Practice Questions Section 3.2

Solubility Curves & Solubility Tables

1. Use a solubility curve to determine the solubility of the following compounds at the temperatures given.

compound	temperature	solubility
NH_3	10°C	
$Ce_2(SO_4)_3$	50°C	
KCl	90°C	

2. For each of the following solutions, classify the solution as unsaturated, saturated, or supersaturated.

compound	temperature	mass solute in 100 mL water	solution
NH_3	90°C	10g	
NH_4Cl	80°C	70g	
$NaNO_3$	30°C	80g	

3. What is the solubility of ammonium chloride, NH_4Cl, at 100°C?

   Express this both as g $\cdot 100mL^{-1}$ and as $mol \cdot L^{-1}$

4. What mass of potassium chlorate, $KClO_3$ could be dissolved in 100mL of water at 70°C?

5. What would happen if a saturated solution of potassium chloride, KCl, in 100g of water was cooled from 80°C to 40°C?

6. Use a Table of Solubility of Common Compounds to predict whether or not the following compounds will be soluble in water at 25°C.

$Mg(NO_3)_2$		$CaSO_4$	
$CaCl_2$		K_2SO_4	
Al_2S_3		$Ba(OH)_2$	
$(NH_4)_3PO_4$		$Mg(OH)_2$	
$SrCO_3$		BeS	
$BaSO_4$		$CuCl_2$	
$Mg(CH_3COO)_2$		CuCl	
SrI_2		H_2CO_3	
PbS		Ag_2SO_4	
$Ra(NO_3)_2$		PbI_2	

Practice Questions Section 3.2

Solubility Curves & Solubility Tables Answers

1. Use a solubility curve to determine the solubility of the following compounds at the temperatures given.

compound	temperature	solubility
NH_3	10°C	70g/100mL
$Ce_2(SO_4)_3$	50°C	5g/100mL
KCl	90°C	53g/100mL

2. For each of the following solutions, classify the solution as unsaturated, saturated, or supersaturated.

compound	temperature	mass solute in 100 mL water	solution
NH_3	90°C	10g	saturated
NH_4Cl	80°C	70g	supersaturated
$NaNO_3$	30°C	80g	unsaturated

3. What is the solubility of ammonium chloride, NH_4Cl, at 100°C?

   Express this both as g $\cdot 100mL^{-1}$ and as mol$\cdot L^{-1}$

   Solution:

   From the Solubility Curve table we find that the solubility of NH_4Cl at 100°C is approximately 75 g $\cdot 100mL^{-1}$.

   To convert this to molarity (mol$\cdot L^{-1}$) we will need to know the molar mass of NH_4Cl. A review:

Atom	atomic mass		No. atoms		
N	14.0	×	1	=	14.0
H	1.0	×	4	=	4.0
Cl	35.5	×	1	=	35.5
	molar mass (in g · mol^{-1})			=	**53.5**

   Next, we need to convert 75 g $\cdot 100mL^{-1}$ to mol$\cdot L^{-1}$, the units for molarity

   Begin by converting 75 g $\cdot 100mL^{-1}$ to g $\cdot L^{-1}$ which will simply our conversion to molarity (mol$\cdot L^{-1}$):

$$\frac{75g}{100mL} \times \frac{10}{10} = \frac{750g}{1000mL} = \frac{750g}{1L}$$

Next – use unit analysis to convert $\frac{g}{L}$ to $\frac{mole}{L}$

$$\frac{mole}{L} = \frac{750g}{1L} \times \frac{1mol}{53.5g} = \frac{14mol}{L} \quad \text{or} \quad 14M \qquad \textbf{answer}$$

4. What mass of potassium chlorate, $KClO_3$ could be dissolved in 100mL of water at 70°C?

Solution

At that temperature any mass up to approximately 32g could be dissolved in 100mL of water.

5. What would happen if a saturated solution of potassium chloride, KCl, in 100g of water was cooled from 80°C to 40°C?

Solution

At 80°C, approximately 50g of KCl will dissolve in 100g of water. At 40°C only 38g of KCl will dissolve in 100g of water. Therefore, when the solution is cooled from 80°C to 40°C, approximately 12g of potassium chloride (50g – 38 g) will come out of solution, forming a solid.

6. Use a Table of Solubility of Common Compounds to predict whether or not the following compounds will be soluble in water at 25°C.

$Mg(NO_3)_2$	soluble	$CaSO_4$	low solubility
$CaCl_2$	soluble	K_2SO_4	soluble
Al_2S_3	low solubility	$Ba(OH)_2$	soluble
$(NH_4)_3PO_4$	soluble	$Mg(OH)_2$	low solubility
$SrCO_3$	low solubility	BeS	soluble
$BaSO_4$	low solubility	$CuCl_2$	soluble
$Mg(CH_3COO)_2$	soluble	CuCl	low solubility
SrI_2	soluble	H_2CO_3	soluble
PbS	low solubility	Ag_2SO_4	low solubility
$Ra(NO_3)_2$	soluble	PbI_2	low solubility