This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Please notice that for your homework to be considered towards your grade, it needs to be submitted one hour before the corresponding recitation starts. Work submitted after this time, but before the DUE DATE on top of this page, will be accepted but not graded.

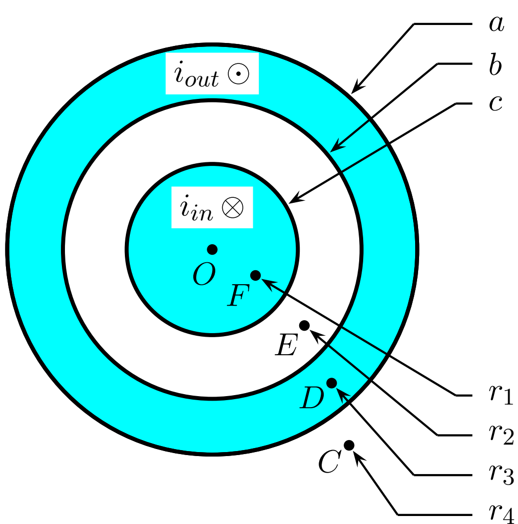
PLEASE REMEMBER THAT YOU MUST CARRY OUT YOUR CALCULATIONS TO AT LEAST THREE SIGNIFICANT FIGURES. YOUR ANSWER MUST BE WITHIN ONE PERCENT OF THE CORRECT RESULT TO BE MARKED AS CORRECT BY THE SERVER.

Cable 01

30:04, calculus, numeric, > 1 min, fixed.

001

The figure below shows a straight cylinderical coaxial cable of radii a, b, and c in which equal, uniformly distributed, but antiparallel currents i exist in the two conductors.



Which expression gives the magnitude $B(r_1)$ at F of the magnetic field in the region $r_1 < c$?

1. $B(r_1) = \dfrac{\mu_0\, i}{2\,\pi\, r_1}$

2. $B(r_1) = 0$

3. $B(r_1) = \dfrac{\mu_0\, i\, r_1}{2\,\pi\, a^2}$

4. $B(r_1) = \dfrac{\mu_0\, i\, r_1}{2\,\pi\, b^2}$

5. $B(r_1) = \dfrac{\mu_0\, i\, r_1}{2\,\pi\, c^2}$

6. $B(r_1) = \dfrac{\mu_0\, i}{\pi\, r_1}$

7. $B(r_1) = \dfrac{\mu_0\, i\,(r_1^2 - b^2)}{2\,\pi\, r_1\,(a^2 - b^2)}$

8. $B(r_1) = \dfrac{\mu_0\, i\,(a^2 - b^2)}{2\,\pi\, r_1\,(r_1^2 - b^2)}$

9. $B(r_1) = \dfrac{\mu_0\, i\,(a^2 - r_1^2)}{2\,\pi\, r_1\,(a^2 - b^2)}$

10. $B(r_1) = \dfrac{\mu_0\, i\,(a^2 + r_1^2 - 2\,b^2)}{2\,\pi\, r_1\,(a^2 - b^2)}$

002

Which expression gives the magnitude $B(r_2)$ E of the magnetic field in the region $c < r_2 < b$?

1. $B(r_2) = \dfrac{\mu_0\, i}{2\,\pi\, r_2}$

2. $B(r_2) = 0$

3. $B(r_2) = \dfrac{\mu_0\, i\, r_2}{2\,\pi\, a^2}$

4. $B(r_2) = \dfrac{\mu_0\, i\, r_2}{2\,\pi\, b^2}$

5. $B(r_2) = \dfrac{\mu_0\, i\, r_2}{2\,\pi\, c^2}$

6. $B(r_2) = \dfrac{\mu_0\, i}{\pi\, r_2}$

7. $B(r_2) = \dfrac{\mu_0\, i\,(r_2^2 - b^2)}{2\,\pi\, r_2\,(a^2 - b^2)}$

8. $B(r_2) = \dfrac{\mu_0\, i\,(a^2 - b^2)}{2\,\pi\, r_2\,(r_2^2 - b^2)}$

9. $B(r_2) = \dfrac{\mu_0\, i\,(a^2 - r_2^2)}{2\,\pi\, r_2\,(a^2 - b^2)}$

10. $B(r_2) = \dfrac{\mu_0\, i\,(a^2 + r_2^2 - 2\,b^2)}{2\,\pi\, r_2\,(a^2 - b^2)}$

003

Which expression gives the magnitude $B(r_3)$

at D of the magnetic field in the region $b < r_3 < a$?

1. $B(r_3) = \dfrac{\mu_0 \, i}{2\,\pi\, r_3}$

2. $B(r_3) = 0$

3. $B(r_3) = \dfrac{\mu_0 \, i \, r_3}{2\,\pi\, a^2}$

4. $B(r_3) = \dfrac{\mu_0 \, i \, r_3}{2\,\pi\, b^2}$

5. $B(r_3) = \dfrac{\mu_0 \, i \, r_3}{2\,\pi\, c^2}$

6. $B(r_3) = \dfrac{\mu_0 \, i}{\pi\, r_3}$

7. $B(r_3) = \dfrac{\mu_0 \, i \,(r_3^2 - b^2)}{2\,\pi\, r_3\,(a^2 - b^2)}$

8. $B(r_3) = \dfrac{\mu_0 \, i \,(a^2 - b^2)}{2\,\pi\, r_3\,(r_3^2 - b^2)}$

9. $B(r_3) = \dfrac{\mu_0 \, i \,(a^2 - r_3^2)}{2\,\pi\, r_3\,(a^2 - b^2)}$

10. $B(r_3) = \dfrac{\mu_0 \, i \,(a^2 + r_3^2 - 2\,b^2)}{2\,\pi\, r_3\,(a^2 - b^2)}$

004

Which expression gives the magnitude $B(r_4)$ at C of the magnetic field in the region $r_4 > a$?

1. $B(r_4) = \dfrac{\mu_0 \, i}{2\,\pi\, r_4}$

2. $B(r_4) = 0$

3. $B(r_4) = \dfrac{\mu_0 \, i \, r_4}{2\,\pi\, a^2}$

4. $B(r_4) = \dfrac{\mu_0 \, i \, r_4}{2\,\pi\, b^2}$

5. $B(r_4) = \dfrac{\mu_0 \, i \, r_4}{2\,\pi\, c^2}$

6. $B(r_4) = \dfrac{\mu_0 \, i}{\pi\, r_4}$

7. $B(r_4) = \dfrac{\mu_0 \, i \,(r_4^2 - b^2)}{2\,\pi\, r_4\,(a^2 - b^2)}$

8. $B(r_4) = \dfrac{\mu_0 \, i \,(a^2 - b^2)}{2\,\pi\, r_4\,(r_4^2 - b^2)}$

9. $B(r_4) = \dfrac{\mu_0 \, i \,(a^2 - r_4^2)}{2\,\pi\, r_4\,(a^2 - b^2)}$

10. $B(r_4) = \dfrac{\mu_0 \, i \,(a^2 + r_4^2 - 2\,b^2)}{2\,\pi\, r_4\,(a^2 - b^2)}$

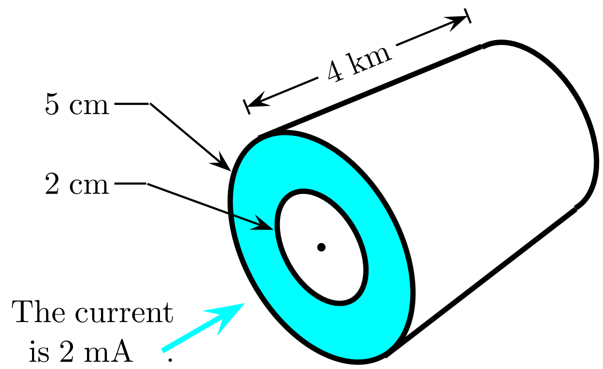
Cylindrical Shell of Current

30:04, calculus, numeric, > 1 min, normal.

005

A long cylindrical shell has a uniform current density. The total current flowing through the shell is 2 mA.

The permeability of free space is 1.25664×10^{-6} T · m/A .



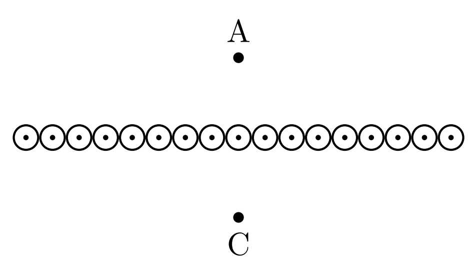
Find the magnitude of the magnetic field at a point $r_1 = 3.5$ cm from the cylindrical axis. Answer in units of nT.

Infinite Sheet of Current A01

30:04, calculus, multiple choice, > 1 min, fixed.

006

A conductor consists of an infinite number of adjacent wires, each infinitely long and carrying a current I (whose direction is out-of-the-page), thus forming a conducting plane.



If there are n wires per unit length, what is the magnitude of $\vec{B}$?

1. $B = \dfrac{\mu_0 I}{4}$

2. $B = \dfrac{\mu_0 I}{2}$

3. $B = \mu_0 n I$

4. $B = 2 \mu_0 n I$

5. $B = 4 \mu_0 n I$

6. $B = \dfrac{\mu_0 n I}{4}$

7. $B = \mu_0 I$

8. $B = 2 \mu_0 I$

9. $B = 4 \mu_0 I$

10. $B = \dfrac{\mu_0 n I}{2}$

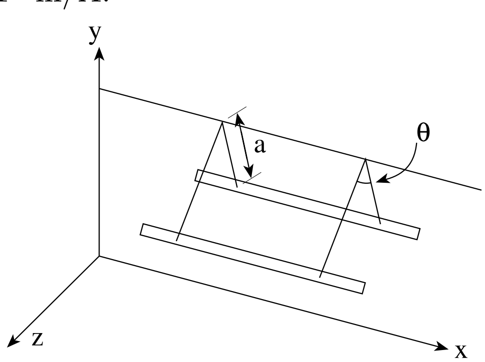
Suspended Parallel Wires

30:04, trigonometry, numeric, > 1 min, normal.

007

Two long, parallel wires, each having a mass per unit length of 40 g/m, are supported in a horizontal plane by strings 6 cm long, as in the figure. Each wire carries the same current I, causing the wires to repel each other so that the angle between the supporting strings is 16°.

The acceleration due to gravity is 9.8 m/s^2 and the permeability of free space is 1.25664×10^{-6} T · m/A.



Find the magnitude of each current. Answer in units of A.

Long Solenoid

30:05, trigonometry, numeric, > 1 min, normal.

008

What current is required in the windings of a long solenoid that has 1000 turns uniformly distributed over a length of 0.4 m in order to produce inside the solenoid a magnetic field of magnitude 0.0001 T? The permeablity of free space is 1.25664×10^{-6} T m/A. Answer in units of mA.