Electric Field Mapping Lab

You can map Electric fields two dimensionally by using a conductive medium, a power supply and a voltmeter. You actually will find lines of equal potential, but it is a short leap from there to E field lines. Every man, woman and child will need to do their own two field maps. I have several suggestions for what you can try to map, and you can also make up your own configuration. Try to do two <u>different</u> field maps. Branch out.

1. You will need heavy paper, some electrodes, a pencil attached to a voltmeter, and a shallow tray filled with about 1-2" of water.
2. Write your name in pencil on the top of your sheet op paper, slide the paper into the water from one end so that there are no bubbles under it, and place the electrodes on top of the paper to hold it down.
3. Attach the leads from the power supply to the electrodes. (It is possible that some electrodes can be electrically unattached) Label the attached electrodes 0 and 6 V.
4. Pick 5 voltages more or less evenly spaced from your maximum voltage to your minimum. Because of electrochemistry, we will read .8 V above, so for 0 to 6 V you would do 1.8, 2.8, 3.8, 4.8, 5.8 Set the voltmeter to 200 V, so that it shows the voltage with only one decimal point. (Otherwise you will go mad) Notice as you move the pencil around in the water (Don't draw on the sheet yet) that the voltage changes, and that closer to the 6 V electrode, the voltage is closer to 6 V, and the 0 V electrode, 0V.
5. First mark where all the electrodes are – so if you bump them you can put them back. Label them "0 V", "6 V" or "N" for neutral
6. Now mark gently on the paper (so as not to tear it) points separated by about a centimeter or so all the way across the page for every voltage. These lines are called equipotential lines.
7. When you are done, carefully remove your paper, and place it to dry, and do another different map if you haven't already.
8. When your paper is dry, it should now have a bunch of dots on it that form neat patterns of equal potential. Connect the dots of equal potential with nice smooth lines in pencil, erasing if they aren't smooth. (i.e. all 1.8 volt dots, all 4.8 volt dots) Then trace over your equipotential lines with pen so they won't erase. Starting from the positive electrode, draw lines lightly at first in pencil that go to the negative electrode, and always cross the equipotential lines at right angles. (These lines are E-Field Lines) This will take some practice. Remember, the electrodes were conductors, and electric field lines are always perpendicular to conductors. (They will leave the electrodes at right angles)
9. Answer these questions for each picture:
    A. Where on your picture is the E-field the strongest? Circle that region, and calculate the E field there. $E = \Delta V/d$. For ΔV you know the voltage of every equipotential line, so just subtract. For d, use a ruler. Remember to use meters. Show this calculation on the sheet itself.
    B. Where on your picture is the E-Field the most uniform? Box that region and calculate the E-Field there.
    C. Turn in both your pictures, with your calculations on them. That's it. (Each man, woman, and child must turn in their own two field maps)