Polytechnic Tutoring Center
Midterm Review – PH 2023 Spring 2021

Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.

1. A container with cross sectional area 0.02 m^2 is filled with 10 L equal parts saltwater (SG = 1.035) and fresh water. Assume properties of mixing are negligible. What will be its gauge pressure at the bottom? (Atmospheric pressure is 1.013×10^5 Pa)

2. A flask has a base of radius 12 cm and narrows to a neck of radius 6 cm. It's filled to the base of the neck with water. If 5.5x10-4 m^3 of additional water is poured into the flask, by how much does the force of the water on the base increase?

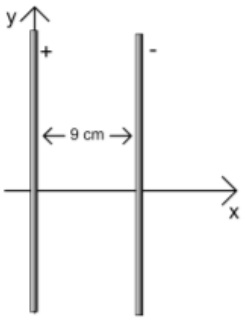
3. A U tube closed at one end holds mercury, for which the level on the open-end side is 31 cm higher than it is on the closed-end side. What is the absolute pressure in the air that is trapped in the closed end of the tube? The density of mercury is 13.6 grams/cm^3.

4. A +15 nC point charge is placed on the x axis at x = 1.5 m, and a -20 nC charge is placed on the y axis at y = -2.0m. What is the magnitude of the electric field at the origin?

5. A proton is fired at 5500 m/s directly toward an infinite plane of surface charge density 1.8 nC/m^2. Assuming it doesn't hit the plane, how far does it travel before turning around?

6. A solid, nonconducting shell (inner radius 5 cm and outer radius 10 cm) has a total charge of 5 µC. What is the electric field at a point 8 cm from the center of the sphere?

7. Two infinitely long wires carry charges 8 nC/m and -6 nC/m as shown in the figure. Where on the x-axis is the electric field zero?



8. A -3 µC charge is held stationary while a -19 µC charge (weighing 1 g) is placed 2 m away and released. As it reaches a maximum speed, it encounters an opposing electric field. What field strength is necessary to stop the particle over a distance of 3 m?

9. Points A (3 m, 6 m) and B (6 m, -3 m) are in a region where the electric field is uniform and given by E = 12 N/C in the positive x direction. What is the electric potential difference $V_A - V_B$?

10. An infinite plane has a surface charge density of 80 nC/m^2. What distance towards the plane must be traveled to experience a voltage decrease of 98 V?