Objectives Electric Circuits

Topic	Objectives
Circuit diagrams	Recognise and draw symbols for voltage supply, switch, light bulb, resistor, meter, capacitor and diode Draw schematic diagram including series and parallel wiring
Current	Define electric current in words Units ampere and Ah.
Power	Calculate the power dissipated in an electric circuit or in a single resistor Know examples for the effects of electric current (especially heat and light) and their inversion A consumer load does not consume the current, but it transforms electric energy into another energy form!
Resistance	Resistance of a general consumer load is not constant Read values from a current vs. voltage characteristic Graphically determine the current in a circuit with the characteristic and a load line
Resistance of wires	Calculate the resistance of a wire from length, diameter and resistivity (FoTa T 177) Calculate the temperature of a wire from its resistance and temperature coefficient (FoTa T 177)
Resistors	The resistance of a linear resistor is independent of the current Describe two different types of resistors Calculations with Ohm's law (valid only for linear resistors) Calculate the equivalent resistance for a combination of resistors (series and parallel wiring) Calculate partial voltages and partial currents in a circuit Describe how the range of a voltmeter or ammeter can be changed Connect voltmeter and ammeter correctly to a circuit Describe how a meter influences the current in a circuit and what the conditions for an ideal meter are Draw the equivalent circuit for a battery Calculate the terminal voltage from the battery's emf, its internal resistance and the load resistance
Kirchhoff's rules	Set up the junction and loop rules for a rather complicated circuit and solve the system of linear equations with the calculator
Capacitors in a dc circuit	Explain qualitatively the behaviour of voltage, current and power in an RC circuit Calculate the time constant and the half life time Calculate the charge for any given moment
Conduction mechanisms	Qualitatively describe the experiment of Tolman and Stewart to measure the mass of the charge carriers in metals Calculate the drift velocity and know a typical value Know two examples of conduction mechanisms in gases

Semiconductors	Draw the energy band scheme of a conductor and an insulator Explain the principle of doping (donator/acceptor) Describe the conduction in n- and p-doped semiconductors Sketch the current vs. voltage characteristic of a semiconductor diode Sketch and explain a full wave rectifier

Constant	**Value**
Household voltage (Europe/USA)	V = 230 V/110 V, f = 50 Hz/60 Hz
Resistance of a 100 m long copper wire with cross section 1 mm²	R = 1.7 Ω
ln(2)	ln(2) ≅ 0.7 (used in calculations with half life time)
Drift velocity in copper	v = 5 mm/s (at 1 V/m)

Property	**Table**
Properties of conductors (resistivity, temperature coefficient)	FoTa T 177
Charge carrier concentration	FoTa T 178