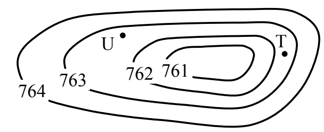
ILD 11

Name ____________________________

Electrostatic Potential & analogies

I. Equi-something lines vs. the direction of flow

A. On a weather web site, we saw this equibaric (equi-pressure) map. The lines show points of equal pressure, labeled here in millibars.

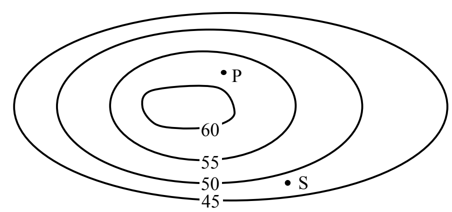


1. Draw arrows at U and T showing the direction of the wind at those points. Explain your reasoning in terms a 14-year-old would get.

2. Explain why wind blows (flows) perpendicular to equibaric lines. Hint: Why doesn't wind flow *along* an equibaric line?

3. At which point, U or T, is the wind stronger? Explain.

B. A laptop computer will overheat unless heat produced by the central processing unit (main microchip) flows out of the computer instead of building up inside. On this equithermal map of the inside of a laptop, the lines show points of equal temperature, labeled in degrees Celsius.



1. Where in the diagram is the microchip? How do you know?

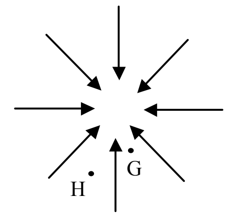
2. Draw arrows at P and S showing the direction in which heat flows at those points. Explain.

3. Explain why heat flows perpendicular to equithermal lines. Hint: Why doesn't heat flow *along* an equithermal line?

4. At which point, P or S, is heat flowing faster? Explain why.

C. Can you think of other scenarios in which, if you draw an equi-something map, there would be a flow perpendicular to those lines?

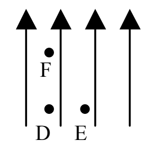
II. Equipotential lines vs. the electric field



A. Consider this electric field produced by a negatively charged sphere. Recall that an equipotential line consists of points that all have the same potential. So, when a charge moves along an equipotential line, it neither gains nor loses potential energy.

1. Draw the equipotential line through point G, making sure it contains all points on the page that have the same potential as G. Explain your reasoning.

2. Draw the equipotential line through point H.



B. Now consider this uniform electric field.

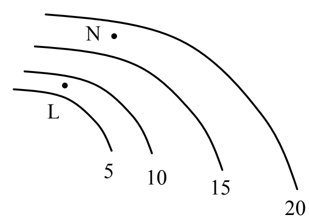
1. Draw the equipotential line through point F, and explain your reasoning.

2. Now draw the equipotential line through point D.

C. For the simple electric fields you just considered…

1. What is the angle between the field lines and the corresponding equipotential lines?

2. Here's the punch line. This conclusion applies to *all* electrostatic fields, not just simple ones. Explain why, relating your reasoning to page 1 of this ILD. Hint: The electric field shows which way a positive charge would "fall." In other words, it shows the direction of charge flow! Why wouldn't charges ever fall (flow) along an equipotential line?



D. Finally, consider this equipotential map.

1. At L and N, draw arrows showing the electric field at those points.

2. At which point, L or N is the electric field stronger? What rule did you just use to figure it out?

3. Explain why that rule is true, relating your answer to page 1 of this ILD.

III. Study strategies in Physics 121 vs. 122, revisited

Two weeks ago in the Electric Fields tutorial, we asked whether you agree or disagree with this advice:

> With forces and motion, you can use your everyday experiences and in many cases your common sense to help you learn. But in Physics 122, with really abstract concepts, you can't rely on intuitive ideas at all; you have to use a less common-sense, more abstract style of learning.

What's your current opinion (subject to change, of course) about the advice above? Specifically, what role, if any, do you see common sense and analogies playing in your learning of the abstract ideas in this course, such as electric field and potential. Please say what *you* think, not what you think *we* think!

