

Homework #11 — due Monday, April 22

Numbers refer to the problems in Griffiths

From Monday, April 15:

1. 12.37
2. 12.39
3. 12.40

From Wednesday, April 17:

4. Problem F (below)
5. 12.42

From Friday, April 19:

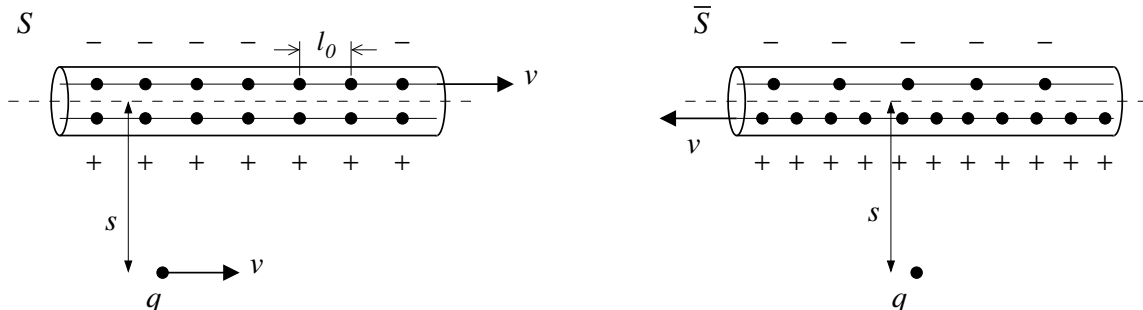
6. 12.45
7. 12.47

Problem F

Consider a variation on the neutral current presented in Section 12.3.1. As before, in frame S the positive charges and negative charges ($\pm q_0$) are equally spaced with separation ℓ_0 , so the charge densities are

$$\lambda_{\pm} = \pm\lambda_0 = \pm q_0/\ell_0$$

However, consider the case where the positive charges are stationary in S , while the negative charges are moving at speed v . Also, take the charge q to be moving with the same speed v , in the same direction as the negative charges.



(a) Determine the current in frame S , and from the current, determine the force on charge q .

(b) Now consider a frame \bar{S} in which the charge q is at rest, as well as the negative charges ($-q_0$) in the wire. Determine the new charge densities $\bar{\lambda}_+$ and $\bar{\lambda}_-$ in \bar{S} .

(c) Using your answer from (b), determine the force on the charge q .

(d) Comment on the relationship between your answers in parts (a) and (c).