- PHY 482 Homework Assignment 2 due 01/22

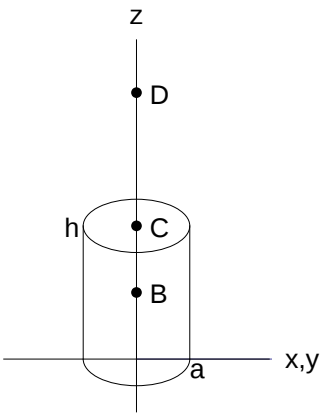
(1) Exercise 6.11

(2) A dielectric sphere (radius = a and dielectric constant = κ) is placed in a uniform electric field $E_0\hat{k}$. This modifies the field. The electric field far from the sphere is $E_0\hat{k}$.
(A) Refer to Chapter 6. What is the electric field **E(x)**? (You can just copy the result from the book.) (B) Using the result of (A) calculate the dipole moment of the sphere. Explain your calculation.

(3) *The cylindrical bar magnet.*

Consider a uniformly magnetized cylinder, with radius a and height h. The magnetization is **M(x)** = M $\hat{\mathbf{k}}$ for r $\leqslant$ a and 0 $\leqslant$ z $\leqslant$ h, where (r,z) are cylindrical coordinates.
(A) Determine the magnetic field **B(x)** for all points on the cylinder axis; i.e., **x** = (0,0,z). [Hint: First determine the surface current density $\mathbf{K_B}$. Subdivide the surface into rings of radius a; use the Biot-Savart formula to determine the on-axis field of a current carrying ring; and integrate from z = 0 to h.]
Now suppose h = 4 a. (B) Calculate B_z / (μ_0M) at (0,0,h/2). (C) Similarly, calculate B_z / (μ_0M) at (0,0,h). (D) Similarly, calculate B_z / (μ_0M) at (0,0,2h).

sfig



(4) Exercise 9.13.

(5) Exercise 9.14.

Figures

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fancy = {BaseStyle → bs}
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{FontFamily → Arial, FontSize → 14}
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{BaseStyle → {FontFamily → Arial, FontSize → 14}}
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draw = {Circle[{0, 0}, {2, 1}, {Pi, 2 Pi}], Circle[{0, 5}, {2, 1}],
  Line[{{2, 0}, {2, 5}}], Line[{{-2, 0}, {-2, 5}}],
  Disk[{0, 2.5}, 0.2], Disk[{0, 5}, 0.2], Disk[{0, 10}, 0.2]}
letter = {Text["B", {0.5, 2.5}, {-1, 0}],
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  Text["D", {0.5, 10}, {-1, 0}],
  Text["h", {-2.7, 5}, {-1, 0}],
  Text["a", {2, -0.3}, {-1, 0}]}
fig = Plot[0, {x, 0, 10}, Evaluate[fancy],
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  AxesLabel → {"x,y", "z"}, Ticks → None,
  Epilog → {draw, letter}]
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 Line[{{-2, 0}, {-2, 5}}], Disk[{0, 2.5}, 0.2], Disk[{0, 5}, 0.2], Disk[{0, 10}, 0.2]}
```

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 Text[D, {0.5, 10}, {-1, 0}], Text[h, {-2.7, 5}, {-1, 0}], Text[a, {2, -0.3}, {-1, 0}]}
```

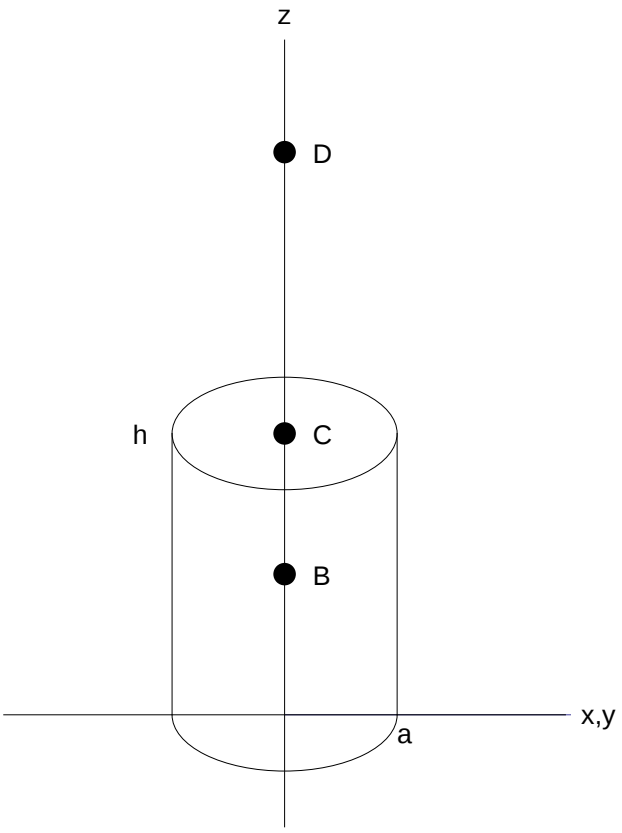

```
SetDirectory["/home/stump/AAA/PHY482/Spring2014/Homework"]
FileNames[]
fig = Import["HW1.2013.pdf"]
```

```
/home/stump/AAA/PHY482/Spring2014/Homework
```

```
{HW1.2013.pdf, HW2.2013.pdf, HW2.nb, HW2.pdf, HW3.2013.pdf, HW3.nb, HW3.pdf, HW4.2013.pdf,
 HW5.2013.pdf, HW6.2013.pdf, HW7.2013.pdf, HWKEY02.2013.pdf, HWKEY03.2013pdf}
```

sfig = Show[fig, ImageSize → Small]