

In the Name of God

Assignment number 7 of Electromagnetics 1

Spring 2020

1. Please answer the following questions from “Introduction to Electrodynamics” by D.J. Griffiths (fourth edition):

- 5.13
- 5.18
- 5.22
- 5.34
- 5.45
- 5.53

2. In chapter 5, we have seen that there exists a freedom for choosing A . Where do you think this freedom comes from? What are the other choices we have? (First write your own opinions and then go for a search. This problem is aimed to lead you to the meaning of “gauge”).

3. Please answer the following question from “Electricity and Magnetism” by E.M. Purcell and D.J. Morin (third edition - 2013):

Solenoids and superposition ***

A number of simple facts about the fields of solenoids can be found by using superposition. The idea is that two solenoids of the same diameter, and length L , if joined end to end, make a solenoid of length $2L$. Two semi-infinite solenoids butted together make an infinite solenoid, and so on. (A semi-infinite solenoid is one that has one end here and the other infinitely far away.) Here are some facts you can prove this way.

- (a) In the finite-length solenoid shown in Fig. 6.50(a), the magnetic field on the axis at the point P_2 at one end is approximately half the field at the point P_1 in the center. (Is it slightly more than half, or slightly less than half?)
- (b) In the semi-infinite solenoid shown in Fig. 6.50(b), the field line FGH , which passes through the very end of the winding, is a straight line from G out to infinity.
- (c) The flux of \mathbf{B} through the end face of the semi-infinite solenoid is just half the flux through the coil at a large distance back in the interior.
- (d) Any field line that is a distance r_0 from the axis far back in the interior of the coil exits from the end of the coil at a radius $r_1 = \sqrt{2} r_0$, assuming that $r_0 < (\text{solenoid radius})/\sqrt{2}$.

Show that these statements are true. What else can you find out?

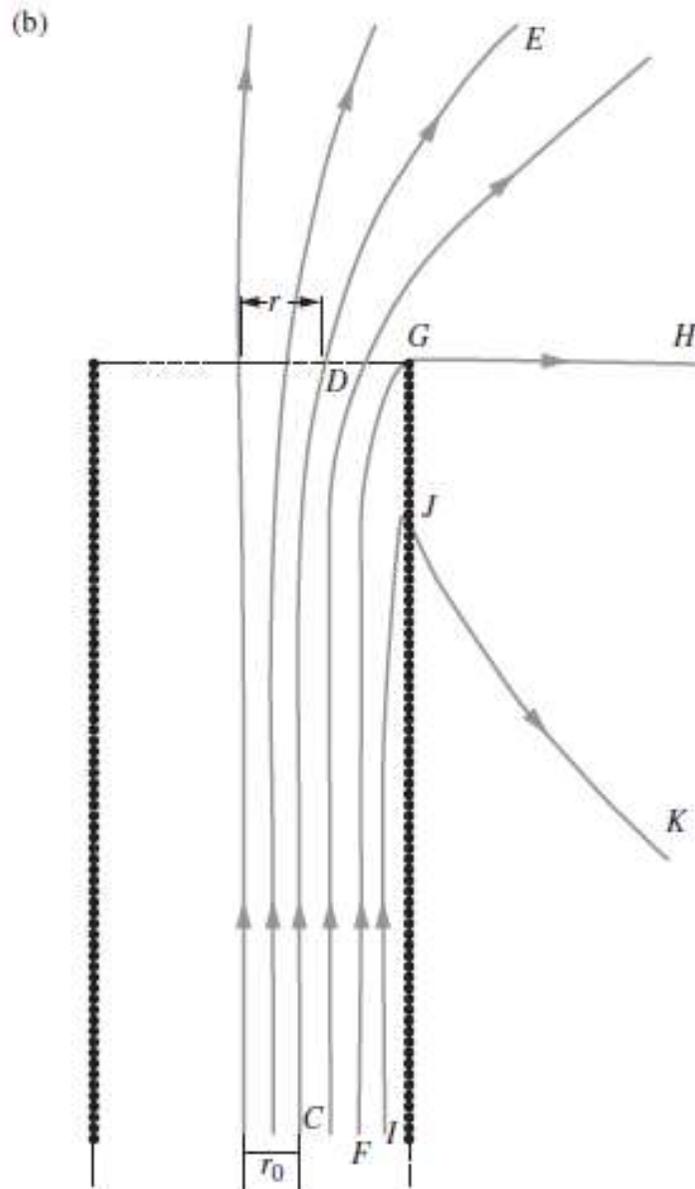
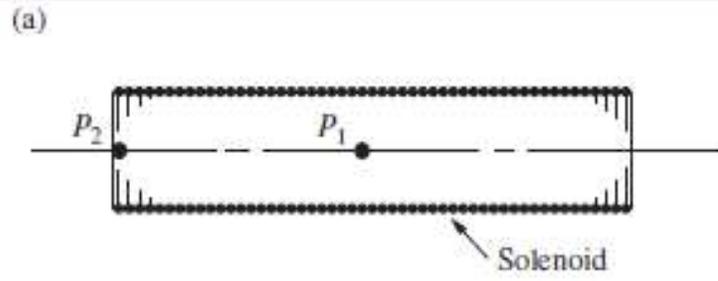


Figure 6.50.