

# Solutions

**'homogeneous mixture'**

# Terminology

**solute- what you are trying to dissolve**

**solvent- the dissolving medium**

solute

solvent

s

s

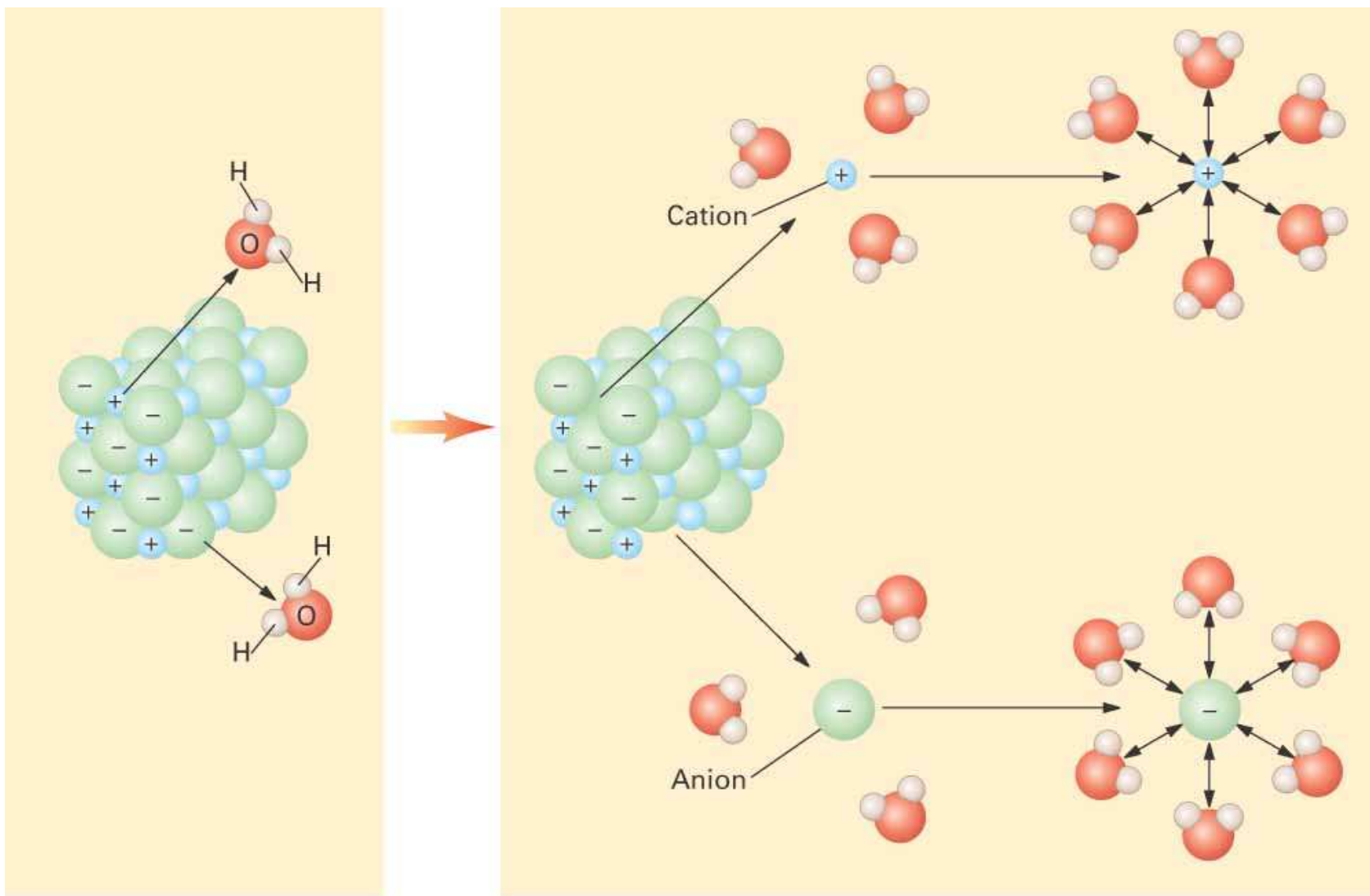
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l

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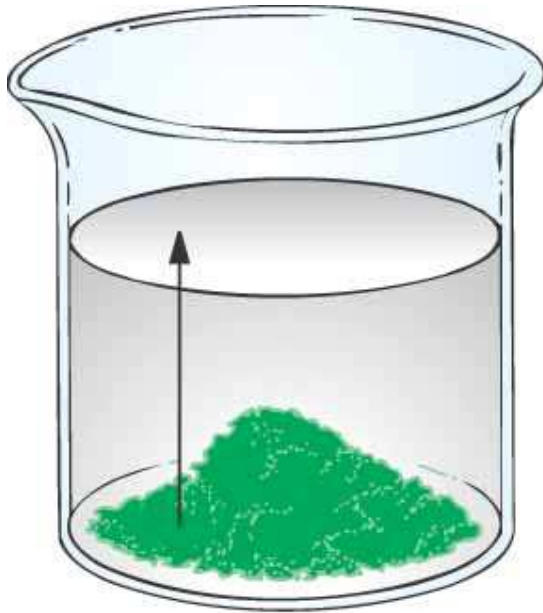
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# Formation of a Solution



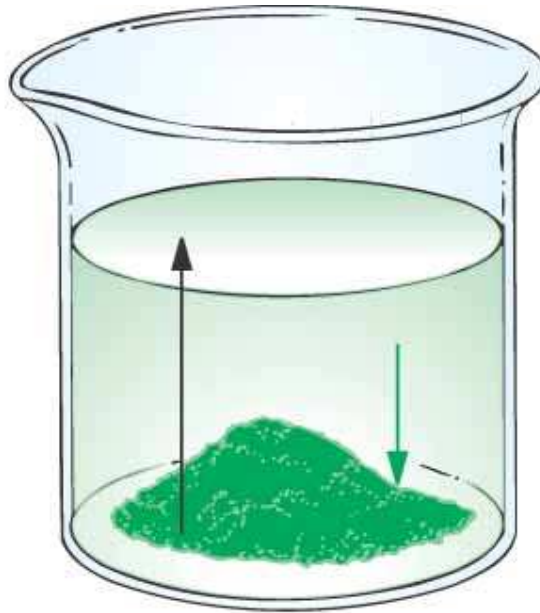
# A Developing Solution

**initially adding solute**



(a)

**more solute dissolving  
than redepositing**



(b)

**equilibrium attained  
(a saturated solution)**

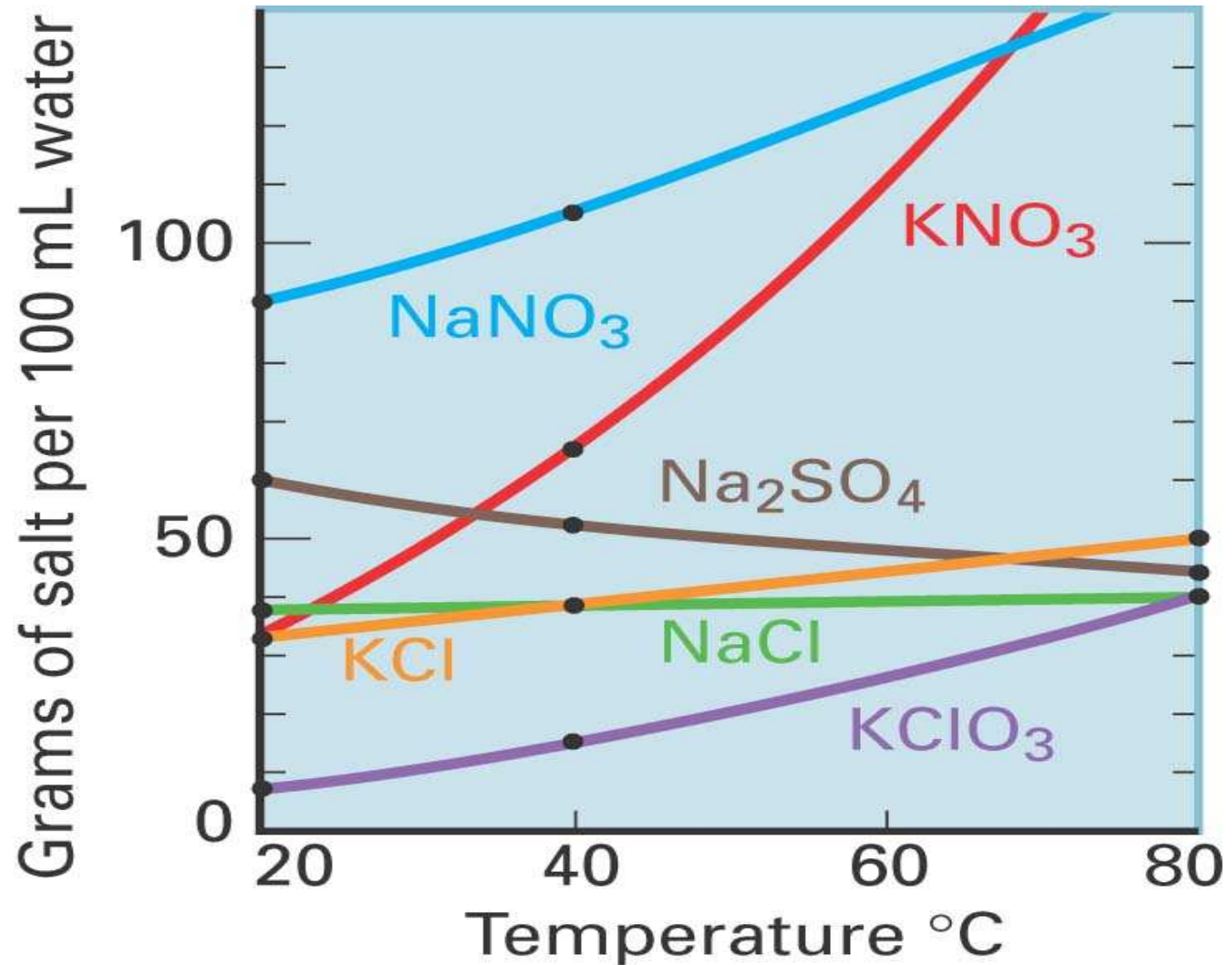


(c)

# Factors That Affect Solubility

rate

amount



# Solution Concentration

**the actual amount of solute dissolved  
into a given amount of solution/solvent**

percentage       $\% \text{ solute} = \frac{\text{mass solute}}{\text{mass solution}} \times 100$

"A solution is 25.0% NaCl by mass."

# A Problem

**How many grams of a 25.0% solution of NaCl must be weighed to contain 82.5 g NaCl?**

**25.0 g NaCl = 100. g solution**

# Q1

How many grams of water are contained in 375 g of a 45.5%  $\text{KNO}_3$  solution?

# Molarity

$$M = \frac{\text{mols solute}}{\text{liters solution}}$$

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**Q2**  
**Q2**

**What is the molarity of a solution made  
by dissolving 145 g HCl into 375 mL of solution?**

$$\text{Molarity} = \frac{\text{mols HCl}}{\text{L sol'n}}$$

“M”

- Read : mol/L anytime you see “M” in the text. DO NOT USE “M’ EVER!!!!!!!

# Molarity as an Identity-dimensional analysis!

10.6 mol HCl/L sol'n

**Q3** How many grams of calcium hydroxide are contained in 250. mL of a 1.75 mol/L solution?

250. mL sol'n  $\longrightarrow$  g Ca(OH)<sub>2</sub>      **1.75 mol Ca(OH)<sub>2</sub> = 1 L sol'n**

**L sol'n  $\longrightarrow$  mol Ca(OH)<sub>2</sub>**

# Q3

## Solution

# Q4

How many mL of a 0.505 mol/L sulfuric acid solution must be measured to contain 45.5 g of sulfuric acid?

# Dilution

$$M_C V_C = M_D V_D$$

**Note: volumes do NOT have to be in liters, just in the same units (mL for example)**

# Question

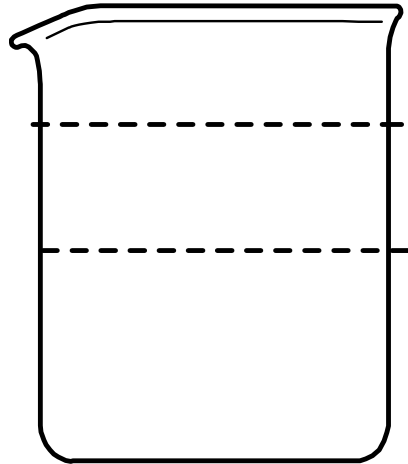
How many mL of a 12.5 mol/L solution of NaOH must be measured to prepare 500. mL of a 3.88 mol/L solution?

$$M_c V_c = M_d V_d$$

# Q5

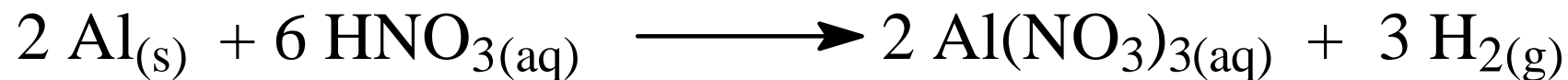
What will be the molarity of a solution made by diluting 175 mL of 2.50 mol/L KOH to 475 mL?

# Water Added



How much water was added to  $V_C$  ?

# Solution Stoichiometry



**How many grams of aluminum are required to react with 275 mL of a 1.65 mol/L solution of HNO<sub>3</sub>?**

# Q7

How many mL of a 1.55 mol/L solution of  $\text{HNO}_3$  are required to produce 10.5 L of  $\text{H}_2$  at STP?