LETTER

CHEMICAL IMBALANCE

As a teacher of high-school chemistry, I was intrigued by the article "Experiments in Electrochemistry" by Stanley A. Czarnik (**Popular Electronics**, June 1991). The suggested experiments are interesting and can easily be performed by an experienced chemistry teacher. Students can also carry out the exercise under appropriate supervision.

There does appear to be an error, however, in the explanation of the formation of sodium hydroxide during the electrolysis of brine. The sodium ions are *not* discharged at the cathode forming metallic sodium, which then immediately reacts with water to form the base.

According to *Chemistry: Experiment and Theory* by Bernice G. Segal, "If an aqueous solution of NaCl is electrolyzed using inert electrodes, chlorine is produced at the anode, but sodium metal is not produced at the cathode. Instead, $H_{2(g)}$ is formed at the cathode. The reason is simply that water contains hydronium ions, and $H^+_{(aq)}$ ions are a stronger oxidizing agent than Na^+ ions, and are therefore more easily reduced. The cathode reaction for the electrolysis of an aqueous solution of NaCl (or $ZnCl_2$, $CaCl_2$, $ScCl_3$, KCl, and so on) is:

$$2\,H_2O + 2e^- \rightarrow H_{2(g)} + 2\,OH^-$$

so that the products of the electrolysis of aqueous NaCl are $H_{2(g)}$, $Cl_{2(g)}$, and a solution of NaOH."

I hope that the above quote serves to clarify the chemistry occurring during the electrolysis of alkali or alkaline earth cations.

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SAFETY FIRST

I have just finished reading Jim Stephens' article, "A Telephone Operated Power Switch for Your Computer" (**Popular Electronics**, June 1991). It seems like a useful project, but I have to take exception with the line voltage wiring instructions.

The instructions on the bottom of page 54 concerning not connecting the green ground wire to the metal case is wrong—possible *dead* wrong! *The green wire (safety ground) must always be directly connected to a metal case switching or containing line voltage.* That is to make sure that if a line-voltage carrying wire or component comes in contact with the case, the fuse or circuit breaker will open, removing line voltage from the case. If the case is left unconnected, it is very likely that a deadly electric shock could happen if someone were to touch the case while touching some grounded point, such as a computer, typewriter, calculator, or metal desk.

There are some other comments about safety that also apply to the line-voltage wiring. A fuse or circuit breaker should be installed in the power cord wire leading to switch S1. That is needed since the project is left "on" at all times, particularly overnight and weekends, when the possibility of an overload inside the box could result in a fire when no one is present. The cord manufacturer has to obtain UL approval for their cord, and they will tell the user what the cord rating is in amps; the rating of the fuse or breaker should be that size or smaller. The internal wiring should be the same gauge size or larger (smaller number) as the cord.

In addition, the neon indicator lights need a correct-size series resistor for proper operation (none are listed in Fig. 1 of the article), and should be housed in an appropriate lamp holder. Alternately, use a neon indicator assembly that includes a resistor. That will protect users from electric shock in case the tip of the lamp is broken off and the internal electrodes are exposed. And the line cord needs to have a strain relief to prevent internal damage to the wiring in case of a strong pull to the cord and also to guard against the eventual cutting and short circuiting of the cord at the case entry point.

All of the above corrections are for the personal safety of anyone coming into contact with the project. These suggestions really apply to any line-voltage-powered project. To ignore them is to invite a needless, and possibly lethal, hazard where none need exist.

D.S.
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APPEARANCES COUNT

I have just completed building a binary clock, following the instructions in the article in the January 1991 issue of **Popular Electronics** and using the kit sold by Electronic Kits International, Inc. The kit is certainly complete in every detail, and the instructions are more than adequate. I found the assembly to be quite straightforward, and free of any special problems. The finished clock works flawlessly, and is quite impressive in appearance. I have had a lot of fun with it since it is most puzzling to my friends, few of whom know anything about binary numbers. Once the number system is explained to them, most think it is clever, and a nice addition to the household. However, a few have said, sourly, "Why don't you use an ordinary clock?" I enjoy their reactions.

I do have one suggestion for improvement, however. I don't think the quality of the wooden case supplied is a match for the rest of the clock. Mine was not square, and was ⅛-inch wider at one end than at the other. In addition, it was made of pine, which is not widely perceived to be a cabinet wood. I would suggest the use of Philippine mahogany, which costs the same as pine around here and is a much prettier wood. In addition, it can be finished very simply with a clear wood sealer since it already has some natural color—particularly the variety called "Narra." I made my own case, giving it a very neat, finished appearance. The skills required were not significantly greater than those used