What Questions Would You Ask?

Last year, students in a discussion session (calculus-based course for engineers) were given the following group practice problem to solve.

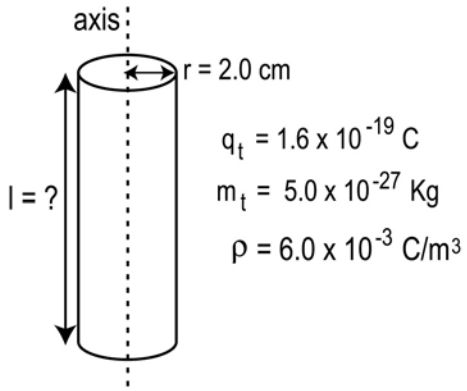
> You have a great summer job in a research laboratory with a group investigating the possibility of producing power from fusion. The device being designed confines a hot gas of positively charged ions, called plasma, in a very long cylinder with a radius of 2.0 cm. The charge density of the plasma in the cylinder is 6.0 x 10^{-5} C/m^3. Positively charged Tritium ions are to be injected into the plasma perpendicular to the axis of the cylinder in a direction toward the center of the cylinder. Your job is to determine the speed that a Tritium ion should have when it enters the plasma cylinder so that its velocity is zero when it reaches the axis of the cylinder. Tritium is an isotope of Hydrogen with one proton and two neutrons. You look up the charge of a proton and mass of the tritium in your trusty Physics text to be 1.6 x 10^{-19} C and 5.0 x 10^{-27} Kg.

The TA asked groups to:

- draw and label a diagram; and
- write and number the equations they used to solve the problem.

Three groups put the following diagrams and equations on the board.

Group #1



$q_t = 1.6 \times 10^{-19}$ C

$m_t = 5.0 \times 10^{-27}$ Kg

$\rho = 6.0 \times 10^{-3}$ C/m^3

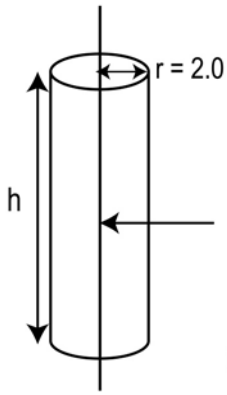
① $W = \Delta KE = \frac{1}{2} m v^2 = F r$

② $F = E q$

③ $\oiint E \cdot dA = \frac{q}{\varepsilon_o}$

④ $q = V \rho$

Group 2



tritium charge $= 1.6 \times 10^{-19}$ C

tritium mass $= 5.0 \times 10^{-27}$ Kg

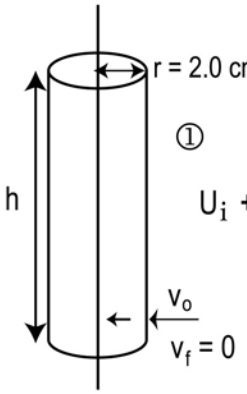
charge density $\rho = \frac{Q}{V} = 6.0 \times 10^{-3}$ C/m^3

① $A = 2\pi r h$ ② $V = \pi r^2 h$

③ $W = F r$ ⑤ $\oiint E \cdot dA = \frac{q}{\varepsilon_o}$

④ $U_f - U_i = F r$

Group 3



① $U_i + K_i = U + K_f$ $\quad U_i + \frac{1}{2}mv^2 = U_f + 0$

② $W = Fr = U_f - U_i$

③ $F = \frac{kq}{r^2}$

GROUP TASK

1. Individually, examine what each group put on the board.
2. As a group, discuss how you would lead the class discussion.
   a) What questions would you ask about the diagrams?
   b) What questions would you ask about the conservation of energy for this problem?
   c) What questions would you ask about the electricity concept needed to solve this problem?
   d) What, if anything, would you write on the board during or at the end of the discussion?

TIME: 20 minutes

PRODUCT

Answer sheet for this activity. One answer sheet will be randomly collected from each group for grading.

Activity 13 (2 points)

Manager: _____

Recorder: _____

Skeptic: _____

Summarizer: _____

Answer Sheet for Activity 13

a) What questions would you ask about the diagrams?

b) What questions would you ask about the conservation of energy for this problem?

c) What questions would you ask about the electricity concept needed to solve this problem?

d) What, if anything, would you write on the board during or at the end of the discussion?