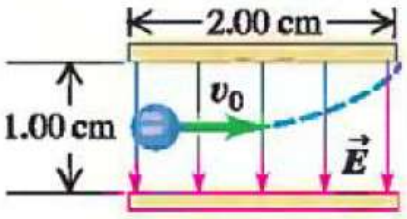
GENERAL PHYSICS II COURSE BONUS QUESTIONS.

There are four questions below. Each question is worth 5 points for a total of 20 points. Please solve your homework on plain A4 papers and bring it to the office 350 (Faculty of Science) by 13:00 on 29 April 2025 at the latest.

Prof. Dr. Hüseyin Çavuş

QUESTION 1



An electron is projected with an initial speed $v_0 = 1.60 \times 10^6$ m/s into the uniform field between the parallel plates in Fig. Assume that the field between the plates is uniform and directed vertically downward, and that the field outside the plates is zero. The electron enters the field at a point midway between the plates. (a) If the electron just misses the upper plate as it emerges from the field, find the magnitude of the electric field. (b) Suppose that in Fig. 21.38 the electron is replaced by a proton with the same initial speed v_0. Would the proton hit one of the plates? If the proton would not hit one of the plates, what would be the magnitude and direction of its vertical displacement as it exits the region between the plates? (c) Compare the paths traveled by the electron and the proton and explain the differences. (d) Discuss whether it is reasonable to ignore the effects of gravity for each particle.

QUESTION 2

Positive electric charge is distributed along the y-axis with charge per unit length λ. (a) Consider the case where charge is distributed only between the points $y = a$ and $y = -a$. For points on the $+x$-axis, graph the x-component of the electric field as a function of x for values of x between $x = a/2$ and $x = 4a$. (b) Consider instead the case where charge is distributed along the entire y-axis with the same charge per unit length λ. Using the same graph as in part (a), plot the x-component of the electric field as a function of x for values of x between $x = a/2$ and $x = 4a$. Label which graph refers to which situation.

QUESTION 3

(a) How much work would it take to push two protons very slowly from a separation of 2.00×10^{-10} m (a typical atomic distance) to 3.00×10^{-15} m (a typical nuclear distance)? (b) If the protons are both released from rest at the closer distance in part (a), how fast are they moving when they reach their original separation?

QUESTION 4

A hollow, conducting sphere with an outer radius of 0.250 m and an inner radius of 0.200 m has a uniform surface charge density of $+6.37 \times 10^{-6}$ C/m^2. A charge of $-0.500\ \mu$C is now introduced into the cavity inside the sphere. (a) What is the new charge density on the outside of the sphere? (b) Calculate the strength of the electric field just outside the sphere. (c) What is the electric flux through a spherical surface just inside the inner surface of the sphere?