Re: Battery type for calibration reference

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- *From*: Jonathan Kirwan <jkirwan@xxxxxxxxxxxxxx>
- *Date*: Sat, 17 Jun 2006 20:15:33 GMT

On 16 Jun 2006 06:23:38 −0700, "David L. Jones" <altzone@xxxxxxxxx>
wrote:

> nospam@xxxxxxxxxxx wrote:
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> > nospam@xxxxxxxxxxx wrote:
> >
> > > Hi, all.
> > > My question has to do with how to provide a voltage
> > > calibration
> > > reference for users who may not have access to decent
> > > equipment or
> > > parts, or may not be especially technically inclined. What I'd
> > > like to
> > > be able to say is "Get a new (some type) battery and measure
> > > it, it
> > > will be within X% of (specified) voltage."
> >
> > <snip>
> >
> > Thanks for the "voltage regulator" responses, but as noted above this
> > is intended as advice to non−technical users. Put another way, what's
> > the best absolute voltage reference a non−technical person can buy in a
> > drugstore or maybe a (third−world?) country "general store". No
> > circuits that might intimidate. Batteries seem to be pretty widely
> > available and non−intimidating; I can't think of anything else as a
> > likely candidate. ("Stick a copper wire and a galvanized nail into a
> > lemon" probably isn't
> > gonna cut it!)
> >
> > Best regards,
> >
> > Bob Masta
>
> Why would a non−technical person want a stable voltage reference?

I can think of a few cases, neither of which probably apply to this case though: 1) A child growing up in a very poor family, but learning, and wanting to actually _do_ some science on the cheap or just learn. 2) Someone living in circumstances where there is no infrastructure but only primitive raw materials and physical theory to go on. This case, of course, presumes a meter in hand and that generally means that there either is infrastructure, money, or else it's a one−off that just happened to fall into poor hands (given, perhaps?)

> BTW, voltage references aren't complex − one chip with 3 pins (supply, gnd, ref out), that's it no "circuit" required. Shunt types might need an additional resistor, but that it.
> Local electronics stores carry basic types.

If they exist. Sometimes it's just fun to answer the general question from physical theory −− for example, what kinds of materials that can be readily found and with low technology means turned into a reasonable voltage reference that provides _any_ valid approximation. Think of this in terms of what can be described on paper in words in sufficient detail that they can be replicated reasonably well, say, 2 millennia ago. Would be interesting, no?

Some time ago, someone I knew currently living among native indians in South America asked me about the possibility of arranging a way they could make their own AM radios. Batteries were impossible to be had, so of course the idea of a "crystal set" came to mind. I set about to describe how to make an AM receiver. Galena was locally available, luckily, so that was a good starting point. Needles of metal (steel) were also locally available. Together, with a little bit of molten lead, that was sufficient to make a diode detector. The result was that I gave them instructions for fabricating circular permanent magnets, coupled with flat bits of metal for diaphragms, wound wire, etc, to make their own higher impedance earpiece (which was the harder part of this), along with the rest (tuning coil, capacitor) to make an AM radio from what could be accessed in what was then rather a remote area.

[All kinds of wonderful things can be done with simple items. You can fabricate a microbarometer capable of detecting an elevation change of less than a meter using DOT brake fluid from a car, some glass tubing, two LEDs, some nichrome wire from a toaster, and a few other bits.]

I think it's interesting to think about how to develop a voltage reference from common materials available in different locals. Sometimes, one might want to make one and doesn't have access to high tech resources for the purpose.

What would you do if you were making such a voltage reference and

lived, say, 100 years ago and there were no ICs, transistors, bandgap references, and so on? Yet you wanted to "do science" all the same? What about 200 years ago?

I haven't done the experiments to see, but I wonder about using two dissimilar metals, freshly sanded with emery paper and placed in a lemon or lime for a short time (the reactions will soon block the EMF, but fresh metal surfaces placed a consistent distance apart may provide a reasonably repeatable result. Unfortunately perhaps not a _known_ result from theory, though. So accuracy would still be in question.

Still, copper sulfate pentahydrate (simple, hydrated copper sulfate) is available as root killer at garden supply stores. Which is a copper salt. That, with copper wire can easily provide one half of a wet cell with known (predictable) voltage. The only need would then be to find another metal and an associated salt for the solution. One could then use either a saline bridge between (traditional method) or else just use sausage casings (squish out the sausage first and wash thoroughly!) filled with one of the salts and the metal electrode and immerse it directly in the other salt solution.

Anyway, the electric potentials from the reactions are readily available for calculation −− for example, the standard Cu/Zn combo yields a predicted (+0.342 − −0.762) = 1.104V of potential difference.

I'm going to set about the local store today and see what I can easily find to test this out. (1) copper sulfate (root killer), (2) sausages for their casings to use as a porous membrane, (3) copper wire, (4) angle iron, (5) ferrous or ferric sulfate (etchant or moss kill) to go with the iron, (6) aluminum, sanded, from pop cans, (7) aluminum sulfate from "slug kill" supplies. Might be fun. That's three metals and their salts to play with and a porous membrane.

Jon
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