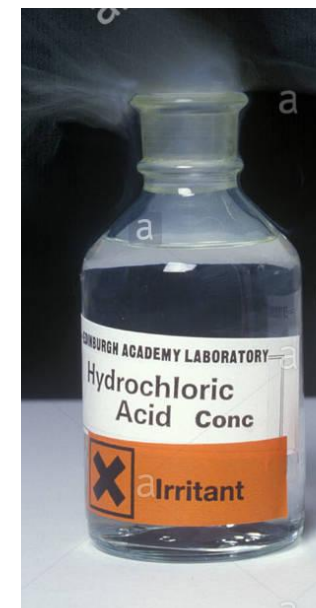


# Hydrochloric acid

HCl

# Physical properties

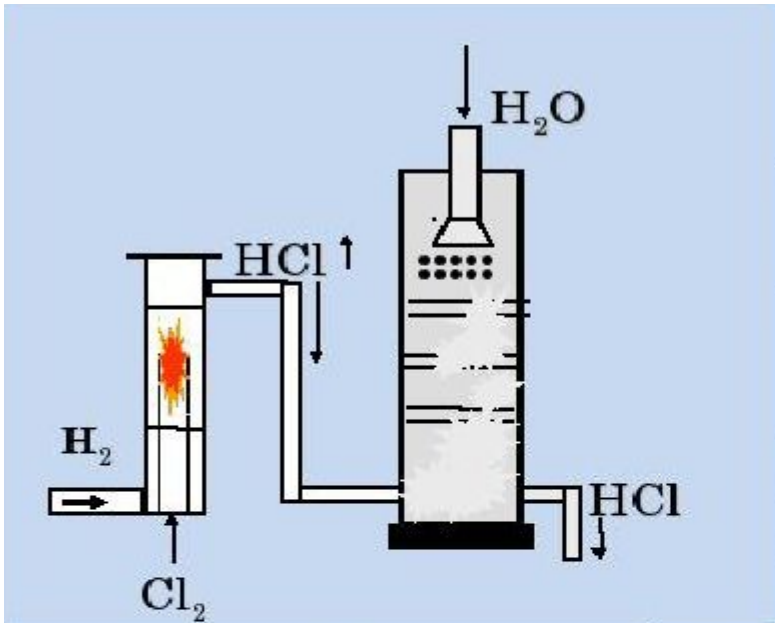
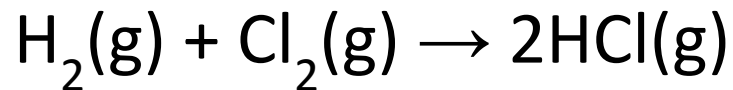
- Hydrogen chloride is a gas with an irritating odour.
- An aqueous solution of HCl is called hydrochloric acid.
- The concentrated HCl used in the laboratories is 36 %. It is a colourless acid with a sharp odour. It fumes in moist air and hydrogen chloride, gas is evolved.



# Production

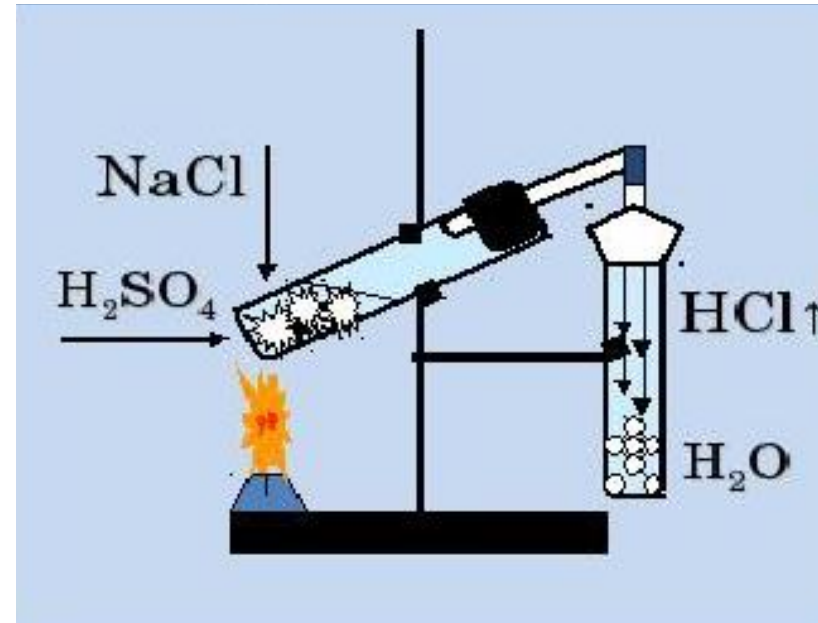
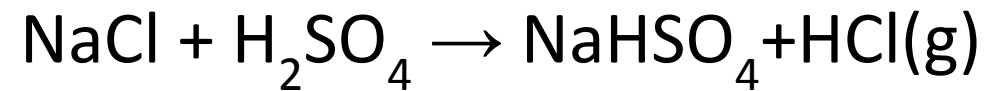
## In industry

- It is formed by the reaction of chlorine with hydrogen:



## In lab

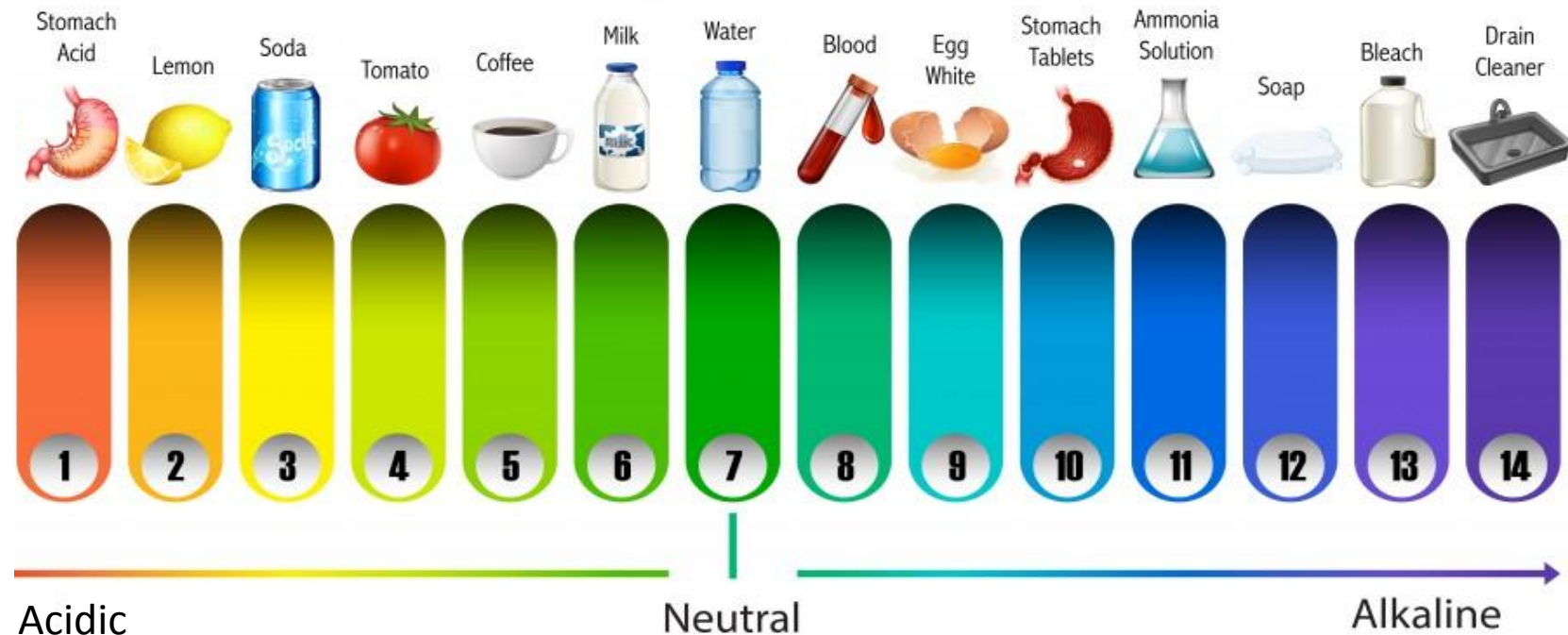
- It is formed by the reaction of NaCl with  $\text{H}_2\text{SO}_4$ :



# Chemical properties

- 1. It reacts with bases to give neutralization reactions:
- $\text{HCl(aq)} + \text{KOH(aq)} \rightarrow \text{KCl(aq)} + \text{H}_2\text{O(l)}$

## The pH Scale



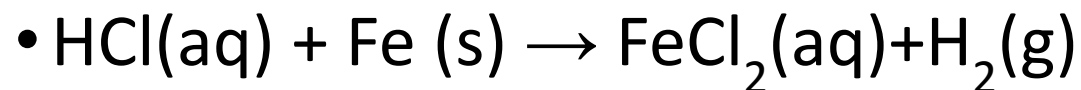
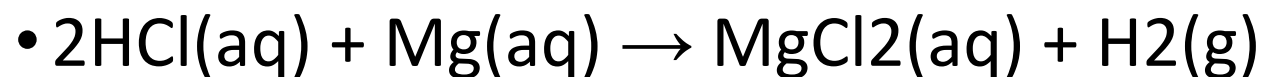
# Chemical properties (qualitative reaction)

- 2. It reacts with  $\text{AgNO}_3$ , and a white precipitate is formed:
- $\text{HCl(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{AgCl(s)} + \text{HNO}_3\text{(aq)}$



# Chemical properties

- 3. HCl reacts with active and medium active metals to produce the chloride salts and H<sub>2</sub> gas.



• Li K Ba Ca Na Mg Al Mn Zn Cr Fe Co Ni Sn Pb (H) Cu Ag Hg Pt Au

# Chemical properties

- 4. It reacts with oxidizing agents such as  $\text{KMnO}_4$  to produce  $\text{Cl}_2(\text{g})$ :
- $16\text{HCl}(\text{aq}) + 2\text{KMnO}_4(\text{aq}) \rightarrow 2\text{KCl}(\text{aq}) + 2\text{MnCl}_2(\text{aq}) + 5\text{Cl}_2(\text{g}) + 8\text{H}_2\text{O}(\text{l})$

# How to solve problems? (5 steps)

1. Write down the reaction
2. Balance it
3. Find the mole
4. Find mole of another compound by proportion (you will need coefficients )
5. Find mass, volume etc



# Problems

- What is the number of moles of  $\text{Cl}_2$  required to produce 146 g HCl?

# Problems

- A 30 g sample of iron reacts with 200 g of 14.6% HCl solution by mass, in order to produce iron (II) chloride and hydrogen gas. What is the percentage of iron in the sample?

# Finish the reactions

- $\text{Fe}(\text{OH})_3 + \text{HCl} \rightarrow$
- $\text{Ca} + \text{HCl} \rightarrow$
- $\text{Ag} + \text{HCl} \rightarrow$
- $\text{MgCO}_3 + \text{HCl} \rightarrow$
- $\text{Na}_2\text{S} + \text{HCl} \rightarrow$
- $\text{Li}_2\text{O} + \text{HCl} \rightarrow$
- $\text{Ba}(\text{NO}_3)_2 + \text{HCl} \rightarrow$
- $\text{K}_2\text{SO}_4 + \text{HCl} \rightarrow$
- $\text{HNO}_3 + \text{HCl} \rightarrow$
- $\text{F}_2 + \text{HCl} \rightarrow$
- $\text{I}_2 + \text{HCl} \rightarrow$