Battery Basics

Rob Faludi

there are thousands of different batteries

only one is best for your project

factors to consider

- Power needs
- Maximum current
- Run time
- Replacement schedule
- Size
- Shelf-life
- Context and availability

pressure and current

- voltage ~= water pressure
- amperes ~= water current

power

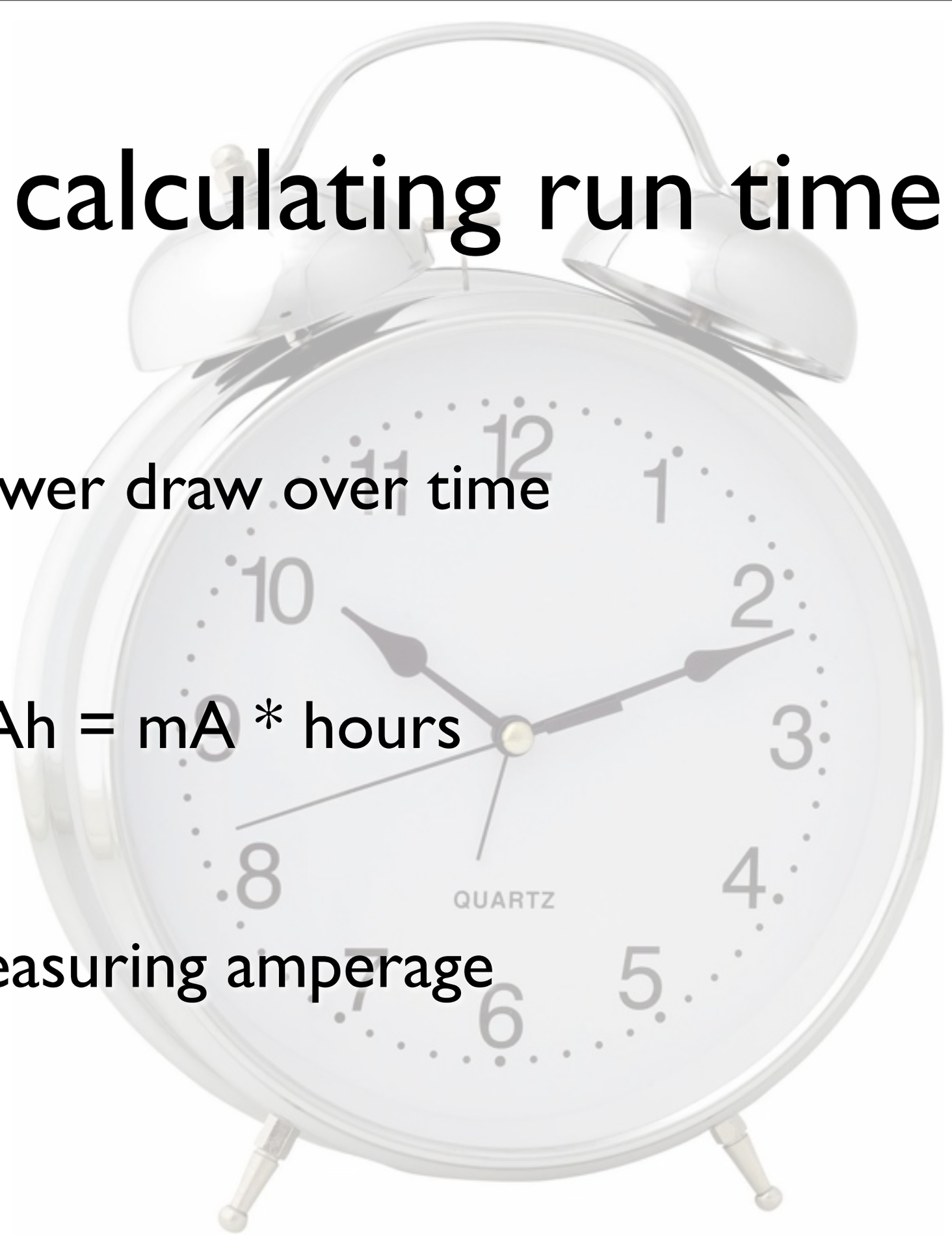
- WATTS
  - wattage: *W = VA*
    - *watts = volts * amps*
    - 100 volts, 2A = ?
    - 3.3 volts, 100 mA = ?

capacity

- mAh = milliamp hour
  - how many milliamps supplied for 1 hour

- capacity is total power available over time
- run time is based on capacity

calculating run time



- power draw over time
- mAh = mA * hours
- measuring amperage

data sheets

- Look for:
  - mAh
  - max current
  - voltage

PRODUCT DATASHEET

Energizer

1-800-383-7323 USA/CAN
www.energizer.com

ENERGIZER 522

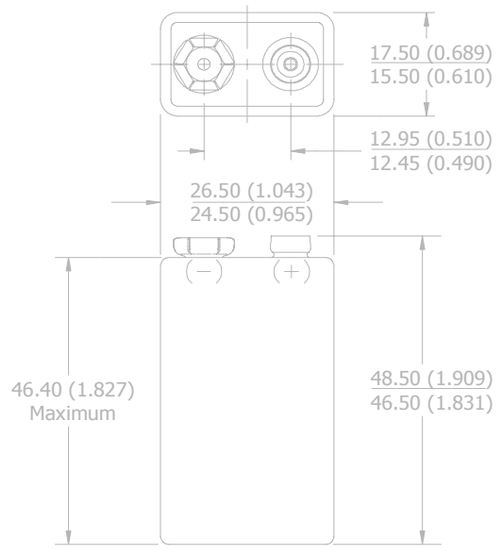
9V

Specifications

Classification:	Alkaline
Chemical System:	Zinc-Manganese Dioxide (Zn/MnO_2)
	No added mercury or cadmium
Designation:	ANSI-1604A, IEC-6LR61
Nominal Voltage:	9.0 volts
Operating Temp:	-18°C to 55°C (0°F to 130°F)
Typical Weight:	45.6 grams (1.6 oz.)
Typical Volume:	21.1 cubic centimeters (1.3 cubic inch)
Jacket:	Metal
Shelf Life:	5 years at 21°C (80% of initial capacity)
Terminal:	Miniature Snap

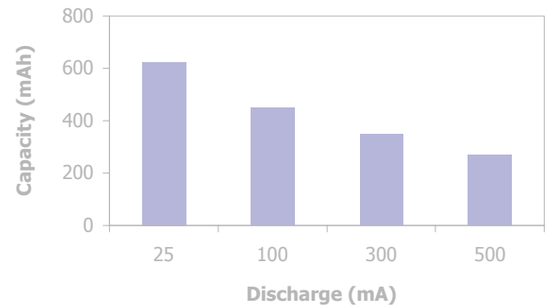
Industry Standard Dimensions

mm (inches)

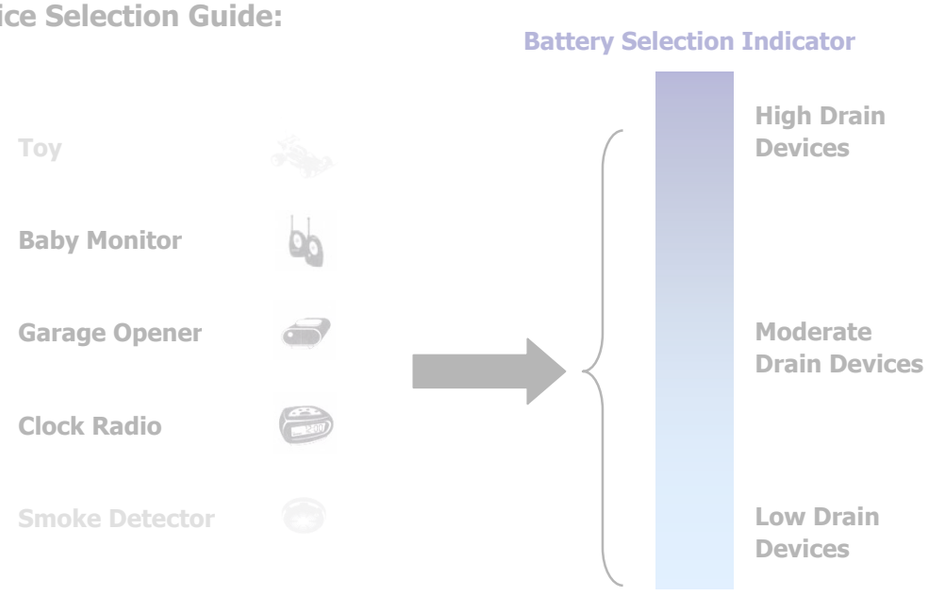


Milliamp-Hours Capacity

Continuous discharge to 4.8 volts at 21°C



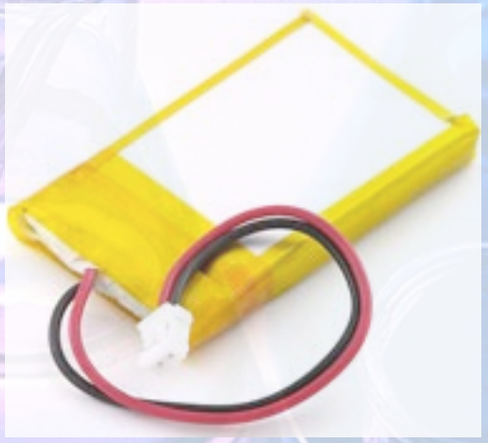
Device Selection Guide:

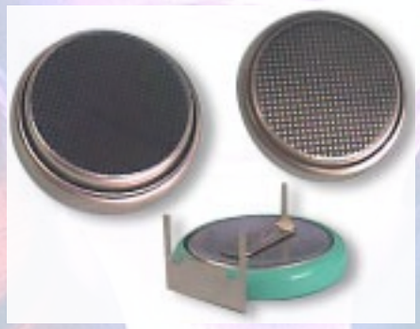


batteries come in more than one flavor

chemistry

- Alkaline
- NiMH
- NiCad
- Lithium
- Lithium Ion



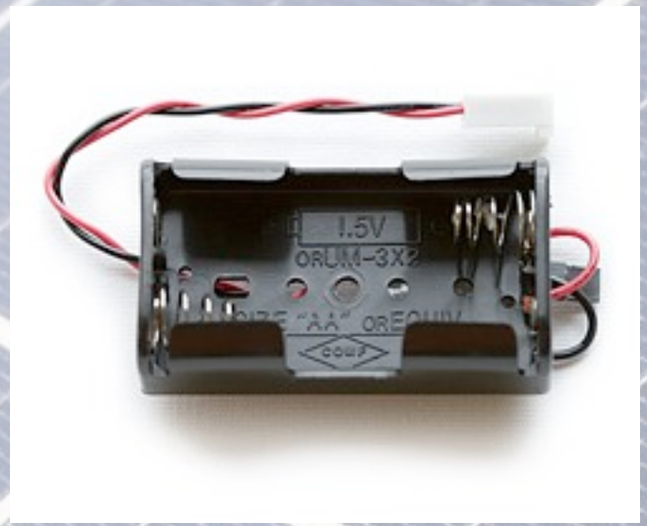


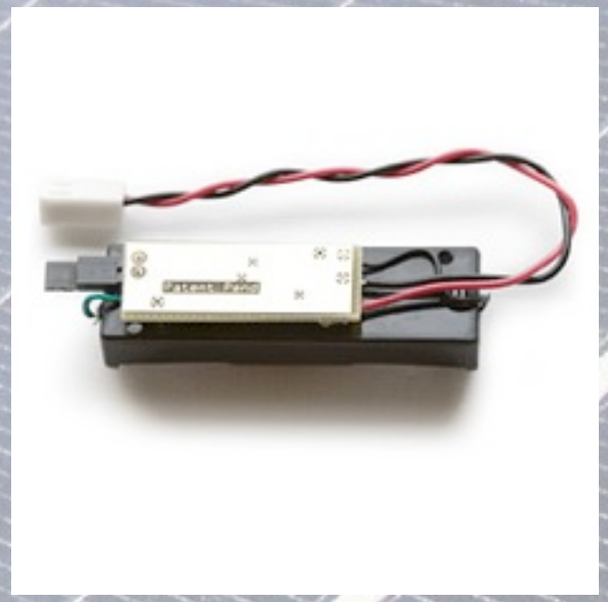
size, life and access

- D, C, AA, AAA
- Coin cells
- Li-ion packs
- Self draining
- Availability

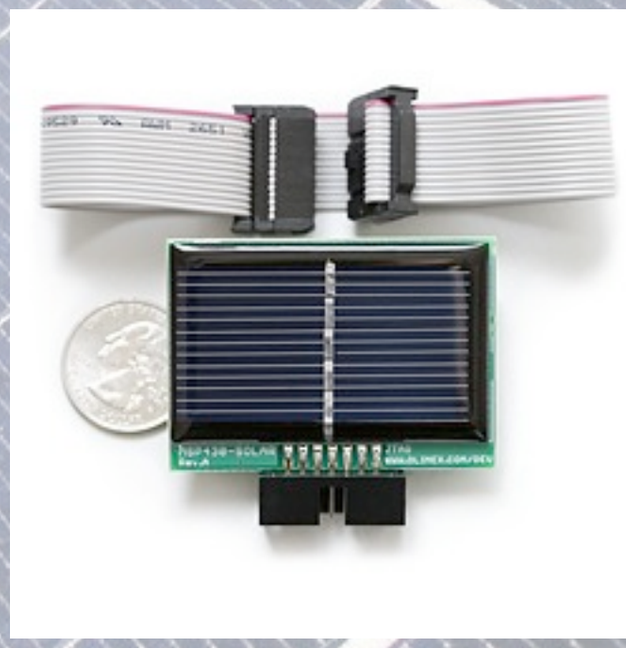
other stuff

- Step-ups





- Solar



- Capacitors

sourcing

- http://itp.nyu.edu/physcomp/Parts/RechargeableBatteries

- http://www.sparkfun.com/commerce/categories.php?c=54

chargers

battery tests

Arduino NG with 9V NiMH Rechargeable - Basic	10 hours, 56 minutes	battery	ATMEGA168 microcontroller transmitting one serial byte every 500 ms at 9600 baud code
Arduino NG with 9V NiMH Rechargeable - LED blink	4 hours, 19 minutes	Rayovac 9V NiMH 170 mAh battery	LED on pin 12, on for 500 ms and off for 500 ms. ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud code
Arduino NG with 9V NiMH Rechargeable - LED strobe	8 hours, 0 minutes	Rayovac 9V NiMH 170 mAh battery	LED on pin 12, on for 10 ms and off for 990 ms. ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud code
Arduino NG with 9V NiMH Rechargeable - LED PWM	4 hours, 29 minutes	Rayovac 9V NiMH 170 mAh battery	LED on pin 12, PWM to full brightness and back to zero every 1000 ms ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud code
Arduino NG with 9V NiMH Rechargeable - Servo 1/2 rotation	minutes -	NiMH 170 mAh	every 1000 ms, servo powered directly ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud code
Arduino NG with 4 AA NiMH Rechargeable - Servo 1/2 rotation	18 hours, 8 minutes	4 AA NiMH 2500 mAh batteries	Servo on pin 2, 1/2 range rotation every 1000 ms, servo powered directly from AA pack ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud code
Arduino NG with 9V NiMH Rechargeable - XBee	2 hours, 8 minutes 2 hours, 17 minutes	Rayovac 9V NiMH 170 mAh battery	ArduinoXBee shield v1.1 with XBee Series 1, no sleeping ATMEGA168 microcontroller transmitting one serial byte every 1000 ms at 9600 baud

- http://www.faludi.com/projects/arduino-and-xbee-battery-test-results/

battery factors

1. power needs
2. max current
3. run time
4. capacity
5. size
6. shelf-life
7. context and availability

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