

GLOSSARY

ANODE

The positive electrode in an electrolytic cell toward which negatively charged particles are attracted. The anode has a positive charge because it is connected to the positively charged end of an external power supply.

CAPACITOR

An electrical device consisting of two conducting plates separated by an electrical insulator designed to hold an electric charge.

CATHODE

The negative electrode in an electrolytic cell toward which positively charged particles are attracted. The cathode has a negative charge because it is connected to the negatively charged end of an external power supply.

ELECTROLYTE

A conducting medium in which the flow of current is accompanied by the movement of matter in the form of ions.

GRAPHITE

A naturally occurring, steel-gray to black, crystalline form of carbon. The carbon atoms in graphite are strongly bonded together in sheets. Because the bonds between the sheets are weak, other atoms can easily fit between them, causing graphite to be soft and slippery to the touch. Graphite is used in pencils and paints; also as a lubricant and electrode.

PHOTOPOLYMER

A polymer or plastic that undergoes a change in physical or chemical properties when exposed to light.

RESISTOR

A device used in electrical circuits to maintain a constant relation between current flow and voltage. Resistors are used to step up or lower the voltage at different points in a circuit and to transform a current signal into a voltage signal or vice versa.

TUNGSTEN CARBIDE

An inorganic carbon compound that forms a fine gray powder of extremely hard, dense grains. Tungsten carbide is used in tools, die castings, wear-resistant machine parts and abrasives.

May be reproduced for use in the classroom.

For a complete list of Educational programs,
please visit our website at www.tmwmedia.com



TMW MEDIA GROUP, INC.

2321 Abbot Kinney Blvd., Venice, CA 90291

(310) 577-8581 Fax (310) 574-0886

Email: sale@tmwmedia.com

Web: www.tmwmedia.com

Producers & Distributors of Quality Educational Media

© 2011 Allegro Productions, Inc. and
TMW MEDIA GROUP, INC.

Show Me Science

ELECTRONICS Science of Circuit Boards

*Exploring the World Of Science
for High School and Beyond*

Advanced Teachers Guide

SYNOPSIS:

Peer inside any electronic device and you will see at the heart of that device, a printed circuit board. These boards which used to connect just enough capacitors and resistors to run a simple transistor radio are now used to run all of our electronic devices. New technology has shrunk the size of all of the components that attach to the board, the width of the wires that connect them and even the size of the circuit board itself. Without the printed circuit board, our world would look a lot different. This program details the processes involved in planning, designing, and building printed circuit boards.

The process begins when a design is created in computer-aided design software. Students will learn what materials are used to construct the boards as well as how the circuits are planned and built into the boards.

CURRICULUM UNITS:

- Chemistry
- Computer Engineering
- Computer Science
- Engineering
- Physical Science
- Physics

CAREER OPPORTUNITIES:

- Chemist
- Engineer
- Computer Aided Design and Drafting (CADD)

PROGRAM OVERVIEW:

There are dozens of printed circuit boards in the average home. They can be found in everything from the television to the stereo and the microwave to the mobile phone. With ever increasing demand for printed circuit boards, manufacturing them has become a multi-billion dollar industry. Over the years, the printed circuit boards have evolved. Components are constantly becoming smaller and more efficient. What started off with very few capacitors and resistors has become an integral part of almost every electronic device. As devices have become smaller, engineers have to squeeze more tracks and components onto boards.

Printed circuit boards (PCBs) start off as a design brief. Computer aided design, or CAD software is used to lay out the working components. Each component has a connection point called a footprint which is linked together with virtual wires in the software. Most PCBs are made of fiberglass and covered with a thin layer of copper, later removed in the manufacturing process. A machine with a tungsten carbide drill bit is then used to drill precise holes in the board, allowing signals to pass from one side of the board to the other and provide locators for later in production. The boards then go through extensive chemical processes to prepare them for the circuit patterns that will be literally printed on them. Finally, the components are attached.

ISSUES & CRITICAL THINKING:

- 1) Have students research the function of metal components on printed circuit boards such as heat sinks, crystals, switches, batteries and connectors.
- 2) CAD technicians can work in fields as different as jewelry design and aerospace. Discuss other fields that benefit from CAD technologies.
- 3) Get PCB's from different devices (cell phone, computer, printer, remote control) or print pictures of PCB's and compare them to see what components are present in each device (and how many).
- 4) Identify the functions of different kinds of components found on a PCB for a computer.
- 5) Since many electronic devices quickly become obsolete, there is a problem with disposing of the device. Have students identify how PCB's can be recycled to reduce the impact of these devices on the environment.