

# Chemistry of sulphuric(vi) acid flashcard



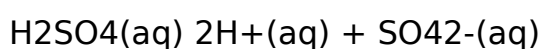
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Sulphuric(VI) acid is very important to our daily lives. In this essay, four aspects of sulphuric(VI) acid, including its production, chemical properties, physical properties and uses will be discussed.

#### Basic information of sulphuric(VI) acid

The formula of sulphuric(VI) acid is  $\text{H}_2\text{SO}_4$ . It is named because the oxidation state of sulphur is +6. The diagram below shows the structure of a sulphuric(VI) acid molecule.

Sulphuric(VI) acid is a basic acid since each sulphuric(VI) acid molecule can dissociate to give two hydrogen ions.



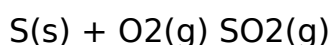
Sulphuric(VI) acid is a strong acid since the sulphuric(VI) acid can ionize completely in water.

#### Production of sulphuric(VI) acid

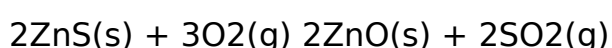
Sulphuric(VI) acid can be produced industrially by Contact Process.

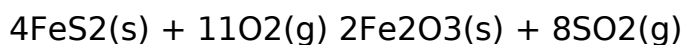
##### (a) Production and purification of sulphur dioxide

Sulphur dioxide is produced by burning sulphur in air.



Alternatively, sulphur dioxide can also be produced by roasting various metal sulphides in air as a part of their extraction process, for example:

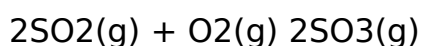




Sulphur dioxide obtained is purified to remove any impurities which may poison the catalyst in the reaction chamber.

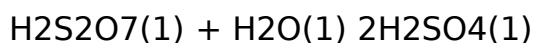
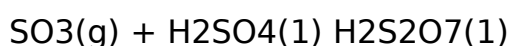
(b) Conversion of sulphur dioxide to sulphur trioxide

The purified sulphur dioxide is allowed to react with oxygen in the chamber containing vanadium(V) oxide as catalyst. The temperature of the chamber is about  $450\frac{1}{2}^{\circ}\text{C}$  and the pressure is 1 atmospheric pressure. The percentage yield for this reaction in the above conditions is 98%.



(c) Conversion of sulphur trioxide to sulphuric(VI) acid

Sulphur trioxide obtained is allowed to dissolve in concentrated sulphur(VI) acid, forming oleum (fuming sulphuric(VI) acid). Oleum is then allowed to mix with water, forming sulphuric(VI) acid again.



Sulphur trioxide is not mixed with water directly since large amount of heat will evolve, which vapourizes sulphuric(VI) acid and makes it very hard to be collected.

Physical properties of sulphuric(VI) acid

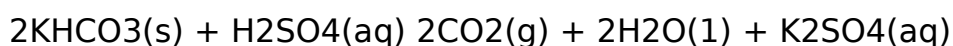
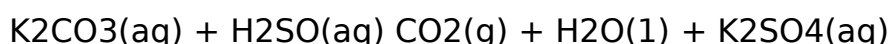
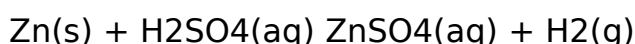
Sulphuric(VI) acid is a colourless oily liquid at room temperature and pressure.

Sulphuric(VI) acid has a high boiling point (338½C) compare with the other acids. There are extensive intermolecular hydrogen bonds between the sulphuric(VI) acid molecules. The intermolecular attractions between molecules are so strong that sulphuric(VI) acid has a high viscosity and high boiling point.

Chemical properties of sulphuric(VI) acid

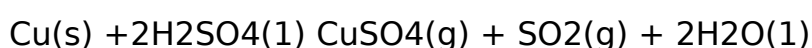
(a) Acidity property

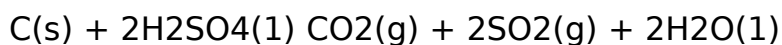
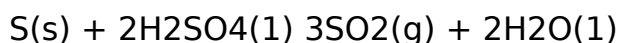
Sulphuric(VI) acid is a dibasic acid. When sulphuric(VI) acid is dilute(2M), it behaves like typical acid and reacts with reactive metal to give out hydrogen gas. It also reacts with metal carbonate or metal hydrogencarbonate to give out carbon dioxide and water.



(b) Oxidizing property

Sulphuric(VI) acid is a strong oxidizing agent when it is concentrated (16M). It oxidizes metals and non-metals, giving out sulphur dioxide. The oxidation number of sulphur in sulphuric(VI) acid changes from +6 to +4.



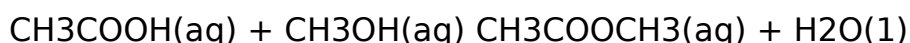


(c) Dehydrating property

Sulphuric(VI) acid is a strong dehydrating agent when it is concentrated. It has so great an affinity for water that it removes water of crystallization from hydrated salts. For example, it turns blue crystals of copper(II) sulphate-5-water to the white anhydrous form of the salt.

(d) Catalytic property

Concentrated sulphuric(VI) acid catalyses certain reactions, for example:



Sulphuric(VI) acid acts as a catalyst and a dehydrating agent, shifting the equilibrium to the right.

(e) Reaction with organic compounds

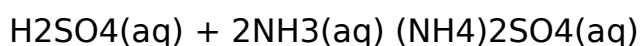
Sulphuric(VI) acid is used in the sulphonation of benzene:

Use of sulphuric(VI) acid

Sulphuric(VI) acid is very useful in our daily lives.

(a) Manufacture of fertilizers

Sulphuric(VI) acid can be used to produce fertilizers such as ammonium sulphate. Ammonium sulphate is produced by the reaction of sulphuric(VI) acid and aqueous ammonia.



(b) Manufacture of soapless detergent

Sulphuric(VI) acid is used in the manufacture of soapless detergents. Soapless detergents are made by reacting hydrocarbons with concentrated sulphuric(VI) acid. Soapless detergents can be used in both soft water and hard water.

(c) Manufacture of paint additives

Sulphuric(VI) acid can also be used in the preparation of paint additives such as barium sulphate and calcium sulphate.