

# CHEMISTRY BOOK

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## INTRODUCTION

The “burning” book, or “chemistry book” is a wonderful way to start a first day of class, or open a presentation to a large group. I usually talk about the importance of being able to understand science without having to be a career scientist. I encourage the audience to learn biology to understand living things, biotechnology, and the importance of understanding the implications of human genome research. I explain the importance of physics to understand light, sound, motion, electricity, and forces. Then I explain how I found that chemistry is the most exciting science since everything is chemical. We can synthesize new compounds, modify existing materials, make many kinds of consumer goods, etc. I tell them that when I opened a chemistry book (as I open the “burning” book), I found excitement that I couldn’t find in a biology book or a physics book.

## MATERIALS NEEDED

Lighter fluid

Hot book (battery operated) available from Magic Shop (Source, below) or constructed according to directions in the following article.

## SAFETY PRECAUTIONS

This item does present a fire hazard. Keep it away from flammable materials and remove the batteries (if it is an electric model) when not in use.

Moisten the wick with lighter fluid away from any flames and, preferable, with the batteries removed. Do not soak the wick.

## DISPOSAL

Disposal of empty container from lighter fluid should be in accordance with local regulations.

## SOURCE

One source for the “hot book” is Hank Lee’s Magic Factory, Mail Order Division, P.O. Box 789, Medford, MA 02155 or on the Internet at [www.magicfact.com](http://www.magicfact.com)

## The "burning" book – a guide to its construction

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The "burning" book is a book that *bursts* into flames while you are "reading" from it. Used appropriately, it can enhance any chemistry lecture and also illustrate specific ideas. We like to use it in introductory lectures and near the beginning of our demonstration shows to provide a dramatic contrast between "science" and "magic". In the former, we study phenomena in order to classify and understand. The purpose of the latter is to entertain via mystification. The audience can guess at how the "trick" was done. However, scientists systematically study nature to elucidate its marvels. The "burning" book can mystify an audience, but it can also be studied as an illustration of volatility, combustion, and insulation when its interior is shown. "Suffocating" the fire by closing the book is an excellent way to demonstrate the fact that combustion requires both a fuel and a source of oxygen.

Burning books (called "hot books") may be purchased from suppliers of magic products for about US\$50-100. You can make your own for considerably less. We have now made about one dozen with the help of our machine shop. The cost for the readily available materials is about US\$20.00. In this paper we describe how to make your own burning book.

The best kind of book to use is a thick book with thick pages. The glossy paper used in chemistry textbooks, for example, makes these books overly heavy and hard to work with. "Pulp" novels with hard covers are the best, and they can be frequently purchased at garage sales for a pittance. For use in chemistry, or other science classes, obtain or make an "appropriate" book cover for the book.

The book must be hollowed out to contain the flameproof chamber. A 4" x 6" x 2" (10.2 cm x 15.2 cm x 5 cm) aluminum chassis available from electronic supply houses works best for fabricating the inner chamber. Depending on the thickness of the book, cut the corners down to a depth of  $\frac{3}{4}$ " or 1" (2 to 2.5 cm). Depending on the size of the pages, then bend over the sides of the chassis so that you have about a 0.5" (1.3 cm) lip on the two sides, the top, and the bottom. Make the lips as flush to the pages as possible so there will not be a bulge which can be seen when you are "reading" the book. (Note: a similar size "box" can be fabricated from aluminum sheet available at hardware stores. Another alternative is a rectangular metal sardine can with all edges removed and sanded smooth. D.A.K.) The center section of the book is then hollowed out leaving free pages at the front *and* the back of the book. The hole can be cut with a sharp knife or a single-edge razor blade. In our shop we modified the blade of a jack plane by cutting it down to 3" (7.6 cm) in length and then welding a rod to the upper end. This rod could then be held in our heavy-duty manual punch to make 2" (5 cm) wide cuts to a depth of about 0.5" (1.3 cm) with each stroke. We made an aluminum mask which we clamped to the book to guide the blade. With care, such an assembly can be used in a large drill press which then functions as a kind of punch. (At my home, I clamped pages of a book together and cut out the opening with a razor knife. D.A.K.)

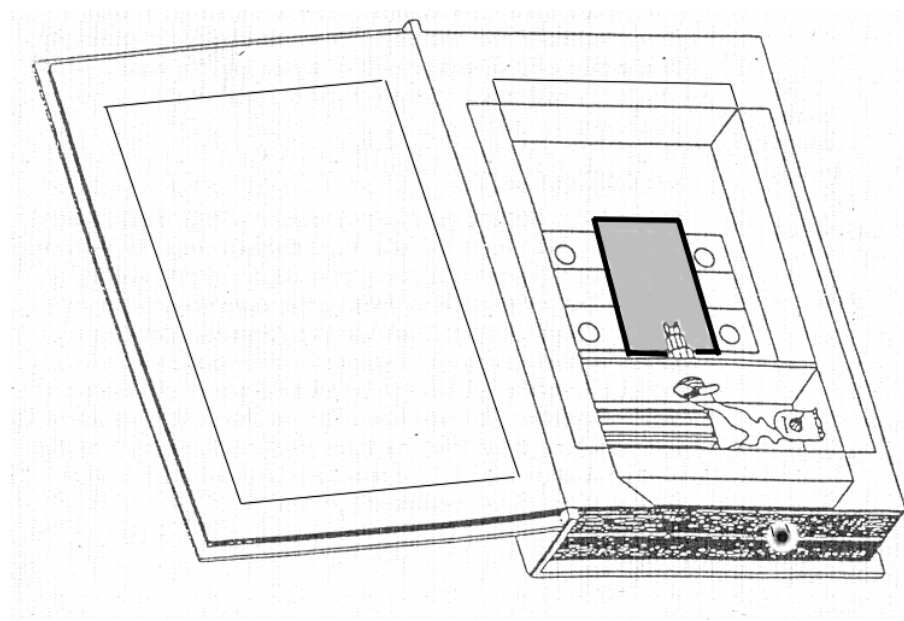
Once the book is hollowed out, the interior of the chassis is prepared. A U-shaped bridge is made from a piece of the discarded chassis to hold the receptacle for the glow plug. This bridge is held in place with two sheet metal screws (or pop rivets if there is enough room). A rubber grommet is used for holding the bayonet socket for the glow lamp. A small bracket is made to hold the momentary switch and this is fastened with small sheet metal screws (or pop rivets if you allow enough room) so that the switch is not activated when the book is closed! A plastic battery holder for two AA batteries is attached to the lower chamber with sheet metal screws (or pop rivets or Velcro). We used a little bit of sauerisen to seat the upper from the lower chamber so that the lighter fluid we use does not accidentally run down into the lower chamber. (The switch is best positioned on the bottom of the chassis and accessible through a hole in the pages in the bottom of the book. Thus, the switch can be pressed with your thumb as you open the book. D.A.K.) (see the diagram)

Three  $\frac{3}{4}$ " (1.9 cm) fireproof fabric ribbon tapes used in glassblowing are stapled together with ordinary staples. This grouping of three is then fastened to the inside back chassis with pop rivets that go all the way through several back pages to a backing plate of fight sheet metal. You may have to drill out part of the underlying book pages to provide relief for the heads of the rivets. As an alternative to the glassblowing tape, you can use a piece of wick from an oil lamp wedged between the glow plug and the back of the chassis.(shown in gray in the diagram)

The switch, the bayonet holder, and the battery holder are all available from stores such as Radio Shack (or Tandy Electronics). The glow lamps are purchased from suppliers of kerosene stoves or heaters since they are the battery powered igniters for the kerosene stoves or heaters. Before the chassis is riveted into place, the page beneath it is covered with a piece of heavy duty aluminum foil which is glued into place. Also, the facing page is covered with the same protective foil or thin sheet aluminum. You can leave the pages loose that have been cut out, or you can glue them together with a thin glue. We found that water glass (sodium silicate solution) worked very well for this gluing operation. The figure clarifies some construction details. (I prefer to glue those free pages together so that the book can be opened to the burning chamber without having to turn pages in the book. D.A.K.)

### Parts list:

- Book
  - Aluminum chassis, 4" x 6" x 2" (10.2 cm x 15.2 cm x 5 cm), or aluminum sheet
  - Glow plug or igniter from kerosene heater or stove (Note: available from shops that repair kerosene heaters or stoves)
  - Socket for glow plug
  - Battery holder for two AA batteries
  - Momentary push button switch
  - Wire
  - Glassblowers tape or kerosene lamp wick
  - Glue
  - Batteries, AA
- } Available from electronic stores such as Radio Shack



**REFERENCE:** Chem 13 News is published through the Department of Chemistry at the University of Waterloo, Waterloo, Ontario, Canada. Chem 13 News contains articles of interest to all teachers in chemistry. To subscribe to Chem 13 News, visit their web site at <http://www.science.uwaterloo.ca/chem13news/>