

# REDUKSI - OKSIDASI

KIMIA X  
SMAK IMMANUEL  
Maret 2015

- **KOMPETENSI DASAR:**

- 3.8 Menganalisis sifat larutan elektrolit dan larutan non-elektrolit berdasarkan daya hantar listriknya.
- 3.9 Menganalisis perkembangan konsep reaksi oksidasi-reduksi serta menentukan bilangan oksidasi atom dalam molekul atau ion.
- 3.10 Menerapkan aturan IUPAC untuk penamaan senyawa anorganik dan organik sederhana.
- 4.8 Merancang, melakukan, dan menyimpulkan serta menyajikan hasil percobaan untuk mengetahui sifat larutan elektrolit dan larutan non- elektrolit.
- 4.9 Merancang, melakukan, dan menyimpulkan serta menyajikan hasil percobaan reaksi oksidasi-reduksi.
- 4.10 Menalar aturan IUPAC dalam penamaan senyawa anorganik dan organik sederhana.

- **Indikator:**

1. Menganalisis dan menjelaskan perbedaan sifat larutan elektrolit dan non-elektrolit berdasarkan daya hantar listriknya.
2. Menganalisis, dan menjelaskan konsep redoks
3. Menentukan bilangan oksidasi atom dalam molekul atau ion.
4. Merancang, melakukan dan menyimpulkan serta menyajikan hasil percobaan untuk mengetahui sifat larutan elektrolit dan larutan non-elektrolit
5. Merancang, melakukan dan menyimpulkan serta menyajikan hasil percobaan reaksi oksidasi – reduksi
6. Mendeskripsikan pengolahan air limbah / kotor
7. Menentukan nama senyawa anorganik dan organik sederhana

# ELEKTROLIT - NONELEKTROLIT

Berdasarkan kemampuannya menghantar arus listrik dalam larutannya

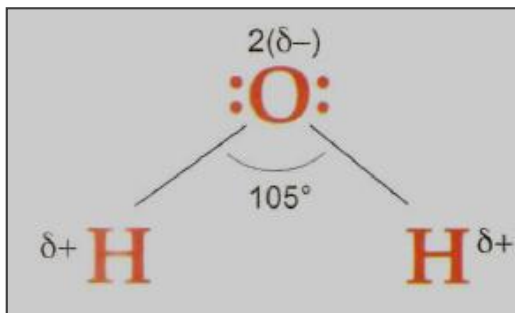
ELEKTROLIT

- Dapat menghantar arus listrik dalam larutan
- dapat mendisosiasi senyawa kemejadi partikel bermuatan atau ion-ion



NONELEKTROLIT

- Tidak dapat menghantar arus listrik dalam larutannya
- tidak dapat terdisosiasi menjadi partikel bermuatan/ion



# B. Electrolytes



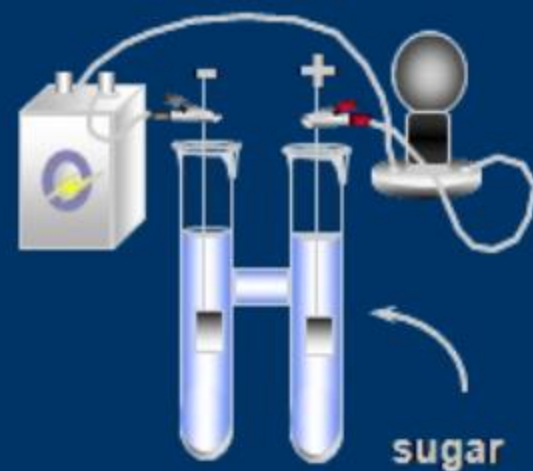
## Electrolyte

solute exists as  
**ions only**



## Weak Electrolyte

solute exists as  
**ions and  
molecules**



## Non- Electrolyte

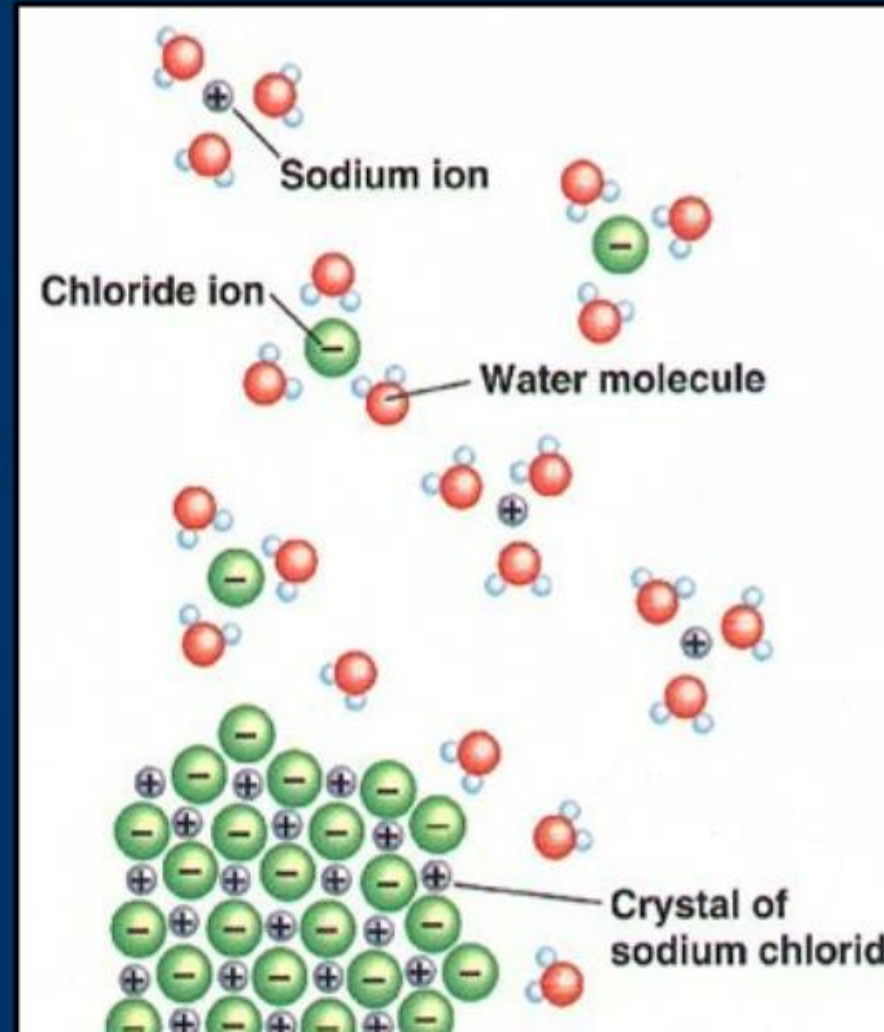
solute exists as  
**molecules  
only**



# B. Electrolytes

## ◆ Dissociation

- separation of  $+/-$  ions when an ionic compound dissolves in water

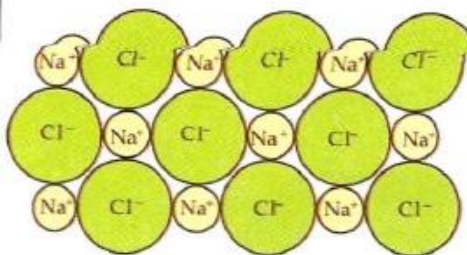


# B. Electrolytes

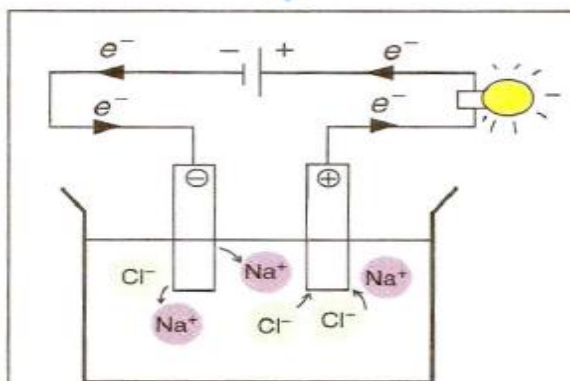


## ◆ Ionization

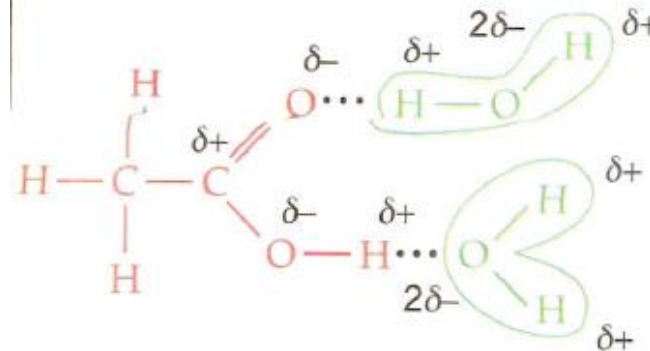
- breaking apart of polar covalent molecules into ions when dissolving in water



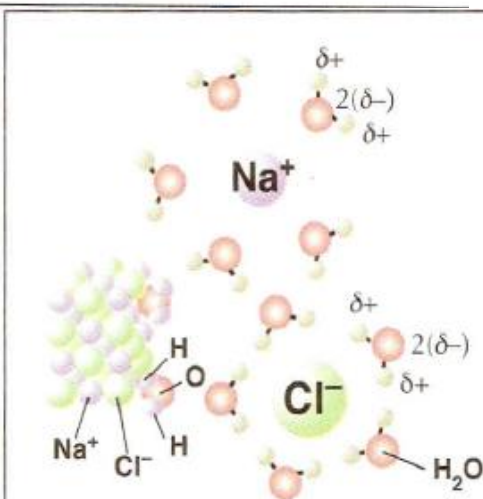
The presence of free ions in solution allows current to pass, thus producing bright light.



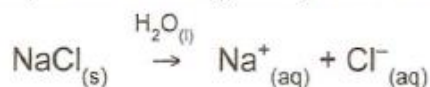
Solution of NaCl has good electrical conductivity.



$\text{CH}_3\text{COOH}$  is a polar covalent compound which has partial positive charge ( $\delta+$ ) and partial negative charge ( $\delta-$ ).

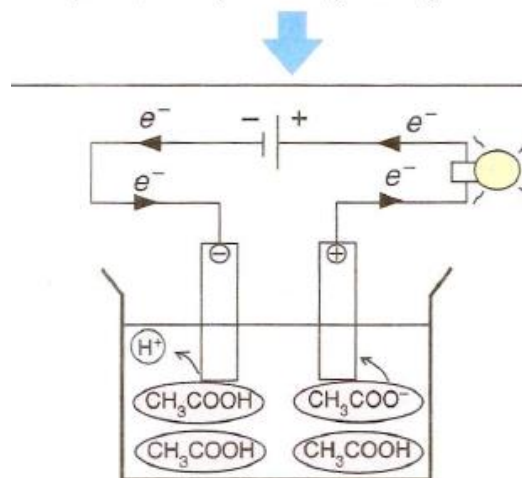


**Dissolving NaCl in water.** The attraction force between the water molecules and the particles of NaCl is strong thus allowing particles of  $\text{Na}^+$  and  $\text{Cl}^-$  to separate forming many free ions.

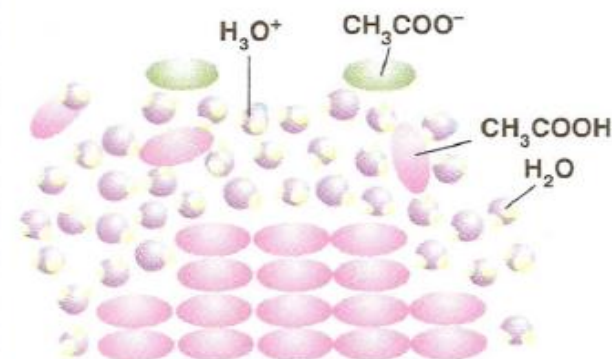


**fully dissociated**

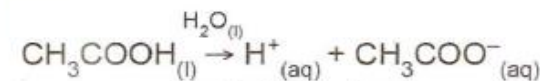
The presence of few free ions in solution allows only little current to pass, thus producing dim light.



Solution of  $\text{CH}_3\text{COOH}$  has poor electrical conductivity.



**Dissolving  $\text{CH}_3\text{COOH}$  in water.** The attraction force between the water molecules and the  $\text{CH}_3\text{COOH}$  molecules is not so strong. Only few O-H bonds are broken producing few  $\text{CH}_3\text{COO}^-$  and  $\text{H}^+$  ions.



**partially ionized**

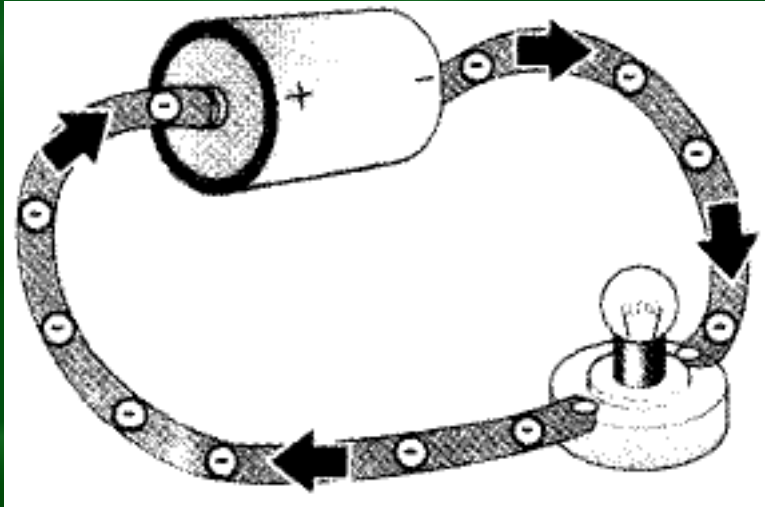
*\* In fact, only 0.5 % of  $\text{CH}_3\text{COOH}$  forms ions in its solution*



$$\alpha = \frac{\text{Moles of substance that are ionized/dissociated}}{\text{Moles of substance dissolved in water}}$$

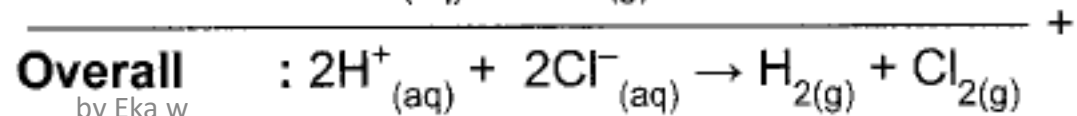
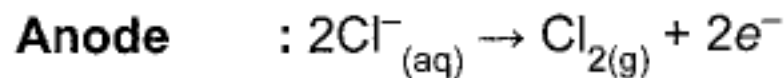
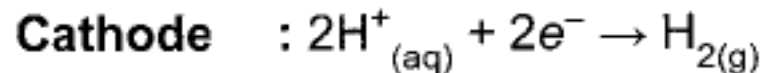
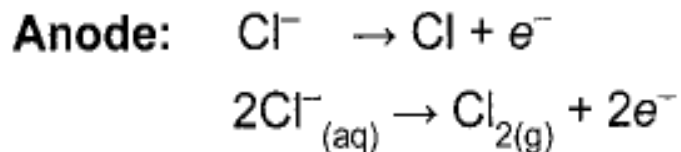
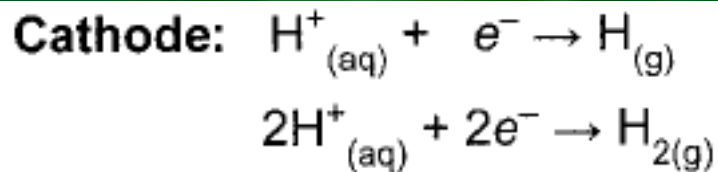
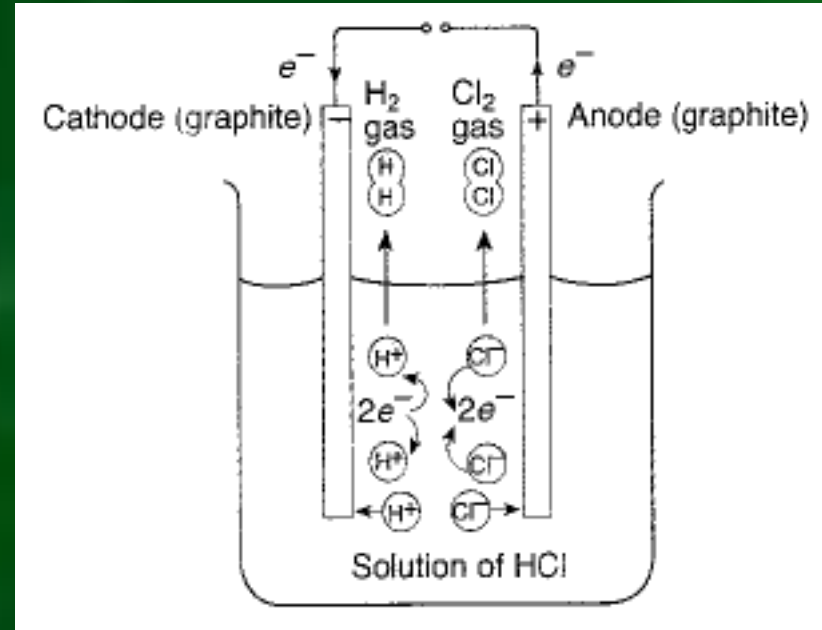
$\alpha = 0$  non elektrolit  
 $0 < \alpha < 1$  disosiasi parsial  
 $\alpha = 1$  disosiasi sempurna

# Bagaimana arus listrik mengalir dalam sirkuit?



Katoda  
Negatif  
Anoda  
Positif

KATODA  
REDUKSI  
ANODA  
OKSIDASI

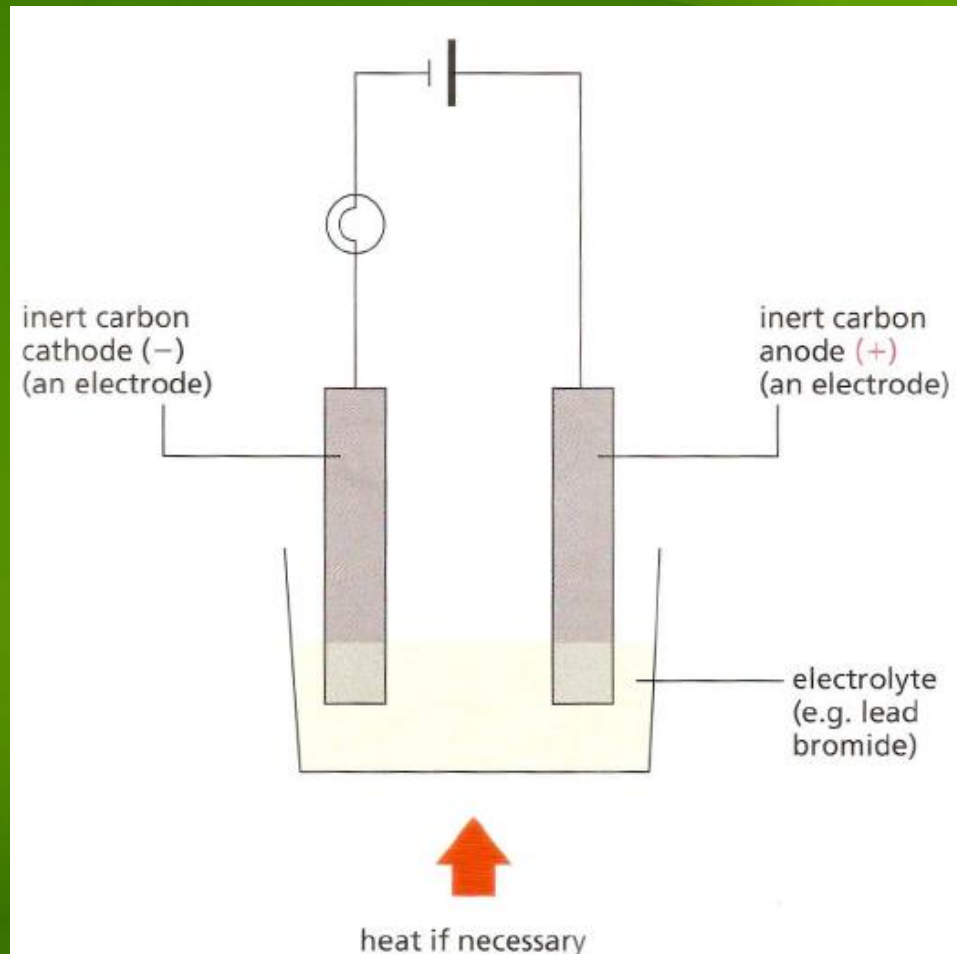


# Elektrolit dalam tubuh

- ★ Membawa pesan menuju dan dari otak sebagai sinyal



# ELEKTROLISIS





# • Elektrolisis dari lelehan senyawa

The metal is always at the cathode

The non-metal is always formed at the anode

Table 4.4 Some examples of the electrolysis of molten salts

Electrolyte	Decomposition products	Cathode reaction	Anode reaction*
Lead bromide, $\text{PbBr}_2$	lead (Pb) and bromine ( $\text{Br}_2$ )	$\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$	$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$
Sodium chloride, $\text{NaCl}$	sodium (Na) and chlorine ( $\text{Cl}_2$ )	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
Potassium iodide, $\text{KI}$	potassium (K) and iodine ( $\text{I}_2$ )	$\text{K}^+ + \text{e}^- \rightarrow \text{K}$	$2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$
Copper(II) bromide, $\text{CuBr}_2$	copper (Cu) and bromine ( $\text{Br}_2$ )	$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$

\*These anode reactions are the sum of the two stages written in the text. The loss of an electron from a negative ion like  $\text{Cl}^-$  can also be written  $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$ .

Katode  
Negatif  
Anode  
Positif

KATODE  
REDUKSI  
ANODE  
OKSIDASI

# • Electrolisis dari larutan

Logam selalu berada di katode.

Semakin reaktif suatu logam, semakin cenderung berada dalam bentuk ion. Ion  $\text{H}^+$  akan menerima elektron dan membentuk molekul hidrogen. Semakin kurang reaktif suatu logam, akan lebih mudah menerima elektron dan membentuk atom logamnya.

Non logam selalu berada di anode

Bila ion dari halogen ( $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ) berada dlm konsentrasi tinggi, akan membentuk  $\text{Cl}_2, \text{Br}_2, \text{I}_2$ . Ion  $\text{OH}^-$  akan tersisa dalam larutan. Bila tidak ada lagi ion halogen dalam larutan, maka ion  $\text{OH}^-$  akan terurai membentuk oxygen

Ion Sulfat and nitrat tidak terurai, sehingga ion  $\text{OH}^-$  dari air yang akan terurai membentuk  $\text{O}_2$ .

Table 4.5 The ease of discharge of ions during electrolysis in solution

Positive ions* (cations)		Negative ions (anions)
$\text{K}^+$	ease of discharge of ions increases downwards	$\text{SO}_4^{2-}$
$\text{Na}^+$		$\text{NO}_3^-$
$\text{Ca}^{2+}$		$\text{OH}^-$
$\text{Mg}^{2+}$		$\text{Cl}^-$
$\text{H}^+$		$\text{Br}^-$
$\text{Cu}^{2+}$		$\text{I}^-$
$\text{Ag}^+$		

\*For the metal ions this series (the electrochemical series) closely parallels the reactivity series

Table 4.6 Results of electrolysis of various salt solutions

	Salt solution	Product at cathode	Product at anode
metals increasingly reactive upwards	↑ Potassium bromide, KBr(aq)	hydrogen $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	bromine $2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$
	Magnesium sulphate, MgSO <sub>4</sub> (aq)	hydrogen $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	oxygen $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
	Copper sulphate, CuSO <sub>4</sub> (aq)	copper $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	oxygen $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$
	Silver nitrate, AgNO <sub>3</sub> (aq)	silver $\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$	oxygen $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$

# Deret Volta

Li – K – Ba – Ca – Na – Mg - Al – Zn – Cr – Fe - Cd – Co – Ni – Sn – Pb – (H) – Sb – Bi – Cu – Hg – Ag – Pt – Au



Metal easier to oxidize



metal easier to reduction



# ELECTROPLATING (penyepuhan)

- Untuk melapisi suatu logam dengan logam lainnya
- **anode tidak** inert, tetapi berasal dari logam yang digunakan untuk melapisi( atau larut dalam larutan elektrolitnya)
- **katode** merupakan object yang akan disepuh





**Figure 6.24** This plastic has been coated with copper by electrolysis.



**Figure 6.10** The oxide layer on the surface of these aluminium cups has been thickened, and dyes added to obtain the vibrant colours.



**Figure 6.25** This leaf has been electroplated.

- Tujuan penyepuhan (electroplating) adalah:
  - Untuk memberikan lapisan pencegahan pada logam di dalamnya terhadap korosi
  - Memberikan penampilan yang mengkilap dan lebih menarik

# REDOKS



Biasanya bersifat  
simultan berpasangan

# REDOKS

**O**xidation  
**I**s  
**L**ose electron

**R**eduction  
**I**s  
**G**ain electron

- **Oksidasi :**

- Mengikat (*Gain*) oksigen  $C + O_2 \rightarrow CO_2$
- Kehilangan (*Lose*) elektron  $H_2 \rightarrow H^+ + 2e^-$
- Bilangan oksidasi (biloks) naik  $C + O_2 \rightarrow CO_2$   
0 0 +4

- **Reduksi :**

- Kehilangan oksigen  $CO_2 \rightarrow C + O_2$
- Mengikat elektron  $H^+ + 2e^- \rightarrow H_2$
- Bilangan oksidasi turun  $CO_2 \rightarrow C + O_2$   
+4 0

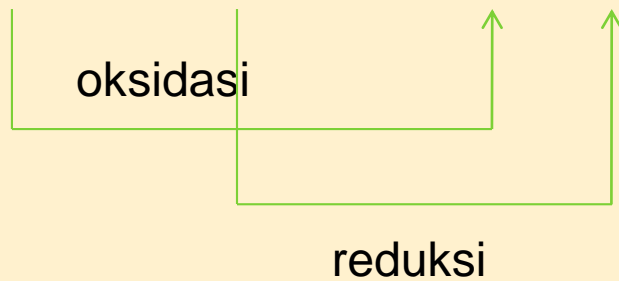
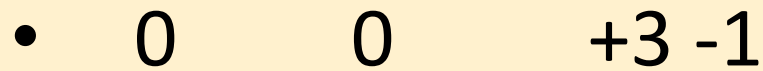
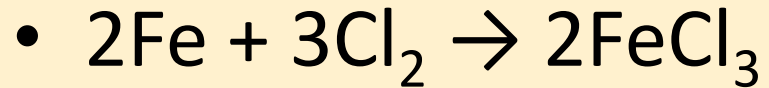


# Tabel biloks

- Lihat handout

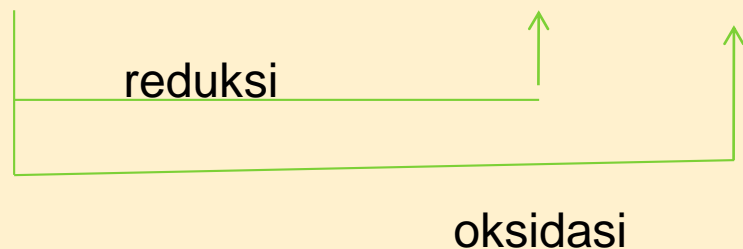


# Reaksi Redoks



# Reaksi Autoreduksi

- Reaksi redoks di mana reaktan dalam reaksi mengalami oksidasi maupun reduksi
- $\text{Cl}_2 + \text{KOH} \rightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$
- 0      +1-2 +1      +1-1      +1+1-2      +1-2





# Terms

- **Electrolyte** : a solution which have ability to conduct the electricity
- **Electrolysis** : a process to decompose a substance to be ions by electrical current in electrolytic cell
- **Electroplating**: a process to coat a metal with another metal with a certain purpose.
- **Conductor** : A substance which have ability to conduct the electricity, But is not chemically changed in the process, usually metal is a good conductor
- **Insulator** : A substance which do not have ability to conduct the electricity.
- **Cathode** : The (-) pole
- **Anode** : the (+) pole

# Terms

- **Oxidation** : takes place at the anode and involves a negative ion losing electrons
- **Oxidation agent/oxidant** : a substance that will add oxygen to another substance
- **Oxidised** : a substance gains oxygen during a reaction
- **Reduction** : takes place at the cathode and involves a positive ion gaining electrons
- **Reducing agent/reductant** : a substance that will remove the oxygen from other substance
- **Reduced** : a substance loses oxygen during a reactions