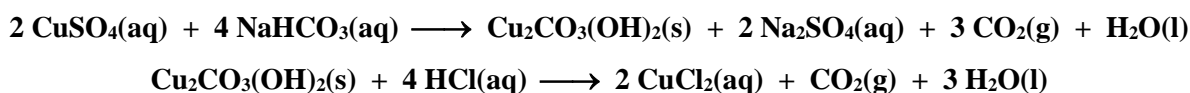


## Preparation of copper(II) chloride dihydrate

Pure and dry copper(II) chloride dihydrate is a pale blue crystalline substance. Its structure consists of distorted octahedra connected to chains, therefore, it is a coordination compound with exact name *trans*-diaqua-dichloridocopper(II) complex, *trans*-[CuCl<sub>2</sub>(H<sub>2</sub>O)<sub>2</sub>]. Often observed green colour of the substance originates from traces of captured water molecules from air humidity. It is very good soluble in water and ethanol. Aqueous solution acidified by hydrochloric acid have intensive grass-green colour as a result of presence of blue tetraaquacopper(II) cations [Cu(H<sub>2</sub>O)<sub>4</sub>]<sup>2+</sup> and yellow tetrachloridocuprate anions [CuCl<sub>4</sub>]<sup>2-</sup>.

Copper(II) chloride dihydrate can be prepared by the reaction of copper(II) salts of weak acids with hydrochloric acid.

In the first step of this two-step synthesis we will prepare insoluble dicopper(II) dihydroxide-carbonate (called also basic copper carbonate) and in the second step we let it react with hydrochloric acid.



### Work

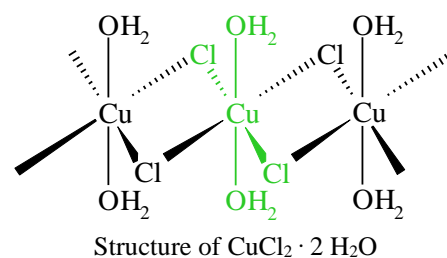
Prepare 0,030 moles of copper(II) chloride dihydrate.

### Chemicals

- copper(II) sulphate pentahydrate, CuSO<sub>4</sub> · 5 H<sub>2</sub>O, light blue crystalline,
- sodium hydrogen carbonate, NaHCO<sub>3</sub>, white crystalline,
- hydrochloric acid, HCl, concentrated, w(HCl) = 0,36.

### Procedure

Dissolve calculated amount of copper(II) sulphate pentahydrate in water to prepare 7% solution. Prepare 4% solution of stoichiometric amount of sodium hydrogen carbonate with 5% excess. Heat the copper(II) sulphate solution almost to a boil and under continuous stirring add dropwise hydrogencarbonate solution. Light green precipitate of Cu<sub>2</sub>CO<sub>3</sub>(OH)<sub>2</sub> is immediately formed. Let settle the precipitate and decant it with 5% sodium hydrogen carbonate solution and then with clear water. After decantation add slowly calculated volume of hydrochloric acid diluted in volume ratio 1 : 1. Be careful to prevent the solution from bubbling up from the beaker. If the solution is not transparent and of grass-green colour, add little more hydrochloric acid. Filter the resulting solution under vacuum on a [fritted glass](#). Connect safety bottle between a suction flask and a vacuum pump to protect filtrate from water from a pump. Pour the filtered solution to an evaporating dish over a water bath and heat it until the crystals of wait until crystals appear. It may take a long time because of very good slubility of copper(II) chloride. Pour the saturated solution into a crystallization dish and cool to room temperature. Filter the obtained crystals on a fritted glass and dry them between two pieces of filter paper.



### *Safety instructions*

#### *Copper(II) sulfate pentahydrate – CuSO<sub>4</sub> · 5H<sub>2</sub>O*

- R22** Harmful if swallowed.
- R36/38** Irritating to eyes and skin.
- S22** Do not breathe dust

#### *Sodium hydrogen carbonate – NaHCO<sub>3</sub>*

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#### *Basic copper(II) carbonate – Cu<sub>2</sub>CO<sub>3</sub>(OH)<sub>2</sub>*

- R23/24/25** Toxic by inhalation, in contact with skin and if swallowed.
- R36/37/38** Irritating to eyes, respiratory system and skin.
- R41** Risk of serious damage to eyes.
- S26** In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
- S45** In case of accident or if you feel unwell seek medical advice immediately (show the label where possible)
- S36/37/39** Wear suitable protective clothing, gloves and eye/face protection.

#### *Hydrochloric acid – HCl*

- R34** Causes burns.
- R37** Irritating to respiratory system.
- S2** Keep out of the reach of children
- S26** In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

#### *Sodium sulfate decahydrate – Na<sub>2</sub>SO<sub>4</sub> · 10H<sub>2</sub>O*

- R36/37/38** Irritating to eyes, respiratory system and skin.
- S26** In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
- S36** Wear suitable protective clothing

#### *Copper(II) chloride dihydrate – CuCl<sub>2</sub> · 2H<sub>2</sub>O*

- R20/22** Harmful by inhalation and if swallowed.
- R36/37/38** Irritating to eyes, respiratory system and skin.
- R41** Risk of serious damage to eyes.
- S45** In case of accident or if you feel unwell seek medical advice immediately (show the label where possible)
- S26** In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
- S28** After contact with skin, wash immediately with plenty of (to be specified by the manufacturer)
- S36/37/39** Wear suitable protective clothing, gloves and eye/face protection.