

Assignment #14
Problem 122 added

Reading:

Feb 2 Purcell Chapter 6.1-6.4*Feb 4* Purcell Chapter 6.5-6.9

Problems:

114. Purcell 4.9

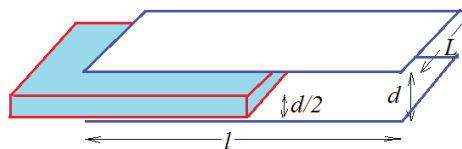
115. Purcell 4.17

116. Purcell 4.19

117. Purcell 4.26

118. Purcell 4.33

119. Consider the problem solved in class in which two parallel plates are separated by a distance d , and have length L and width l . A conducting slab of thickness $d/2$ and width l protrudes into the gap between the two plates as shown in the figure.



- Repeat the calculation given in class for the force pulling the slab into the gap between the plates in the case in which the plates carry charges $+Q$ and $-Q$.
- Solve for this force again for the case in which the two plates are connected to a battery of voltage V . (Be careful to consider both the energy stored in the plate-plate-slab capacitor and in the battery.)
- Show that the force is the same for the two cases considered above when the potential difference V between the plates is the same. Explain.

120. Purcell 5.1

121. Purcell 6.1

122. Three charges, $q_1 = 2$ esu, $q_2 = -2$ esu and $q_3 = 0.5$ esu are located in three dimensions at the positions $\vec{r}_1 = (2, 3, 3)$, $\vec{r}_2 = (3, 2, -1)$, and $\vec{r}_3 = (6, 8, 2)$ expressed in units of cm. Draw a plot showing equipotential lines in the two-dimensional rectangle $0 \leq x \leq 10$ cm, $0 \leq y \leq 10$ cm, $z = 1$ cm. Show lines corresponding to 101 values for ϕ lying between $\phi = -1$ esu/cm and $\phi = +1$ esu/cm separated by 0.02 esu/cm. Show the contours for positive values of ϕ as solid lines and those for negative values of ϕ as dashed lines. (You might start with the Python example on the course website: http://www.columbia.edu/~nhc1/UN2802/Python/Python_index.htm labeled “dipole.ipynb” and then gradually modify it to become the solution to the problem posed here.)