
LaACES
Student
Ballooning
Course

# Batteries and Battery Packs

## Lecture 21

# What is a Battery?

**Batteries** are a type of power supply that utilize electrochemical reactions to supply electric power to an attached system. Often the batteries are contained with a sealed enclosure with contacts to the generated positive and negative or ground voltage

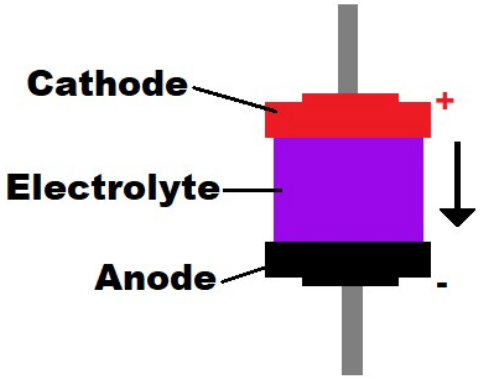
Batteries are typically contracted of one of more **battery cells**. Each cell has a chemical composition that generates the positive and negative voltages

# Battery Composition

A battery is made of three components

**Cathode** – The positive battery terminal

**Anode** – The negative battery terminal




**Electrolyte** – Chemical solution or substance that creates chemical reactions to create the battery voltage difference

# Battery Cells

**Wet cell batteries** contain a liquid electrolyte.
Example – Car batteries

**Dry cell batteries** contain a solid electrolyte

Example – AA batteries

**Gel cell batteries** have an electrolyte gel

Example – LiPO batteries

# Primary Batteries

**Primary Batteries** or **non-rechargeable batteries** are batteries that have been designed to be used only once. The chemical reactions within the battery cells is often non-reversible in these types of batteries

# Secondary Batteries

**Secondary** or **rechargeable batteries** are batteries that can be discharged and charged by an external source. The chemical reactions in these batteries are reversible by applying a higher external voltage to reverse the chemical reaction that occurred

# Battery Characteristics

- Terminal Voltage
- Chemical Composition
- Energy Density
- Capacity
- Discharge Characteristics

# Terminal Voltage

**Terminal Voltage** is the potential difference across the terminals of a battery

Terminal voltage is highly dependent on the battery's chemical composition. It will steadily decrease as the battery discharges

Terminal voltage should be measured with an appropriate electrical load applied

# Chemical Composition

The **chemical composition** of the battery determine many of its characteristics. They are frequently listed with the battery

Common compositions include:

-Carbon-zinc (1.5V per cell)
-Alkaline (1.5V per cell)
-Lead Acid (2V per cell)
-Ni-Cd (1.2V per cell)
-NiMH (1.2V per cell)
-Lithium (1.5V per cell)

# Energy Density

**Energy density** is the amount of charge stored within the battery per unit mass

Energy density determines the physical weight and size of a battery required to provide a specific voltage and capacity

High energy density allows for more compact batteries

# Capacity

**Battery Capacity** is the measurement of the charge stored within a battery, usually measured in A-hr or mA-hr. It is usually specified at the "ten-hour discharge rate"

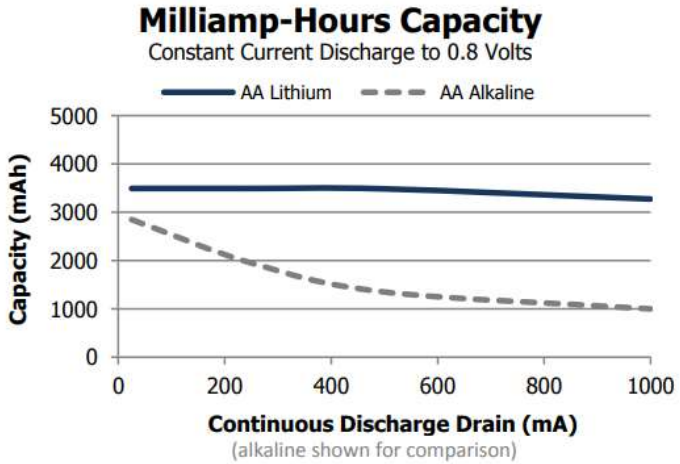
A battery rate for 2900 mA-hr should deliver 290 mA for 10 hrs before the voltage falls below 1V

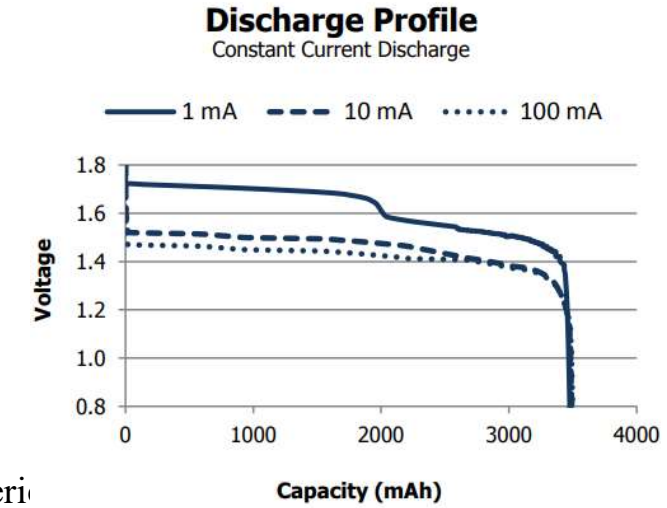
Higher current will discharge the battery faster

# Discharge Characteristics

The rate at which batteries discharge is determined by its discharge characteristics.

Discharge characteristics vary from battery to battery. It is often displayed as a curve on the datasheet (Voltage vs time or capacity)



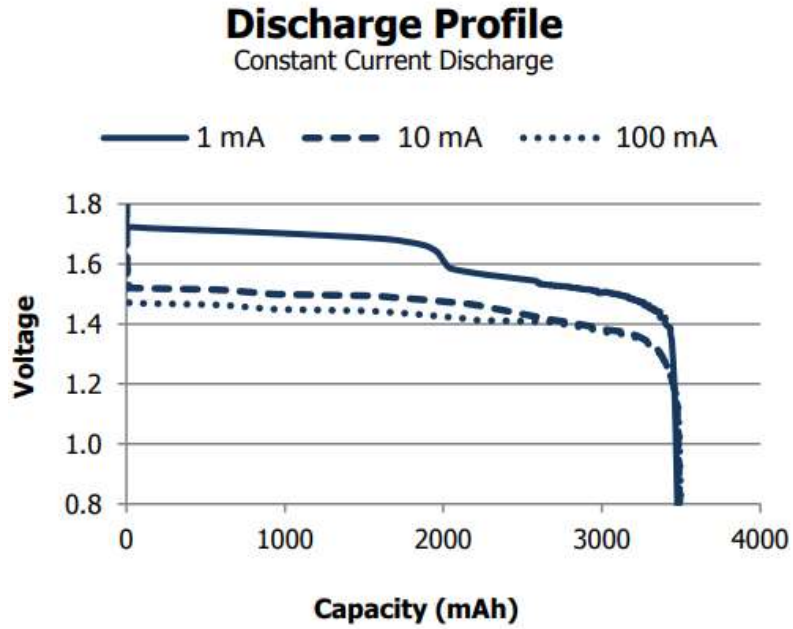



# Loading Effects

The amount of current being drawn affects the life of the battery.

Larger current discharges the battery more quickly.

When choosing an appropriate battery, determine where your expected current draw falls on the curve.

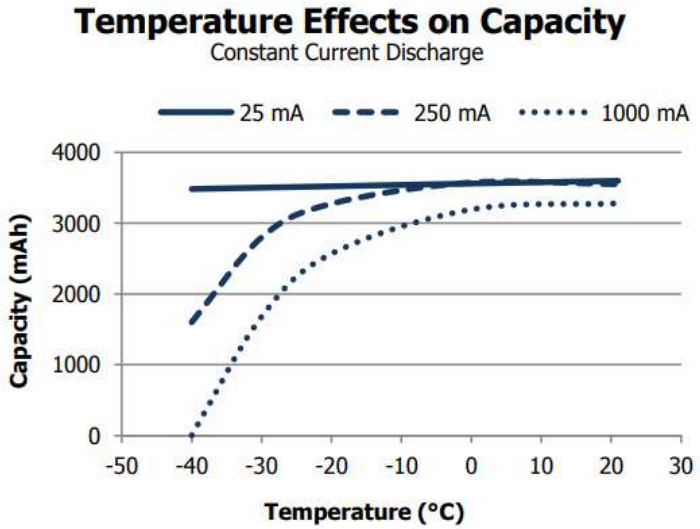


# Temperature Effects

Temperature affects the discharge characteristics.

The effective batteries capacity decreases as temperature decreases.

If your batteries get too cold, they may stop providing power.



# Battery Packs

It may be required to attach multiple batteries together to achieve the voltage and capacity required to power a payload. This may be achieved by making or purchasing a **battery pack.**

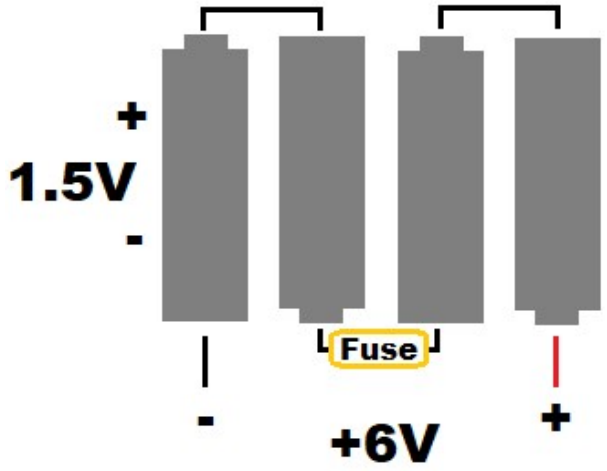
Battery packs are a series of individual batteries that have been attached in series.

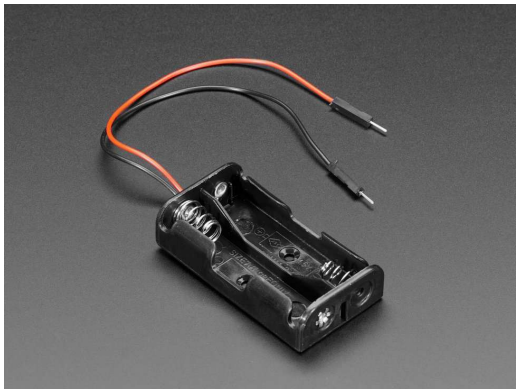
# Battery Pack Assembly

Assembly of battery packs should be done by a trained professional

To create a battery pack, attach the positive terminal of one battery to the negative terminal of another. A fuse should be installed in line to prevent damage from shorts

Commercial battery holders are available



# Battery Safety

- Batteries pose a shock hazard and should be handled with care
- Do not short the terminals of batteries
- Do not disassemble or pierce the battery casing. Many batteries contain flammable components that may ignite with exposure to air.
- If a battery cell is overheating, remove it from nearby students or faculty and report the incident.

# Battery Storage

- Store batteries in a cool, dry location away from metal surfaces. Care should be taken to ensure that the positive and negative terminals do not short.
- It is recommended to charge rechargeable batteries before storing them for long periods of time.

# Battery Disposal

- Batteries should not be disposed with normal waste, especially rechargeable batteries.
- Contact your local recycling centers and waste disposal services to identify collection programs or events.
- Some home improvement or office supply stores may accept used batteries for recycle