

Battery formulas

Quantity	Formula
Energy (Wh)	$\text{mAh} \times V \div 1000$
Runtime (h)	$\text{Wh} \times \text{efficiency} \div \text{load W}$
Average current	$(I_{\text{active}} \times t_{\text{active}} + I_{\text{sleep}} \times t_{\text{sleep}}) \div \text{total time}$
Series pack	Voltages add, mAh stays the same
Parallel pack	mAh adds, voltage stays the same
Charge time (h)	$\text{mAh to replace} \div (\text{charger mA} \times \text{efficiency})$

Typical capacities

Battery	Voltage	Capacity
AA alkaline	1.5 V	1,800–2,800 mAh
AA NiMH	1.2 V	1,900–2,500 mAh
CR2032	3 V	220–240 mAh
18650 Li-ion	3.6–3.7 V	2,500–3,500 mAh
12 V 100 Ah	12 V	1,200 Wh

Notes