



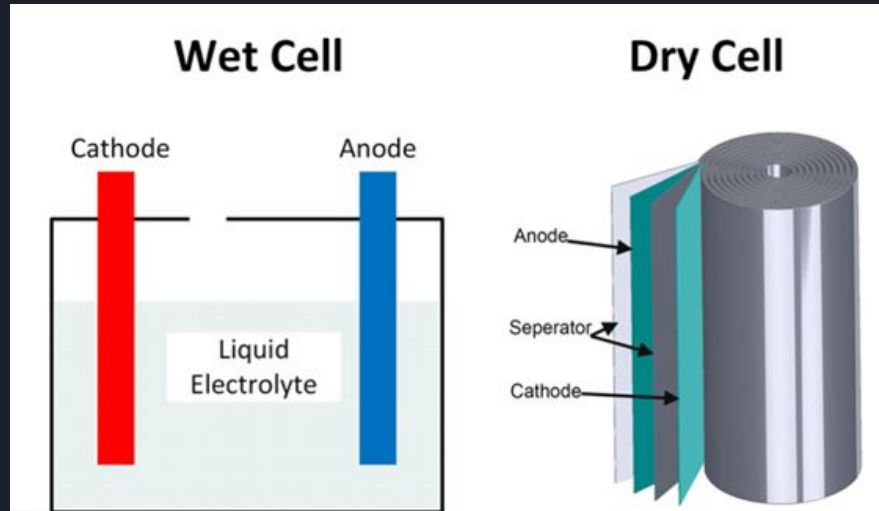
POWER SYSTEM MANAGEMENT

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DEFINITION OF CELL & BATTERY

Battery = a collection of one or more cells, storing electrical energy for powering electrical devices.

Cell = a cell contain three main components which is two electrode(anode & cathode) and electrolyte



TYPES OF BATTERY

Primary

- Can't be recharged once they run out of power
- Inexpensive, lightweight, and convenient to use with no maintenance.
- Usually come in a cylindrical form



Alkaline battery



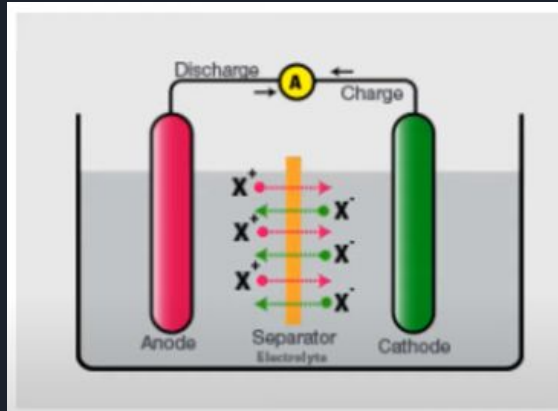
Lithium Battery



Silver Oxide Cell

Secondary

- Can be recharged and reused
- Cost more than primary
- Used for two applications such as energy storage devices and applications where the battery is used and discharged as a primary battery



Rechargeable by applying electric current



Nickel Cadmium

- Exhibit a high power capability
- Wide operating temperature
- Long cycle life
- Low runtime per charge
- Self discharge rate 30% per month
- Contain 15% cadmium toxic



Lithium-Ion

- High current capability
- Long cycle life
- Self discharge rate at 20% per month
- Contain no toxic cadmium



Lead Acid

- Most popular rechargeable battery worldwide
- Manufacturing process of the battery is economical and reliable
- Not used in consumer application due to heavy lead acid
- Lead is toxic and should not enter regular waste stream
- 93% of all battery lead is being recycle and reused in the production of new lead acid battery.



Difference Between Primary Cell and Secondary Cell

Primary Cell	Secondary Cell
Have high energy density and slow in discharge and easy to use	They are smaller energy density
There are no fluids in the cells hence it is also called as dry cells	There are made up of wet cells (flooded and liquid cells) and molten salt (liquid cells with different composition)
It has high internal resistance	It has a low internal resistance
It has an irreversible chemical reaction	It has a reversible chemical reaction
Its design is smaller and lighter	Its design is more complex and heavier
Its initial cost is cheap	Its initial cost is high



STEPS TO CALCULATE BATTERY RUNTIME

Battery life = $\text{Capacity} / \text{Consumption} * (1 - \text{Discharge Safety})$

Where :

- Capacity : capacity of battery, measured in ampere hours. This value can be find on the battery
- Consumption : average current draw of electronic device, expressed in amperes
- Discharge Safety : percentage of battery capacity that is never used. Never discharge below than 20% or else it can be damaged