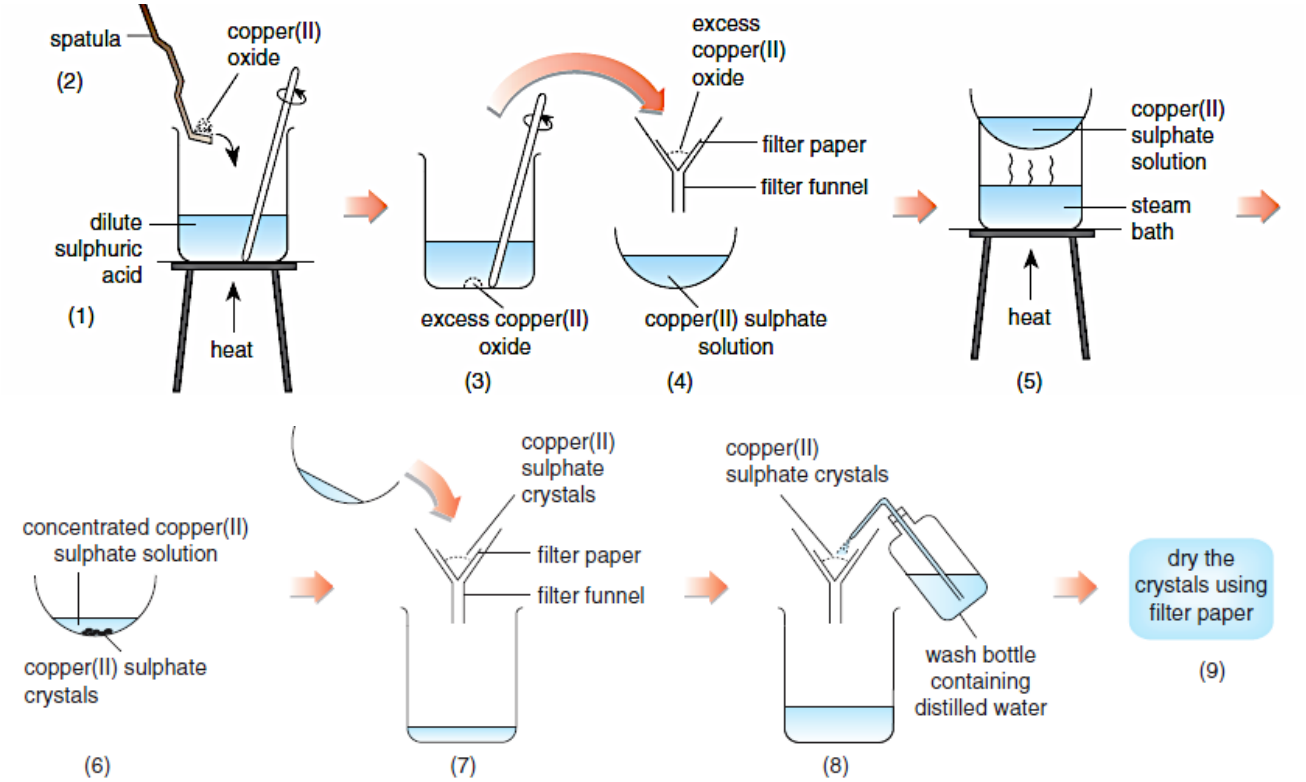
S.4 Chemistry

Class practice 3 (Methods of preparing soluble and insoluble salt) (Suggested answer)

Name: _____ Class: 4___ ( ) Date: _____

(A) Preparation of the soluble salt such as $CuSO_4$

Experimental procedures for preparing a soluble salt such as $CuSO_4$



Standard pattern in writing experimental procedures

Step (1) & (2) Add excess copper (II) oxide to the beaker with dilute sulphuric acid and heat the reaction mixture.

What do we have to do? — What do we have to _____? — Where do we add the excess copper(II) oxide to? — What do we have to do? — What do we have to _____?

Step (3) & (4) Filter the excess copper (II) oxide (in order) to obtain the copper (II) sulphate solution

Instruction: *Below are the remaining procedures for preparation of $CuSO_4$. Use green, red and blue highlighter or ball pen to underline different parts in each step according to the patterns shown in step 1-4.*

Step (5) Heat the copper (II) sulphate solution

(in order) to concentrate the solution

until a saturated copper (II) sulphate solution is formed

Step (6) Leave the saturated copper (II) sulphate solution at room temperature overnight

Step (7) Filter the copper (II) sulphate solution

(in order) to obtain the crystal

Step (8) Wash the crystals with a little cold distilled water

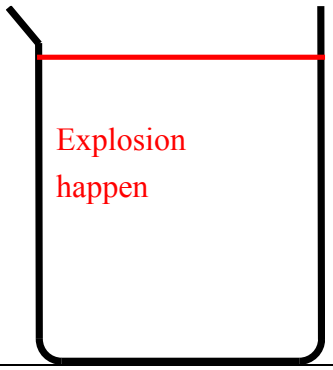
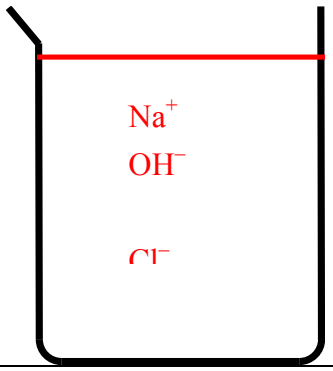
Step (9) Dry the crystals

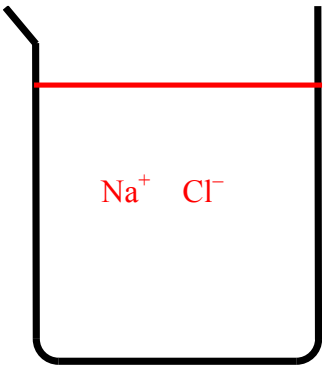
using filter paper

(B) Preparation of soluble salt such as NaCl

Decide which of the following methods is suitable for making pure sodium chloride solution

Aim: To prepare a pure solution of NaCl so that we can use it directly for producing the salt through crystallization.

Method 1: **excess Na + dilute H_2SO_4** Did any reaction occur? Yes / No Chemical equation(if yes): $2Na + H_2SO_4 \rightarrow Na_2SO_4 + H_2$ Did a pure salt form? Yes / No Why? The reaction is too vigorous and explosion will happen. Is it a suitable method? Yes / No	After mixing **excess Na** with **HCl**, what **ions** are left behind? 
Method 2: **excess NaOH + dilute H_2SO_4** Did any reaction occur? Yes / No Chemical equation(if yes): $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$ Did a pure salt form? Yes / No Why? The product, $Na_2SO_4(aq)$ will mix up with the excess NaOH as NaOH is also soluble in water. Is it a suitable method? Yes / No	After mixing **excess NaOH** with **HCl**, what **ions** are left behind? 

Method 3: **Same amount of dilute NaOH + same amount of dilute H_2SO_4**	After mixing same amount of NaOH and HCl, what ions are left behind?
Did any reaction occur? Yes / No Chemical equation(if yes): $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ Did a pure salt form? Yes / No Why? When ALL NaOH reacts with H_2SO_4, only the product, $Na_2SO_4(aq)$ remains in the solution. Is it a suitable method? Yes / No	

Summary

Method 3 (**Same amount of dilute NaOH + same amount of dilute** H_2SO_4) can produce **pure** $Na_2SO_4(aq)$ for making pure $Na_2SO_4(s)$ after **further treatment.**

Question to think about:

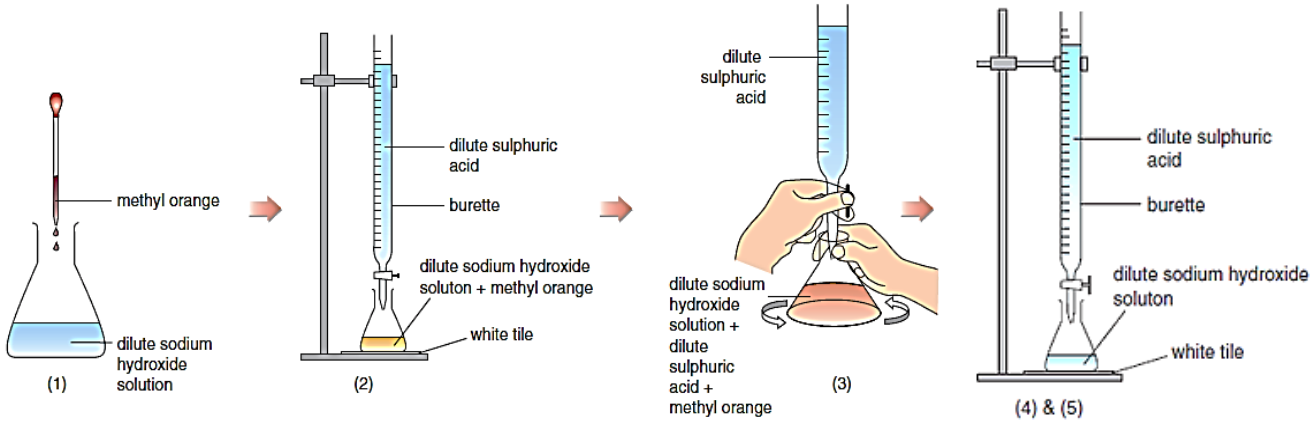
Suggest TWO salts, other than $Na_2SO_4(s)$, that require the same method for their preparation.

Any kind of salt which contains Na^+, K^+, group I metal ion or NH_4^+.

General method of producing soluble salt such as ____ , ____ and ____

Same amount of acids + same amount of alkalis

Writing experimental procedures for preparing a soluble salt such as NaCl



Step	What action do we have to do?	What do we have to (do)?	Where/When/How do we do it?
(1)	Add	a known volume of dilute sodium hydroxide solution	in a conical flask
	Add	a few drops of indicator	to the sodium hydroxide solution
(2) & (3)	Add	dilute hydrochloric acid	into the flask
	(Until) the indicator just changes		
(4) & (5)	Repeat	the experiment	with same volumes of acids and alkalis but without indicator

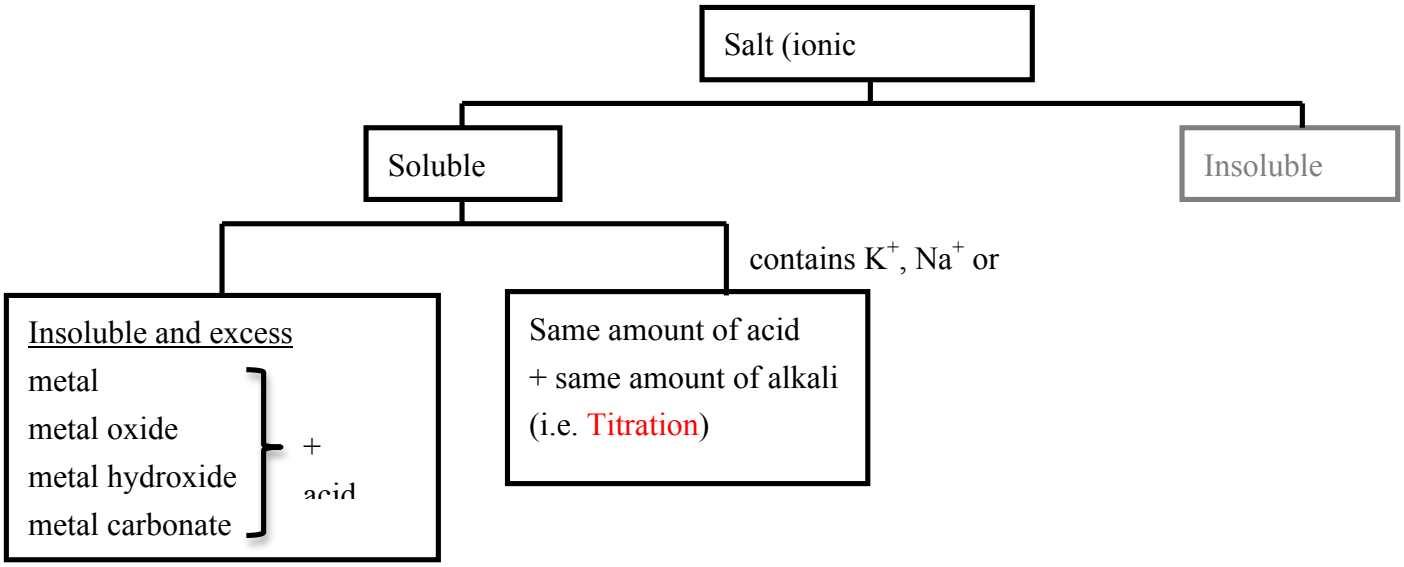
After the above steps, a pure $Na_2SO_4(aq)$ is

What are the next steps for obtaining pure $Na_2SO_4(s)$?

Try to write the procedures for the remaining part according to the standard structures of writing experimental procedures.

Heat **the solution (to)** concentrate **the solution (until) a saturated solution** is formed**. Then,** Filter **the solution (to)** obtain **the crystals.** Wash **the crystal** with a little cold distilled water**.** Dry **it** using **filter paper.**

Summary of the first two methods of making soluble salt



Checkpoint – Suggest a suitable method for preparing particular salt

Give a pair of reactants to prepare each of the following **soluble** salts

	Salt to be prepared	**Reactants to prepare the salt**
E.g.	$MgCl_2$	Excess MgO + dilute HCl
(a)	NH_4NO_3	Same amount of NH_3 + HNO_3
(b)	$FeSO_4$	Excess Fe /FeO/$FeCO_3$/$Fe(OH)_2$ + H_2SO_4
(c)	$NaNO_3$	Same amount of NaOH + HNO_3
(e)	$ZnCl_2$	Excess Zn/$Zn(OH)_2$/ZnO/$ZnCO_3$ + HCl

(C) Preparation of the insoluble salt such as $PbSO_4$

Decide which of the following methods is suitable for making pure sodium chloride solution

Aim: To prepare a pure insoluble $PbSO_4$

Method 1: **$Pb(NO_3)_2$ + Na_2SO_4**

Did any reaction occur? Yes / No

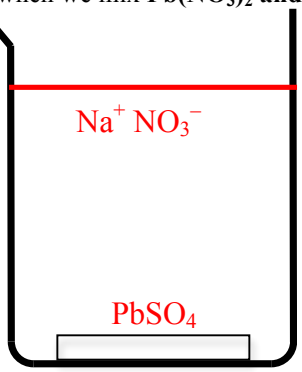
Chemical equation(if yes): $Pb(NO_3)_2 + Na_2SO_4 \rightarrow PbSO_4 + 2NaNO_3$

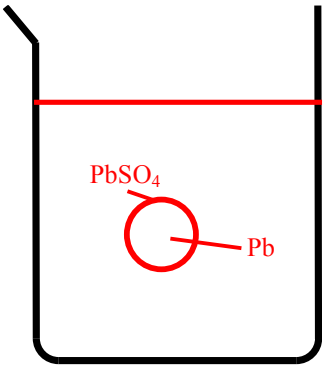
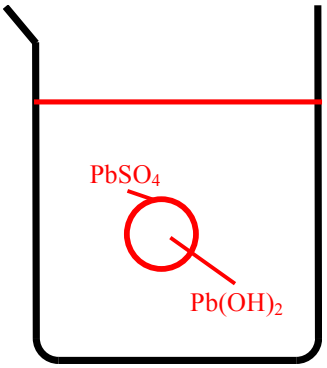
Did a pure salt form? Yes / No

Why? A precipitate ($PbSO_4$) is formed which is the only insoluble salt in the product. (Therefore, we call this process precipitation)

Is it a suitable method? Yes / No

What happen when we mix **$Pb(NO_3)_2$ and Na_2SO_4?**



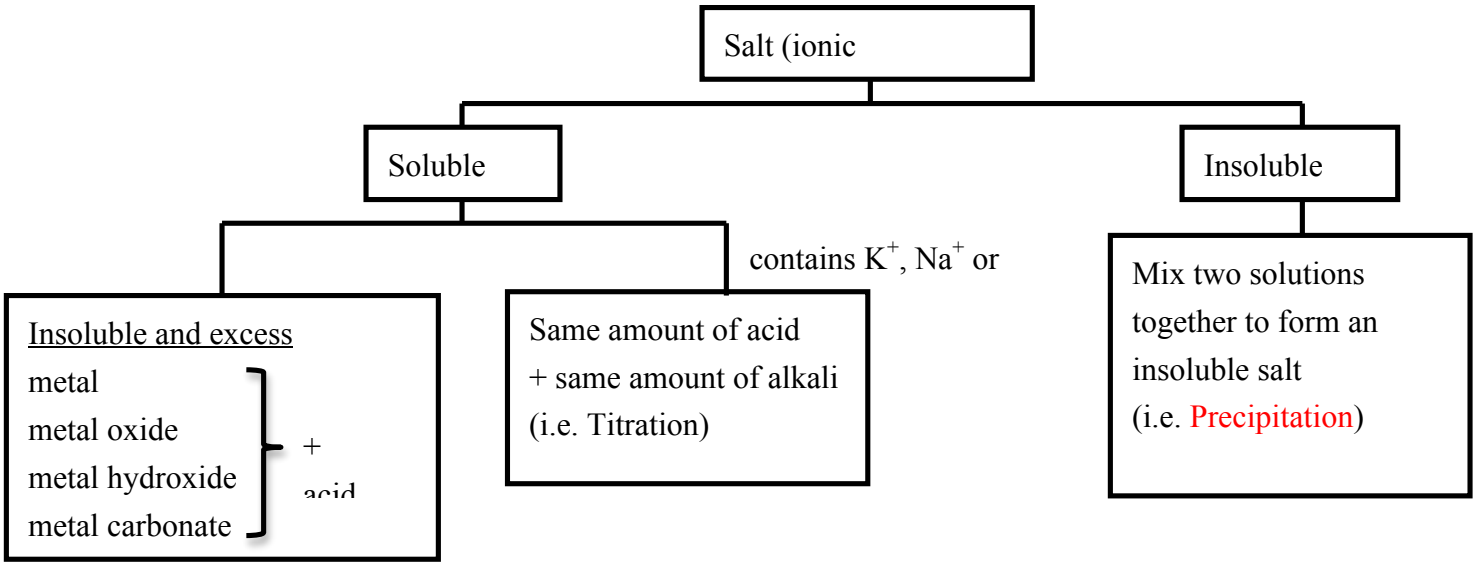
Method 2: **$Pb + H_2SO_4$** Did any reaction occur? Yes / No Chemical equation(if yes): $Pb + H_2SO_4 \rightarrow PbSO_4 + H_2$ Did a pure salt form? Yes / No Why? $PbSO_4$(s) will form on the surface of Pb which is difficult them. Besides, reaction will stop after a while when the surface of Pb is fully covered with $PbSO_4$. Is it a suitable method? Yes / No	What happen when we put **Pb and H_2SO_4?** 
Method 3: **$Pb(OH)_2 + H_2SO_4$** Did any reaction occur? Yes / No Chemical equation(if yes): $Pb(OH)_2 + H_2SO_4 \rightarrow PbSO_4 + 2H_2O$ Did a pure salt form? Yes / No Why? $PbSO_4$(s) will form on the surface of $Pb(OH)_2$ which is difficult them. Besides, reaction will stop after a while when the surface of $Pb(OH)_2$ is fully covered with $PbSO_4$. Is it a suitable method? Yes / No	What happen when we put **Pb and H_2SO_4?** 

Summary

Method **1** (**$Pb(NO_3)_2 + Na_2SO_4$**) can produce **pure** $PbSO_4$ after **further treatment.**

General method of producing insoluble salt such as $PbSO_4$(s)
Mix two solutions together to form a precipitate which is the insoluble salt (i.e. Precipitation)

Summary of the first two methods of making soluble salt



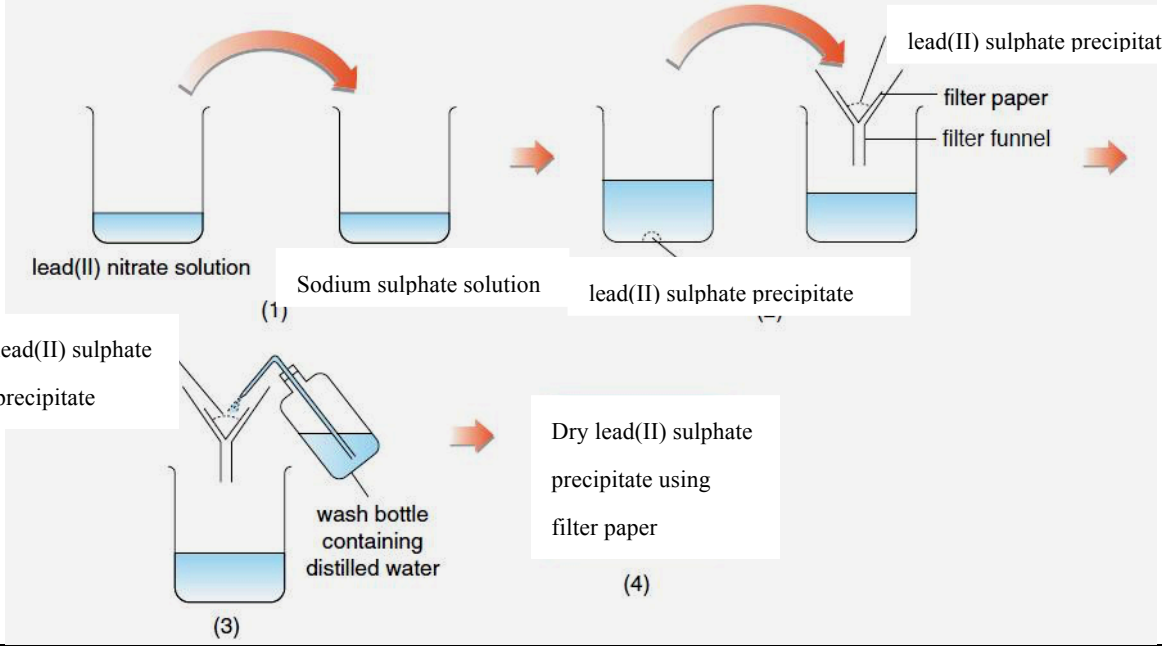
Checkpoint – Suggest a suitable method for preparing particular salt

Give a pair of reactants to prepare each of the following salts.

	Salt to be prepared	Soluble / insoluble	Reactants to prepare the salt
E.g.	$MgCl_2$	Soluble	Excess MgO + dilute HCl
(a)	$PbCl_2$	Insoluble	$Pb(NO_3)_2$ + NaCl
(b)	AgCl	Insoluble	$AgNO_3$ + NaCl
(c)	K_2SO_4	Soluble	KOH + H_2SO_4
(e)	$ZnSO_4$	Soluble	Excess Zn / $Zn(OH)_2$ / $ZnCO_3$ + H_2SO_4

Writing experimental procedures for preparing a insoluble salt such as $PbSO_4$

Draw diagrams to show the experimental procedures of preparing **pure** insoluble salt $PbSO_4$ in the laboratory



Describe the experimental procedures of preparing pure $PbSO_4$ in the laboratory.

First, mix lead(II) nitrate solution and sodium sulphate solution together in a beaker. Second, filter the reaction mixture (to) obtain the precipitate. Third, wash the precipitate with a **large amount of** distilled water. Finally, dry the precipitate using filter paper.

Take home exercises

(a) Salt to be prepared: **$CuCl_2$**

Step 1: Is it soluble or insoluble? *(Refer to note P. 7)* Soluble

Step 2: Deciding what reagents to be used.

Copper(II) oxide solid and hydrochloric acid

Step 3: Write a chemical equation, with state symbols, for the reaction involved.

$CuO + 2HCl \rightarrow CuCl_2 + H2O$

Step 4: Describe how you would prepare a pure crystal of **$CuCl_2$** in the laboratory.

First, add excess copper(II) oxide to the beaker with dilute hydrochloric acid and heat the reaction mixture. Secondly, Filter the excess copper(II) oxide to obtain the copper(II) chloride solution. Third, heat the copper(II) chloride solution to concentrate the solution until a saturated copper(II) chloride solution is formed. Fourth, leave the saturated copper(II) chloride solution at room temperature overnight. Fifth, filter the copper(II) chloride solution to obtain the crystal. Sixth, wash the crystals with a little cold distilled water. Finally, dry the crystals using filter paper

(b) Salt to be prepared: **$MgCO_3$**

Step 1: Is it soluble or insoluble? *(Refer to note P. 7)* insoluble

Step 2: Deciding what reagents to be used.

Magnesium nitrate solution and sodium carbonate solution

Step 3: Write a chemical equation, with state symbols, for the reaction involved.

$Mg(NO_3)_2 + Na_2CO_3 \rightarrow MgCO_3 + 2NaNO_3$

Step 4: Describe how you would prepare a pure crystal of **$MgCO_3$** in the laboratory.

First, Mix magnesium nitrate solution and sodium carbonate solution together in a beaker. Second, filter the reaction mixture to obtain the precipitate. Third, wash the precipitate with a **large amount of** distilled water. Finally, dry the precipitate using filter paper.