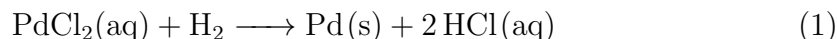


# INORGANIC CHEMICAL EQUATIONS\*

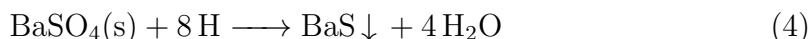
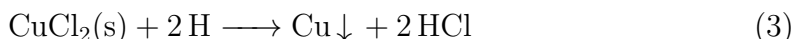
Guangyu Deng<sup>†</sup>

## 1 The Group 1 and 2 elements

Sensitive test of hydrogen:



Hydrogen atom has strong reducibility:



Preparation of alkaline earth metal nitrides:



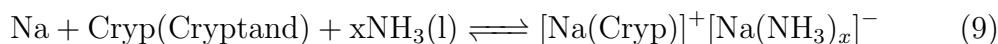
Sodium and magnesium are used as reducing agents in metallurgical industry:



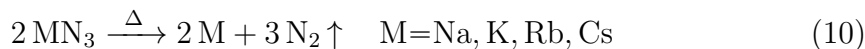
Equilibrium of alkali metals in liquid ammonia:



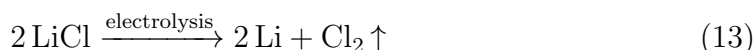
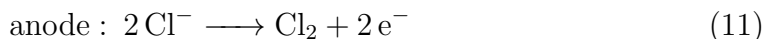
There are stable sodium anions in gaseous sodium, and sodium anions also exist in the following reactions:



Quantitative preparation of alkali metals:



Preparation of lithium by electrolysis:



---

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<sup>†</sup>Department of Chemistry and Materials Science, Xi'an Jiaotong Liverpool University, Suzhou 215123, China

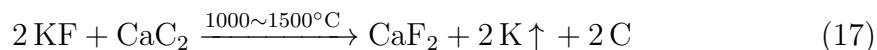
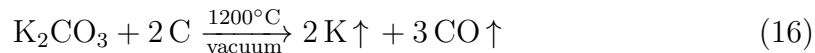
E-mail: [Guangyu.Deng24@student.xjtlu.edu.cn](mailto:Guangyu.Deng24@student.xjtlu.edu.cn), [dgy@m1racle.com](mailto:dgy@m1racle.com)

Personal Website: <https://m1racle.com>

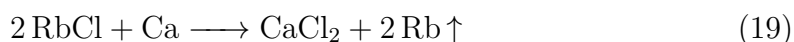
Electrolytic magnesium chloride has a pre-operation:



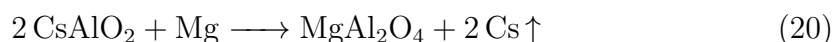
Preparation of potassium by thermal reduction method:



Preparation of rubidium by thermal reduction method:



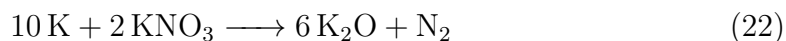
Preparation of cesium by thermal reduction method:



Preparation of sodium oxide:



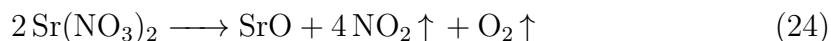
preparation of potassium oxide:



Preparation of rubidium oxide:



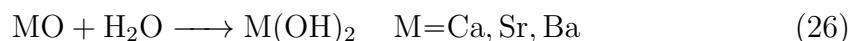
Preparation of cesium oxide:



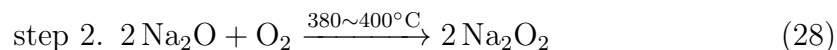
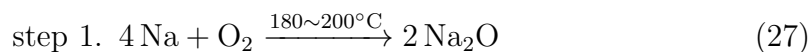
Preparation of alkali metal hydroxides:



Preparation of alkaline earth metal hydroxides:



Preparation of sodium peroxide:



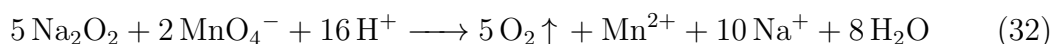
Sodium peroxide is used as an oxygen donor:



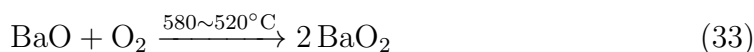
Sodium peroxide is used as a flux for ore:



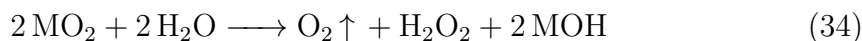
Sodium peroxide shows reducibility when it encounters strong oxides:



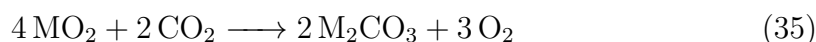
Preparation of barium peroxide:



The strong oxidizing property of alkali metal superoxide:



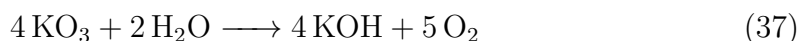
Reaction of alkali metal superoxide with carbon dioxide:



Potassium hydroxide reacts with ozone to prepare superoxide:



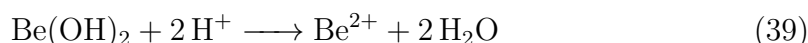
Potassium peroxide reacts with water:



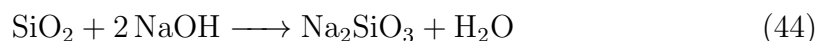
Potassium superoxide and easy decomposition:



Amphoteric of beryllium hydroxide:



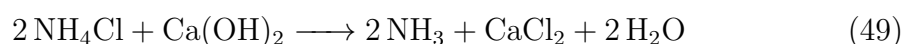
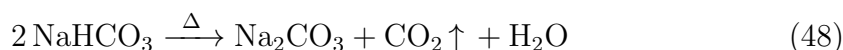
Sodium hydroxide can dissolve zwitterionic metals and their oxides, as well as many nonmetals and their oxides:



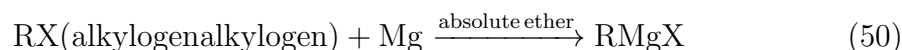
Preparation of sodium hydroxide by causticizing method:



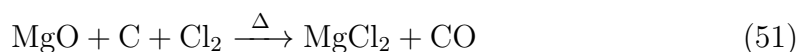
Hou's process:



Preparation of Grignard Reagent:



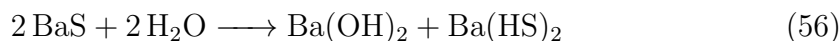
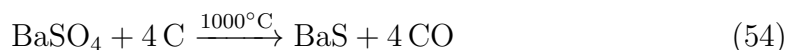
Preparation of magnesium chloride:



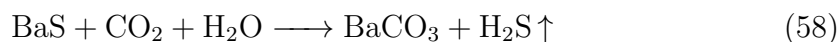
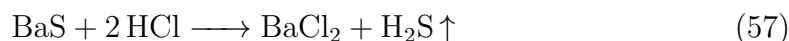
Hydrolysis of magnesium chloride hexahydrate by heating:



Barium sulfate ( barite ) is a raw material for preparing barium compounds:



Barium chloride and barium carbonate were prepared from barium sulfide:



Preparation of hydrogen peroxide from barium peroxide and dilute sulfuric acid:

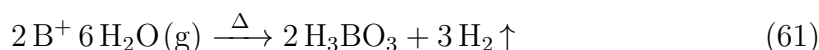


## 2 The Group 13 elements

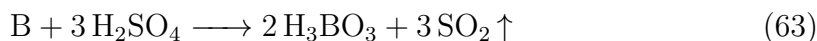
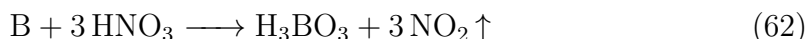
Boron can be used as deoxygenation:



Amorphous boron reacts with water vapor under red heat:



Boron can be oxidized by oxidizing acid:



Boron can react with strong alkali solution:



Boron melts with strong base in the presence of oxidant:



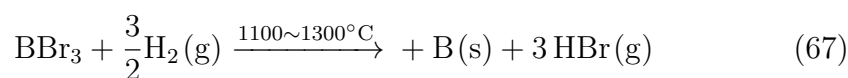
Preparation of boron:

- Metal reduction of boron oxide:

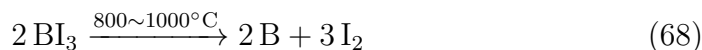


- Electrolytic reduction of molten borate.

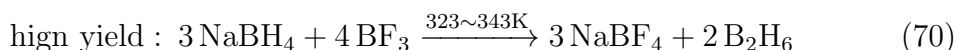
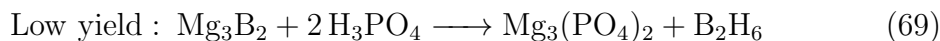
- Hydrogen reduction volatile boride:



- Thermal decomposition of boride:



Preparation of borane:



Borane burns violently in the air:



Reaction of borane with ammonia:



Cyclotriborazane is commonly known as inorganic benzene, and benzene is an isoelectronic body:

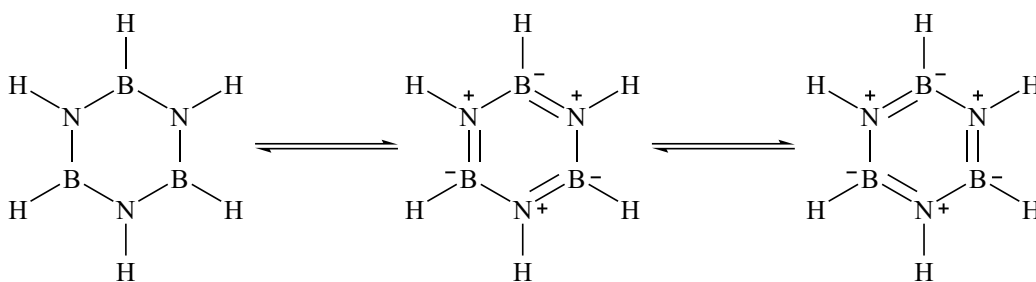
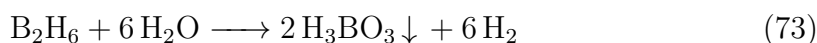
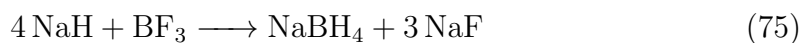
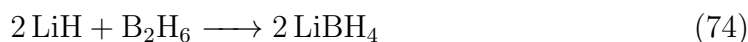


Figure 1: Cyclotriborazane

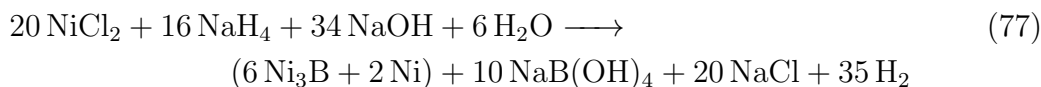
Borane has strong oxidizing property:



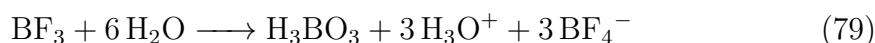
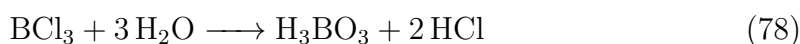
Preparation of alkali metal borohydride complex:



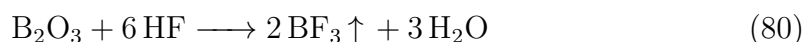
Nickel plating with sodium borohydride provides a hard protective layer that is resistant to chemical corrosion:



Boron halide is coordinated with water:



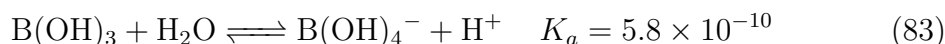
Preparation of boron halide:



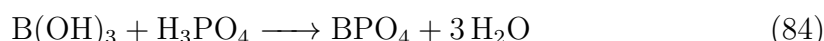
Boron oxide is soluble in water:



The acidity of orthoboric acid is reflected by the lone pair electrons accepting hydroxide in water (Its acidity will increase with the addition of polyhydroxy compounds.):

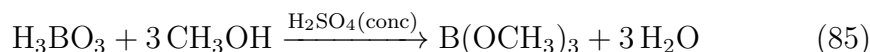


Boric acid meets strong acid and shows alkaline:



Test of boric acid:

1. Add methanol and concentrated sulfuric acid:

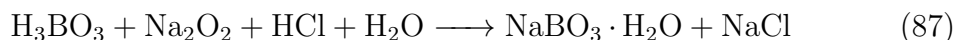


2. The boric acid ester generated by combustion will have a characteristic green flame.

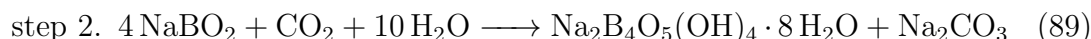
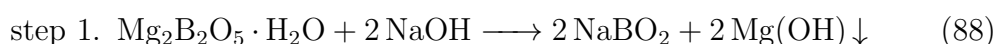
Boric acid is gradually dehydrated by heating, and finally boric anhydride is formed:



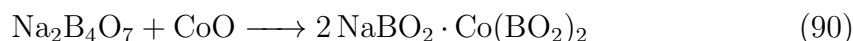
Preparation of sodium perborate:



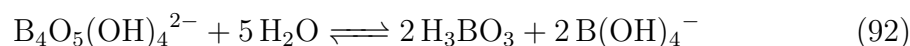
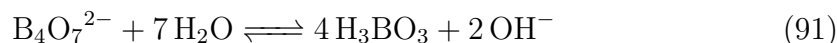
Industrial preparation of borax:



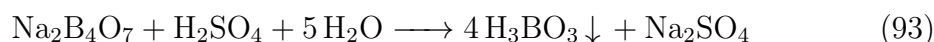
Borax can dissolve metal in molten state, and different metals will produce different colors, which is the borax-bead test:



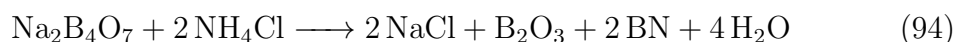
Borax is soluble in water and easy to hydrolyze:



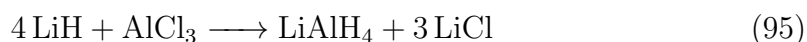
Borax can react with acid.



Preparation of boron nitride(white graphite):

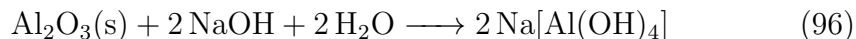


Preparation of lithium aluminum hydride:

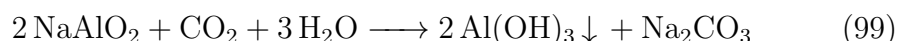
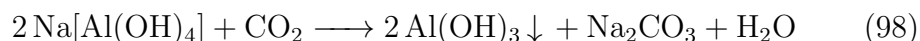


Smelting of aluminium:

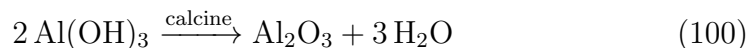
1. Alkali leaching of bauxite to form aluminum-containing compounds:



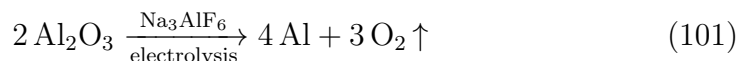
2. Aluminum hydroxide is produced from aluminum-containing compounds:



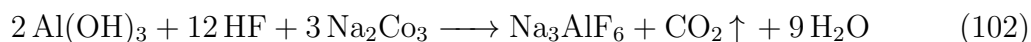
3. Calcination of aluminum hydroxide to produce electrolytically pure alumina:



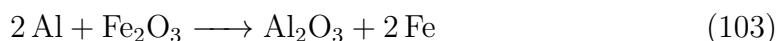
4. Electrolytic alumina, adding combustion-supporting agent trisodium hexafluoroaluminate(cryolite):



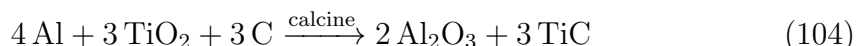
Preparation of trisodium hexafluoroaluminate(cryolite):



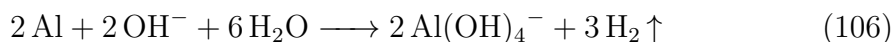
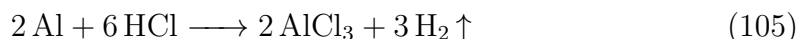
Aluminum has oxygen affinity:



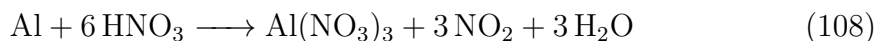
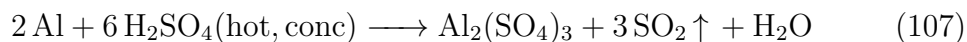
High temperature cermets are made of aluminum:



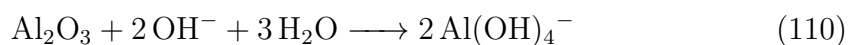
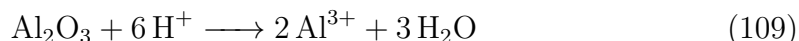
Aluminum is amphoteric:



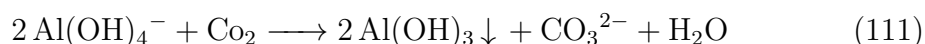
Reactions of aluminum with oxidizing acid:



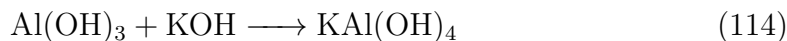
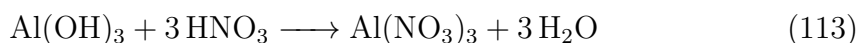
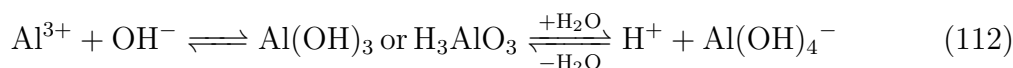
$\gamma$ -alumina is soluble in acid and alkali:



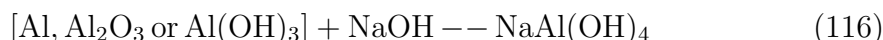
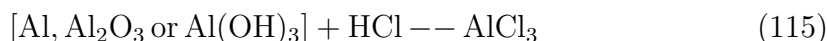
Preparation of Aluminum Hydroxide:



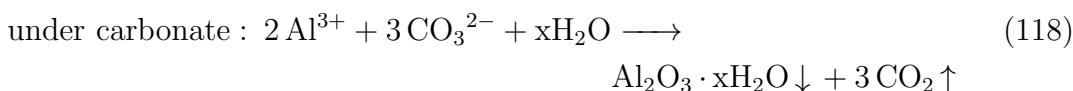
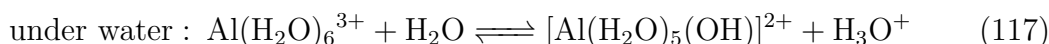
Amphoteric of aluminum hydroxide:



Preparation of aluminum salt and aluminate:



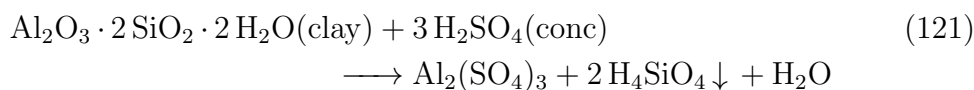
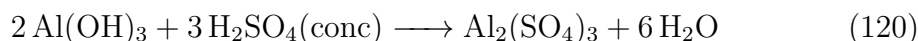
Aluminum salt hydrolysis:



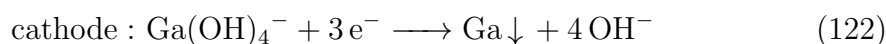
Aluminate hydrolysis:



Preparation of anhydrous aluminum sulfate:



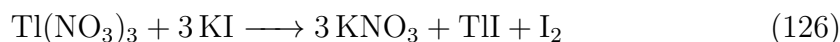
Gallium is distributed in aluminum ore, and gallium can be prepared by electrolysis of gallium hydroxide in aluminum hydroxide (Aluminum does not interfere with gallium electrolysis.):



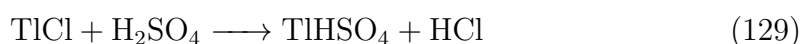
Gallium is amphotericism:



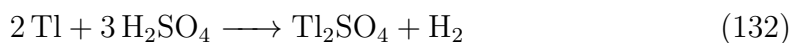
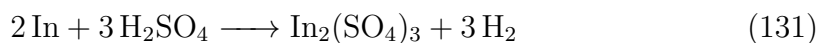
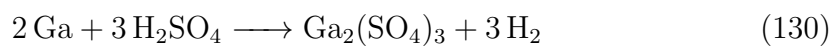
The sixth period element characteristics, 6s electron pair is not easy to lose, once lost, the tendency to recapture the electron pair is very strong (strong oxidizing):



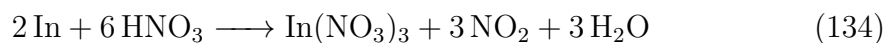
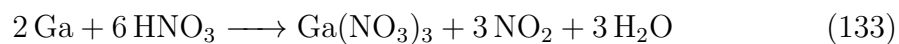
Thallium chloride is dissolved in sulfuric acid:



Reaction of gallium indium thallium with non-oxidizing acid:



Reaction of gallium indium thallium with oxidizing acid:



Reaction of indium sulfate with hydrogen sulfide:

