

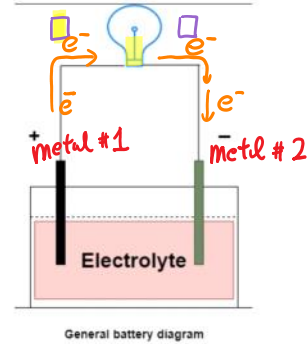
Science 9 – Physics Topic 3.3 Concept 1: Chemical Energy Separates electrical charges in cells

Electrochemical cell:

- Transforms Chemical energy into electrical energy

Two Basic components of an Electrochemical Cell

- Electrodes** – Two different types of Metals
 - Chemical reaction occurs between two metals
 - one metal lose electrons (positively charged)
 - and the other metal gain the electrons (negatively charged)
- Electrolyte** Electrodes are in a solution called an *electrolyte*
 - Allow Charge (+ and -) to move between the two metals.



Types of batteries

Based on functionality, there are two types of batteries available in the market.

1. Primary Batteries (<u>non-rechargeable</u>)	2. Secondary Batteries (<u>rechargeable</u> batteries)
<ul style="list-style-type: none"> Thrown away after <u>one time</u> use Chemical reaction is non-<u>reversible</u> Simple, convenient, and <u>cheap</u>. 	<ul style="list-style-type: none"> <u>Reusable</u> up to a <u>few hundred</u> to a <u>few thousand</u> times The electrochemical reaction can be <u>reversed</u> Common in portable devices like mobile phones, <u>laptops</u>, electric vehicles, etc.

Dry Cell v.s. Wet Cell

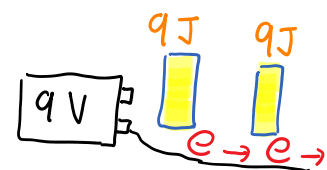
	Parts of a Dry Cell	Wet Cell
Electrolyte	(moist) <u>paste</u> electrolyte	<u>Liquid</u> electrolyte (usually ACID !!)
Directional Usage	<u>any</u>	<u>upright to avoid acid spilling</u>
Emission	<u>No</u>	<u>produce harmful gas.</u>
Weight	Relatively <u>lighter</u>	<u>Heavier</u>
Cost	More expensive	<u>Cheap</u>

Usage	Very common in everyday electronics due to its small size le) <ul style="list-style-type: none"> • <u>Alkaline</u> battery (Primary): AA, AAA in clocks, remotes • <u>Button cell</u> (<u>primary</u>): in watches, calculator • <u>Lithium-Ion</u> batteries (Secondary): in computer, cellphones 	<u>Low cost</u> and large size. Good for heavy-duty application but not easily portable. Examples: <ul style="list-style-type: none"> • <u>Lead-acid</u> battery for automobiles (<u>Secondary</u>) • <u>Solar-panel</u> energy storage for backup power (<u>Secondary</u>)
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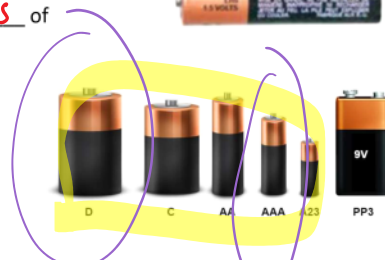
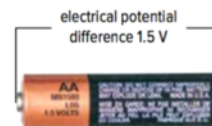
Electrical Potential Difference (also called Voltage)

- A charge like electron gains electrical potential energy when it passes through a power source (such as a battery)
- energy is measured in "Joules" – short form "J"
 - ie, Your phone battery holds ~ 50000 J of energy!!
- The amount Charge is measure in "Coulomb" – short form "C"
 - ie, there was only 0.02 C of charge (electrons) on the Van de Graaff generator
 - But it take 6,240,000,000,000,000,000 electrons to make up 1 Coulomb ^_^
- The Voltage (V) of a battery is the amount of Energy (J) carried by One Coulomb (C) of electrons in a circuit.
 - Symbol: V
 - Units: volts (V)
 - Ex) A 9V battery will send out electron groups that carrying 9J of energy



Common misconceptions

- Size of an Alkaline cell does not increase its voltage!! AAA, AA, C and D cells are all "1.5 V"
- Remember the "voltage" of a battery depends on the types of electrodes (metals) inside.
- The size of a cell determines the total amount of energy it can supply, that is, how long it will last.



Fun fact: An AA "battery" is an electrochemical cell (even though it is commonly known as a "battery")

one cell

more than one battery