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Rock Radios

Background

The earliest radios needed no batteries or plug-in power to operate. They used the energy in the radio waves to allow a listener to hear. These radios used rocks to detect the radio signal – well, not just any kind of rock – one called a galena crystal.

When a radio station broadcasts, the music or voice sent out is packed inside a much stronger broadcast signal, or frequency. This is the frequency you tune in on your radio. If you like to listen to say 103.7 on your radio, that is the broadcast station's own special frequency, or signal.

Once you lock onto the station, your radio detects and decodes the music or voice from the broadcast signal and you hear it. Think of it as stripping peas from a pea pod. Electronic circuitry is necessary in your radio to amplify the broadcast signal and do the detecting and decoding so you can hear what you want.

A galena crystal is the natural mineral form of lead sulfide. It can act like a very crude diode, a kind of one-way valve, or switch, for the flow of electricity. This valve action allows the music or voice from inside the radio signal to be detected and separated from the radio signal. A very thin wire, sometimes known as a cat whisker, was used by a radio listener to probe across the face of the galena crystal until a surface feature of the crystal allowed a station to be heard through a pair of earphones. The music and voice heard was weak but certainly understandable.

This was a very exciting hobby in rural areas in the 1920s and 30s when radio was still developing. During this time, most rural homes also did not have electric wiring yet. Young boys took a special interest in crystal radio as a hobby and grew up to become engineers and radio technicians. It was a fun way to learn about radio and to hear the latest news before it was reported in newspapers.

During World War II, soldiers made a variety of such radios and substituted rusty shaving blades for hard-to-obtain galena crystals. The rust particles often acted like the galena crystal. These "foxhole" radios worked remarkably well, enabling soldiers to hear radio stations sometimes as far away as neighboring countries.

Today, these crystal radios can be built from science and electronic kits using modern-day electronic components. By the way, lead sulfide is the official mineral of the states of Missouri and Wisconsin.

Discussing and Making Radios

First, study how radios work and how broadcast stations send out their signals. Talk about the:

1) Energy and information contained within the radio waves that move through the air.
2) Electromagnetic spectrum and where radio waves reside within.
3) Difference between AM and FM broadcasts.

4) Main components of modern radios.
5) Difference between radio and TV broadcasts.
6) Progression from tubes to transistors to integrated circuits.

Make sure the students understand that when they tune to a radio station they are actually changing the inductive-capacitance circuit that resonates to the station's broadcast signal. Also, discuss how radio is important to wireless connections for computers, cell phones, and iPods and how this technology is related to voice and music radio we all listen to.

Search the Internet for more information about crystal radios and foxhole radios and engage the class in trying to make them. Perhaps some of the kids will invent their own kinds of radios. Make sure the students use plenty of sketches and design drawings to show and discuss their ideas.

Perhaps there is someone in class whose father or mother is a ham-radio operator and can augment your classroom activities with a visit and discussion about radio and how it developed. What is needed to become a ham-radio operator and what kinds of fun things can one do?

Can the various key inventors of radio be identified and maybe discussed by the students? How did modern electronic circuits and components change radio? How is radio used by industry and the military?
Might there be an opportunity to visit a local radio station, perhaps at a nearby college or small station in your area? Here students could meet a broadcast engineer and discuss how the station operates and maintains its equipment. The broadcast engineer might be able to visit the school if a tour of the station cannot be arranged. Do radio engineers belong to their own professional organizations, and if so, which ones? What do they study in technical school and college? How is math related to the daily workday of a radio engineer?

Have the students discuss how they could have a small radio station right there in your school. What kinds of equipment would they need? How would they obtain the necessary FCC permits for this? How much range would such a station have if allowed? What kinds of broadcasting could they do? How would this differ from the school's public address system? How are they similar? Compare through-the-air radio and TV wave transmission with cable-transmitted radio and TV. What are the benefits and disadvantages of each?

It might be possible to obtain some radio kits through your school and to order them from approved science and technology suppliers that service the educational system. Check their catalogs and offerings. They are probably available via the Internet.