Letters

Bigger Gap...Bigger Spark

Students generally have a more difficult time with topics from electricity and magnetism than they do with topics from mechanics. Trying to visualize charges and how they behave is just tougher to do than visualizing the motion of a dynamics cart or a pendulum. Usually the idea of voltage is preceded by a description of the electric potential energy gained by separating oppositely charged particles. This is often compared to the gravitational potential energy gained by raising a mass above the Earth.

After reading through the static electricity demonstrations in the October issue,[1] I was reminded of an interesting observation I made during a demonstration by Paul Doherty of the Exploratorium in San Francisco of how to make an inexpensive electrophorous.[2] Paul was talking to a group of about 30 science teachers when one of the participants asked where the seemingly endless energy from the electrophorous came from. Indeed, the electrophorous can appear to be almost magical in its ability to pick up endless amounts of charge. Knowing how the electrophorous works and realizing that the charge really comes from the demonstrator, I suppose I had never thought closely about where the energy comes from for those endless sparks. Paul explained that the energy was electric potential energy produced by physically separating the electrophorous from its base and thus separating the charge. *It intrigued me that the greater the separation from the base, the greater the electrical potential energy, and thus the greater the spark discharge should be.* I tried collecting some charge and discharging it only 1 cm from the base of the electrophorous. There was a very small, almost imperceptible spark. Then I tried gathering charge and discharging it from a few centimeters—more spark! Then I tried the discharge from about a half a meter (the distance I normally use when demonstrating the electrophorous in class). This time I got a spark that was surprisingly large—noticeably louder and brighter. I asked Paul if he had ever observed the phenomenon before. He hadn't and none of the other teachers present had either. I realized that we probably always discharge the electrophorous from about the same position above the base and thus don't make the connection between separation distance and spark intensity.

I intend to show my students what I discovered next time I discuss static electricity. I hope that after they see the spark intensity grow with separation distance they will make the connection between mechanical work and electrical potential energy (and are better able to visualize what is happening to the charges). Such connections help students see how all of physics can be integrated and that the laws of physics are far reaching—going beyond the artificial barriers that we physics teachers sometimes erect.

References

1. Gordon R. Gore, *Phys. Teach.* **30**, 400 (1992).
2. *The Exploratorium Science Snackbook*, edited by Paul Doherty (The Exploratorium, San Francisco, CA, 1991), pp. 20-1 to 20-3.

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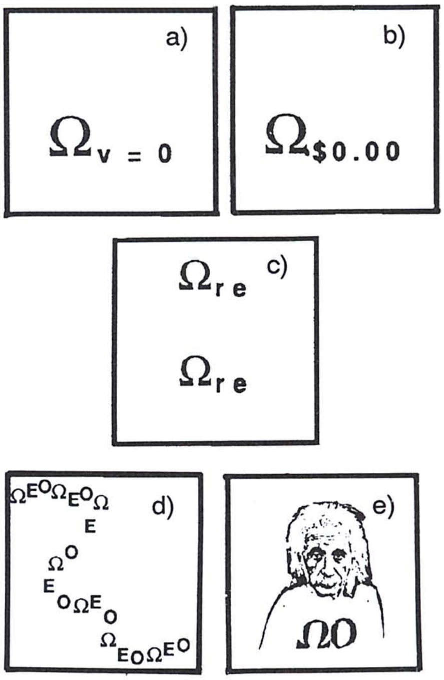
More Ohms-Pun Humor

Marshall Ellenstein's ohms-pun humor [*Phys. Teach.* **29**, 347 (1991)] inspired the following:



[The answers can be found on page 511.]

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More 1¢ Physics

I would like to add one more demonstration to Ron Edge's "Bags, Balloons, and Such."[1]

After doing the orbit demonstration with a penny in an inflated round "nine-inch" balloon, use a pin to poke a hole at the end opposite to the mouth of the balloon. Usually the balloon will not break and air will start to come out when the pin is removed.

Now by holding the balloon slightly overhead so that you can see the hole, you can maneuver the penny inside of the balloon so that it covers the pinhole. This will stop the air flow! Not only that, the balloon can now be turned so that the penny is on the top. The penny will not fall down! The pressure differential apparently holds it in place.

I tell my friends that a small hole in a space ship can be fixed by putting a book over the hole!

Reference

1. R.D. Edge, *Phys. Teach.* **30**, 379 (1992).

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