



Université d'Ottawa • University of Ottawa

Faculté des sciences
Physique

Faculty of Science
Physics

PHY 1102

July 18, 2003

Supplemental Final OPEN BOOK Exam: 3 hours

Prof. J. Gort

Page 1 of 4 pages

Do any THREE questions below, SHOWING ALL YOUR WORK, as neatly as possible, in the examination booklet. These questions REQUIRE SOME THOUGHT. You will be graded on how well you approach the problem as well as the final answer. Clearly identify your assumptions and show your reasoning (even if you get stuck). If integration is required and you cannot integrate to obtain the final answer, leave the result in the form of an integral (with appropriate limits of integration).

If you have time and wish to attempt the fourth problem, you may do so for a maximum of 10 BONUS POINTS. CLEARLY PRINT THE WORDS "BONUS PROBLEM" to indicate the chosen problem. If you try four problems and do not indicate the "BONUS PROBLEM", three problems will be selected at random for marking.

You may keep this questionnaire after the exam.

You have exactly three hours.

1. Consider a solid sphere of uniform charge density. What is the ratio of the electrostatic potential at the surface to that at the center?
2. Suppose the circular arc shown in the figure below carries a charge per unit length λ that varies with θ as $\lambda = \lambda_0 \cos \theta$, where θ is measured from the x axis. Determine the electric field \mathbf{E} at the origin.

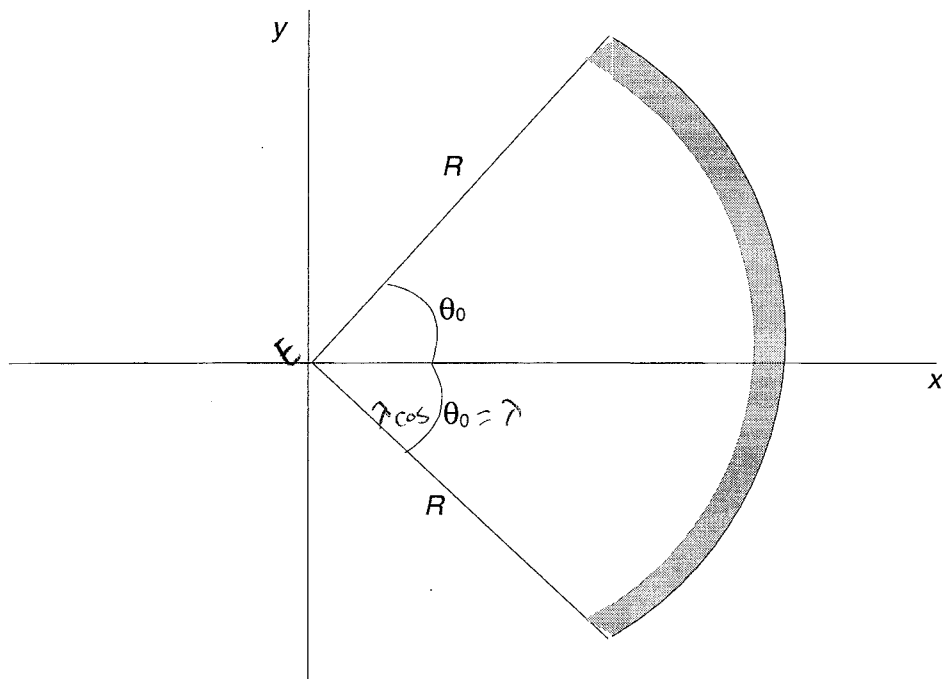


Figure for Problem 2

3. (a) Two conducting infinite half-planes meet at right angles, as shown in the figure below. A charge q is brought in from rest at infinity, to a position (at rest) a distance d from each plane. What is the work done, W_{in} , to bring about this change?
- (b) While the charge q is a distance d from each plane, the planes are magically changed from conducting to insulating (that is, the charges on them are no longer free to move). The charge q is then brought back out to infinity. What is the work done, W_{out} , to bring about this change?
- c) What is the potential energy of the system of charges on the insulating planes?

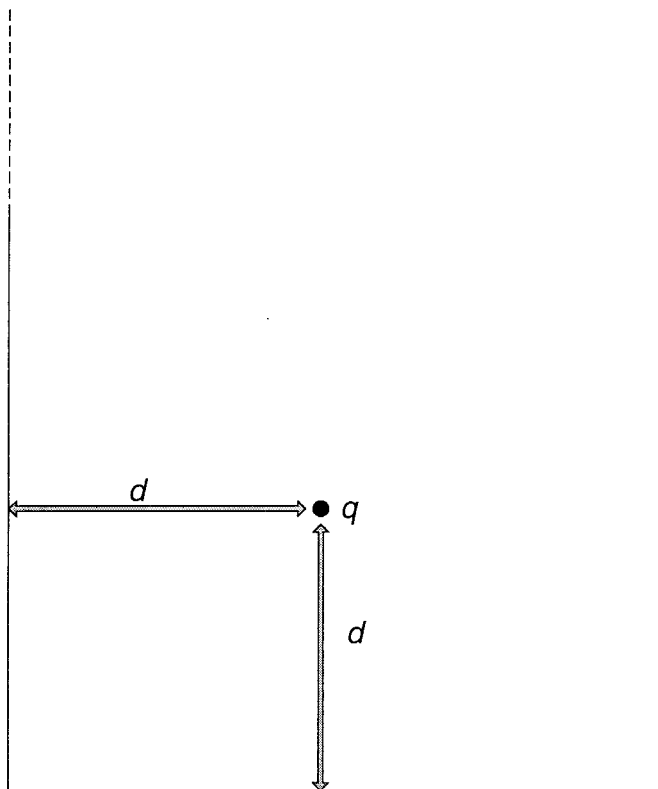


Figure for Problem 3

4. Two trapezoidal containers, connected by a tube as shown in the figure below, hold water.
- If the water in container A is heated (causing it to expand), will water flow through the tube? If so, in which direction?
 - If the water in container B is heated (causing it to expand), will water flow through the tube? If so, in which direction?

(Assume that the containers do not expand when heated.)

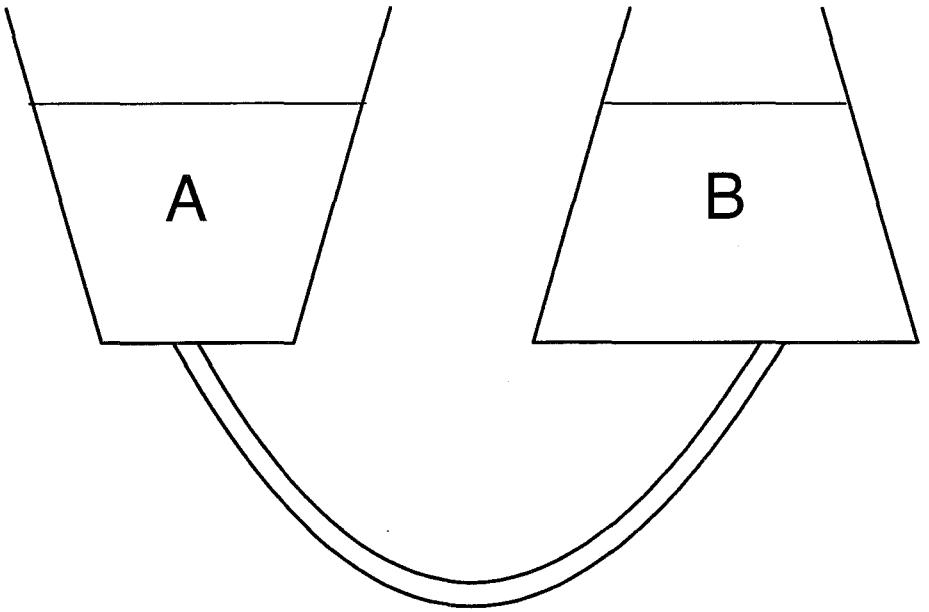


Figure for Problem 4