

RAFT IDEAS

Topics: Chemical Reactions, Acids, Transfer of Energy

Materials List

- ✓ Thermally sensitive fax or cash register paper
- ✓ Foam pieces with adhesive backing
- ✓ Scissors
- ✓ Heat gun or heat embossing tool

This activity can be used to teach:

Next Generation Science Standards:

- Energy can be transferred from place to place and converted from one form to another (Grade 4, Physical Science 3-2)
- properties of materials (Grade 5, Physical Science 1-3)
- Chemical reactions (Middle School, Physical Science 1-2)



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Bring On the Heat

Unusual ways to use fax paper and thermal register tape



Use adhesive backed foam to create words or artwork



Apply very hot air



Portions of the paper exposed to heat will change color.

Thermally sensitive paper can be used to create some stunning artistic effects. This activity is a fantastic exploration of a thermally sensitive chemical reaction.

To Do and Notice

Caution: Heat guns and heat embossing tools create a very hot stream of air. Keep skin and clothing away from the heated air stream. Do not heat paper or foam for prolonged periods.

1. Use the heat gun to heat the paper. The portions of the paper that are heated sufficiently should become black or dark brown. Notice how close to the paper and for what period of time the heat needs to be applied before the paper changes color.
2. Create artwork or words on another piece of thermally sensitive paper by attaching the adhesive-backed foam to the paper. Adhesive foam can be cut with scissors or die cut.
3. Use a heat gun to heat up the paper from the back. Be sure to heat up all portions of the paper that you want to change color. Notice that the unmasked portions of the thermal paper change color while the foam-insulated portions of the paper remain white.

The Science Behind the Activity

Thermal fax machines, cash registers, and some adding machines use thermal chromic paper. This paper has been treated with chemicals so it will change color when heated past a certain threshold temperature. Manufacturers achieve this by treating paper with fluoran dye and octadecylphosphonic acid. The octadecylphosphonic acid in the paper is solid at room temperature, but becomes a liquid at about 100° Celsius (212° F). Once in a liquid state the acid molecule can donate protons (hydrogen ions). The fluoran dye readily accepts the protons and a chemical reaction takes place causing the fluoran dye to change from its uncolored to its colored state. Once the paper cools, the chemicals solidify and the colored state of the dye remains. Thermal printers are popular because the printers are inexpensive to build and to maintain; there are no inks or dyes to replace; and there are no moving parts in a thermal printer other than the paper feed mechanism. The one disadvantage of thermal paper is that an image can fade or become distorted or with age or with exposure to heat or moisture.

Web Resources (Visit www.raft.net/raft-idea?isid=10 for more resources!)

More information about thermal printers and links to Internet resources that discuss the chemistry of thermal chromic paper can be found at:

http://en.wikipedia.org/wiki/Thermal_printer

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