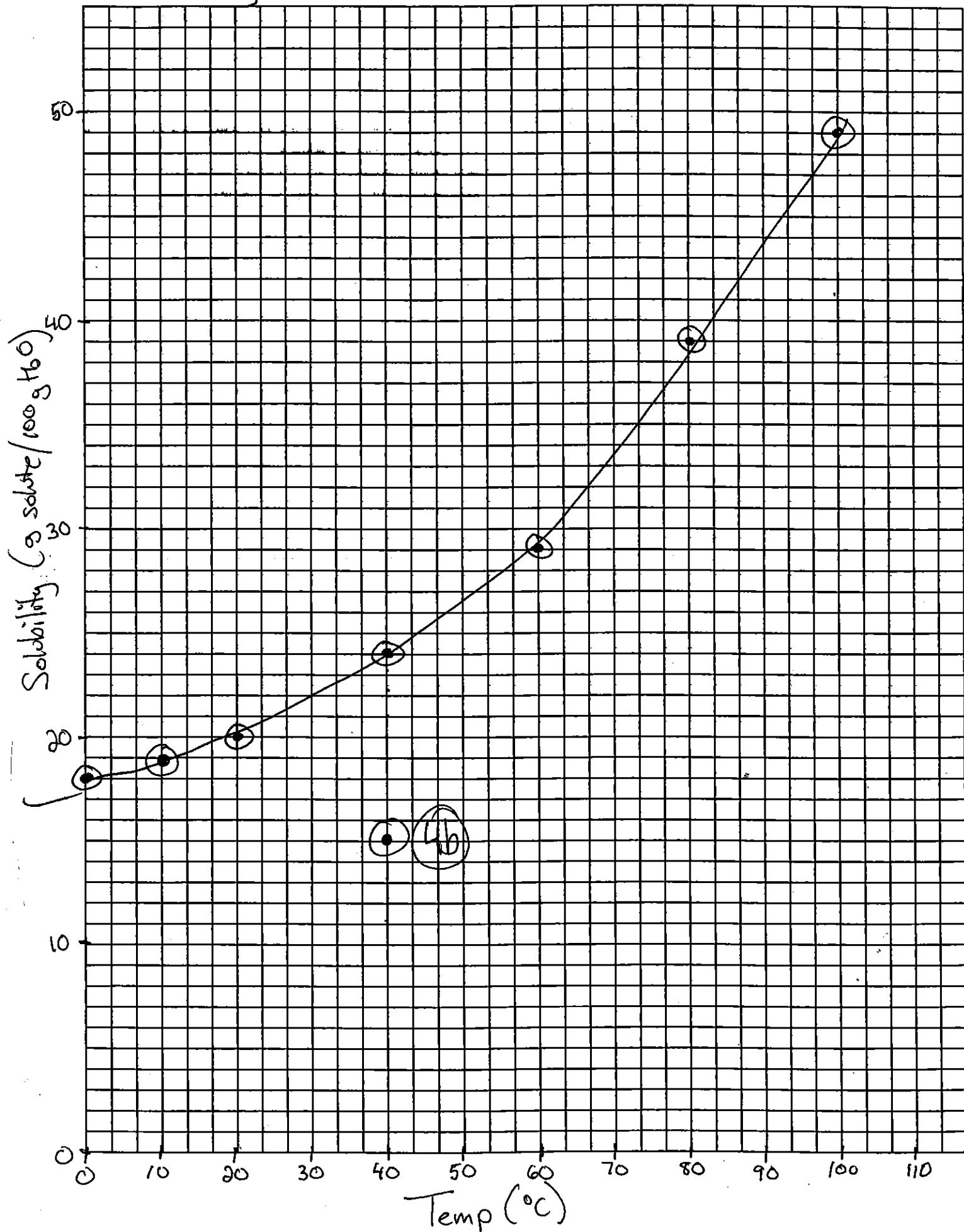
43g will settle out

8. An unsaturated aqueous solution of NH<sub>3</sub> is at 90.°C in 100. grams of water. How many grams of NH<sub>3</sub> could this unsaturated solution contain?

Any amount less than 10g is unsaturated.



# Solubility Curve Worksheet Problem #6



## Solubility Curve Worksheet

- 1) Define solubility. the ability to dissolve a solute in a solution.
- 2) Look at the graph below. In general, how does temperature affect solubility?  
As temp ↑, solubility ↑
- 3) Which compound is LEAST soluble at 10 °C? KClO<sub>3</sub>
- 4) How many grams of KCl can be dissolved in 100g of water at 80°C? 50g
- 5) How many grams of NaCl can be dissolved in 100g of water at 90°C? 40g
- 6) At 40°C, how much KNO<sub>3</sub> can be dissolved in 100g of water? 61-62g
- 7) Which compound shows the least amount of change in solubility from 0°C-100°C?  
NaCl (flat line)
- 8) At 30°C, 90g of NaNO<sub>3</sub> is dissolved in 100g of water. Is this solution saturated or unsaturated?  
UN-SATURATED
- 9) At 60°C, 72g of NH<sub>4</sub>Cl is dissolved in 100g of water. Is this solution saturated or unsaturated?  
Super-saturated
- 10) A saturated solution of KClO<sub>3</sub> is formed from one hundred grams of water. If the saturated solution is cooled from 90°C to 50°C, how many grams of precipitate are formed? 49-20 = 29g
- 11) A saturated solution of NH<sub>4</sub>Cl is formed from one hundred grams of water. If the saturated solution is cooled from 80°C to 40°C, how many grams of precipitate are formed? 65-45 = 20g
- 12) Which compounds show a decrease in solubility from 0°C-100°C?  
NH<sub>3</sub> + Ce<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>
- 13) Which compound is the most soluble at 10°C?  
KI
- 14) Which compound (besides Ce<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>) is the least soluble at 50°C? KClO<sub>3</sub>
- 15) For each of the following solutions, explain how much of the solute will dissolve and how much will remain undissolved at the bottom of the test tube?
  - a) 120 g of KCl in 100 g of water at 80°C  
50g will dissolve  
70g sink to bottom
  - b) 130 g of NaNO<sub>3</sub> in 100 g of water at 50°C  
115 will dissolve  
15 will sink to bottom

