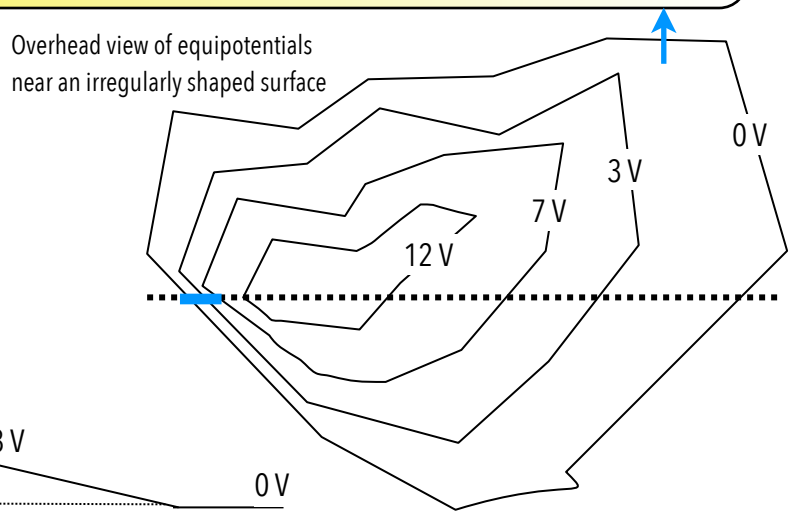
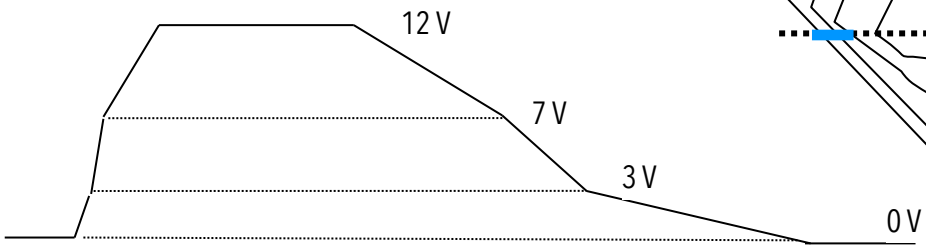
Name_____Pd_____

Charge Contour Maps

Overhead view of equipotentials
near an irregularly shaped surface



Side (cutaway) view of equipotentials
along thick dotted line in picture at right



1. A +1 C charge with a mass of 5 g is set (initially at rest) on the 7 V equipotential. Which way will it move?

To the right (away from the positively charged "hill")

2. If the +1 C charge mentioned above were moved to the top of the 12 V "hill," would work have to be done on the charge, or would it lose electrical potential energy going that way, or both?

Work would have to be done on the charge, so it would gain electrical potential energy

3. What would be the speed of the +1 C charge mentioned if it moved from the 12 V "hill" to the 0 V "plain" at the bottom, if it can be found?

$E_{PE} = QV = 1 \cdot 12 = 12$ J This becomes kinetic energy, so $12 = \frac{1}{2}(0.005)v^2$ $v = 69.28$ m/s

4. What will be the electrical potential energy change for an <u>electron</u> moving from the 0 V to the 3 V equipotential? Is this a gain or a loss of electrical potential energy?

$E_{PE} = QV = 1e \cdot 3V = 3$ eV This is a ***loss*** since the electron is moving toward the positive charge

You could also use: $E_{PE} = QV = 1.6 \cdot 10^{-19}(3) = 4.8 \cdot 10^{-19}$ J

5. Does the charged object responsible for the equipotentials shown have a net positive charge, or negative charge?

Positive, the voltages are positive and increasing toward the "hill"

6. If the distance from the 7 V equipotential to the charged object creating the equipotentials is 3 mm, find the following where possible: The charge's magnitude, the electric force at the 7 V potential, the electric field at the 7 V potential, the electrical potential energy gained by a positive test charge moving from the 3V to the 7 V potential. If something cannot be determined, state why, or what you would need to find it.

$V = kQ/d$ $7 = 9 \cdot 10^9(Q)/(0.003)$, so $Q = +2.33 \cdot 10^{-12}$ C

$F_E = kQq/d^2$ Since we don't know of a charge placed at the 7 V potential line, we can't find a force.

$E = V/d$ $E = 7/0.003$, so $E = 2333$ V/m, away from the + charge

$E_{PE} = qV$ Since we don't know the amount of the + test charge, we can't find the amount of energy gained

[it is energy gained though because it's going from a lower + voltage to a higher one]

7. Looking at the dashed line in the picture above, color in the region of greatest electric field strength along it.

8. Is there a place where the electric field would point directly left, right, up or down in the overhead view? Where?

At the top right of the picture as shown by the arrow.