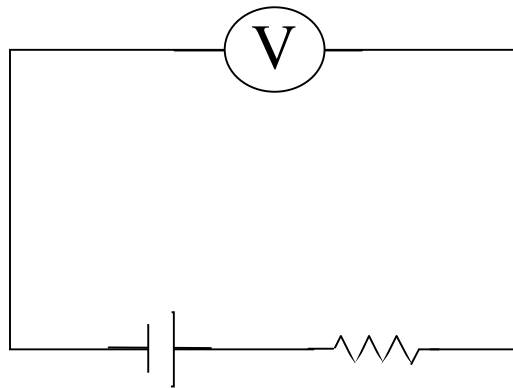


Basic Electronics

A pH measurement of a solution can be represented using a very simple circuit -



The basic rules -

1. $\Sigma I=0$, sum of currents approaching a junction must equal sum of currents leaving it.
2. $\Sigma V=0$, sum of changes in potential encountered while circling a closed circuit must be zero.

For resistive components -

$$E_{\text{resistor}} = V = IR$$

$$P = IV \text{ (power dissipated by resistor)}$$

Basic Electronics

Is $E_{\text{meter}} = 0.667\text{V}$ a good measurement?

$$E_{\text{electrodes}} = E_{\text{sol'n}} + E_{\text{meter}}$$

We want $E_{\text{meter}} = E_{\text{electrodes}}$

Solutions?

$$R_{\text{meter}} =$$

$$R_{\text{sol'n}} =$$

The big idea - The best measurements monitor system response
w/o influencing it

Goal of instrument development: monitor response w/o distorting it
SHC 2A-1, 2A-2, 2A-3

Basic Electronics

Switch

Device or latch to disrupt or restore I to circuit

Battery

Direct current source. Provides potential difference which induces current.

Generator

Alternating current source. Produces oscillating current.

Power Supply

Direct current source. Uses rectifier, filter and regulator to convert AC to DC

filters

Resistor

Circuit element that dissipates current as heat

Capacitor

Circuit element that stores charge

Basic Electronics

Radiation Sources

Electrical discharge between electrodes or resistively heated wires.

Photon Detectors

Electrode pair that has cathode coated w/ emissive (ejects electrons on irradiation) material or semiconductors that generate current (electron/hole pairs) on irradiation

Cells

Electrode pair

Multimeter

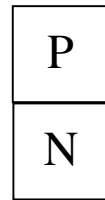
Device to measure voltages, currents & resistances

Voltmeter, Ammeter

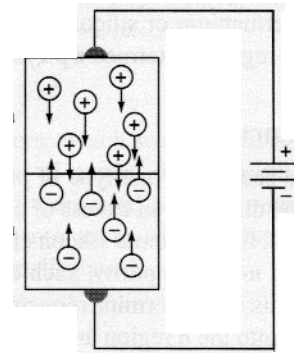
Device to measure voltages and currents

Diodes

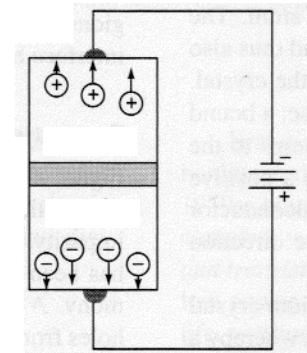
Diodes are semiconductor devices that limit current to one direction



Forward bias

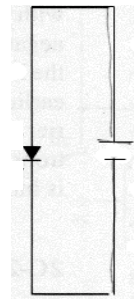


Reverse bias



Forward bias:

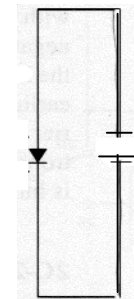
- 1.
- 2.
- 3.
- 4.



high i

Reverse bias:

- 1.
- 2.
- 3.



low i

Basic Electronics

Diodes

A device (usually semiconductor) that limits current to one direction

Transistors

Multiple diode device that amplifies or switches an input signal

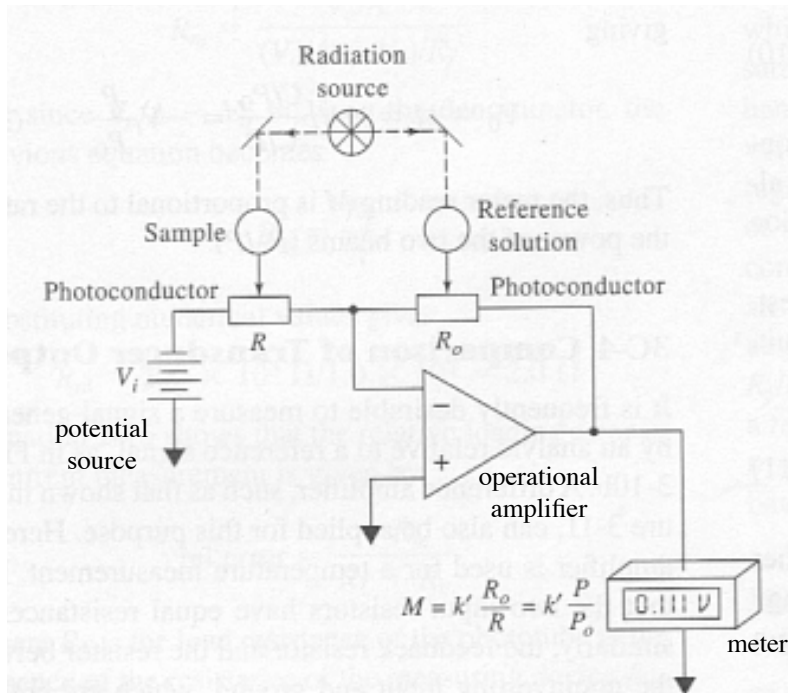
Operational Amplifiers

Integrated circuits (≥ 20 transistors & resistors) that amplify signals, monitor transducer signals and perform mathematical operations

Analog to Digital Converter

IC that calculates an 8 - 16 bit binary representation of instantaneous values of transducer signal

Basic Electronics



Many photometric measurements involve comparing intensity of light transmitted by sample to that of reference. The resistance of photoconductors decreases as the power of light incident on them increases.

1. Simplify the circuit.
2. Label the currents.
3. Use Ohm & Kirchhoff to express the opamp output voltage as a function of the detector signals

Basic Electronics

Many photometric measurements involve comparing intensity of light transmitted by sample to that of reference. The resistance of photoconductors decreases as the power of incident light increases.

Sample detector -

Reference detector -

SHC 2A-1, 2A-2, 3A-1, 3B-1, 3C-4

Electronics Concept Map