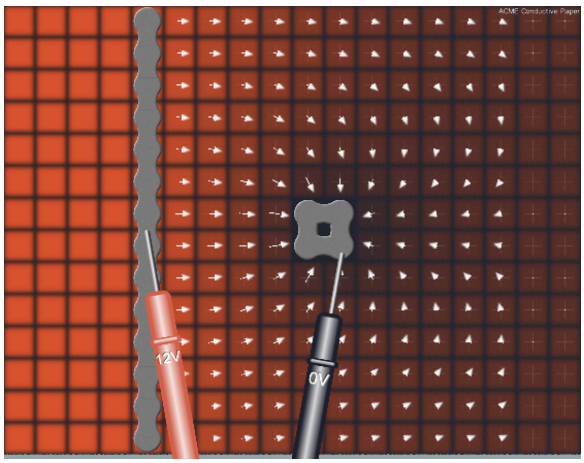
Electrostatics Landscapes Lab
AP Physics

Name _____
1 2 3 4 5 6 7 8

www.simbucket.com -> Simulations -> Electrostatics Landscapes Lab

Procedure

1. Create an electric field map using the simulation. Wait a while until all of the arrows stabilize. Take a screenshot. A complete electric field map might look like the following:



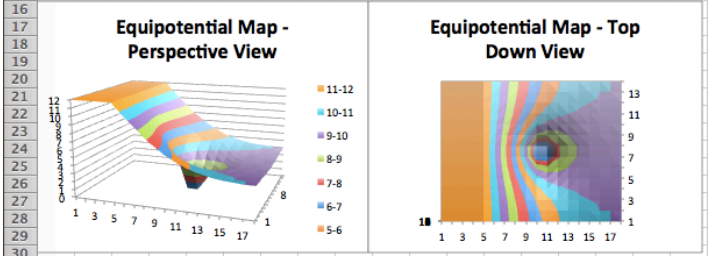
2. Switch to the "Potential" view and wait for all of the potential values to stabilize. This might take a few minutes, particularly if you are using a mobile device. Take a screenshot of these values.

2a. iPad instructions: If you are using an iPad, make sure you have the Microsoft Excel app (free download), then press the export button (). Long-press the numbers that appear and copy them. Open up the Excel app and paste them into a spreadsheet.

2b. Desktop instructions: If you are using a desktop, make sure you have Microsoft Excel. In the simulation, click the "Potential" button and transcribe all of the numbers into a spreadsheet.

3. In Excel, select all of your data, then click on "Charts", then the "Other" button. Select "3-D Surface". You should now see your data rendered as a 3-dimensional surface. If you are using the full version of Excel, you can adjust and rotate the plot to create something similar to the following. Take a screenshot of your 3D plot.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	12	12	12	12	12	10.7	9.5	8.3	7.3	6.4	5.7	5.1	4.7	4.4	4.2	4.1	4	4
3	12	12	12	12	12	10.7	9.4	8.2	7.2	6.2	5.5	5	4.6	4.3	4.2	4	4	3.9
4	12	12	12	12	12	10.6	9.3	8	6.9	5.9	5.2	4.7	4.3	4.1	4	3.9	3.9	3.9
5	12	12	12	12	12	10.5	9.1	7.7	6.4	5.3	4.6	4.2	4	3.9	3.8	3.8	3.8	3.8
6	12	12	12	12	12	10.4	8.8	7.2	5.6	4.4	3.7	3.5	3.5	3.6	3.6	3.7	3.7	3.7
7	12	12	12	12	12	10.3	8.5	6.6	4.7	2.8	2.3	2.6	3	3.3	3.5	3.6	3.6	3.7
8	12	12	12	12	12	10.2	8.3	6.2	3.6	0	0	1.8	2.6	3.1	3.4	3.5	3.6	3.6
9	12	12	12	12	12	10.2	8.3	6.2	3.6	0	0	1.8	2.6	3.1	3.4	3.5	3.6	3.6
10	12	12	12	12	12	10.3	8.5	6.6	4.7	2.8	2.3	2.6	3	3.3	3.5	3.6	3.6	3.7
11	12	12	12	12	12	10.4	8.8	7.2	5.6	4.4	3.7	3.5	3.5	3.6	3.6	3.7	3.7	3.7
12	12	12	12	12	12	10.5	9.1	7.7	6.4	5.3	4.6	4.2	4	3.9	3.8	3.8	3.8	3.8
13	12	12	12	12	12	10.6	9.3	8	6.9	5.9	5.2	4.7	4.3	4.1	4	3.9	3.9	3.9
14	12	12	12	12	12	10.7	9.4	8.2	7.2	6.2	5.5	5	4.6	4.3	4.2	4	4	3.9
15	12	12	12	12	12	10.7	9.5	8.3	7.3	6.4	5.7	5.1	4.7	4.4	4.2	4.1	4	4



Procedure Step 1: Paste a copy of your electric field map here.	Procedure Step 2: Paste a copy of your electric potential map here	Procedure Step 3: Paste a copy of your Excel 3D surface plot here

Analysis

1. What do you notice about the potential values for all contiguous (connected) metal pieces?

2. Find a spot where the electric field is the strongest. Circle the spot on all three graphs.

2a. For this spot, fill in the potential values for all of the grid squares immediately adjacent to this point:

	Potential at grid square with highest E field	

2b. Electric field strength is given by $\vec{E} = \frac{\Delta V}{\Delta s}$, where ΔV is the voltage difference between two points and Δs is the distance between the two points. Assuming that each grid square is 1 cm wide, use your potential map to determine an approximate electric field strength at the spot you identified as the strongest electric field. Remember that the distance between diagonal squares is $\sqrt{2}$ cm!

3. Use the simulation to create a new map containing a closed metal shape. ***Wait for the simulation to come to equilibrium***.

3a. What is the electric field strength inside the conductor?

3b. What is true about the voltage inside the conductor? Why?