

## Grading Key for Homework Asst. 2

(1) Problem 6.11 (A)  $C = 1.06 \times 10^{-8} \text{ F}$   
 (B)  $U = 1.91 \times 10^{-7} \text{ J}$  } 4 points

(2) (A)  $\vec{E}(\vec{r}) = \begin{cases} C_1(\hat{r} \cos\theta + \hat{\theta} \sin\theta) & \text{for } r < a \\ E_0(\hat{r} \cos\theta + \hat{\theta} \sin\theta) & \text{for } r > a \\ + C_2 \frac{a^3}{r^2} (2\hat{r} \cos\theta + \hat{\theta} \sin\theta) & \end{cases}$

(B)  $\vec{P} = 4\pi\epsilon_0 E_0 a^3 \frac{(K-1)}{(K+2)}$   $C_1 = \frac{3E_0}{K+2}$ ;  $C_2 = \frac{K-1}{K+2} E_0$  } 4 points

(3) Cylindrical Bar Magnet

(A)  $\vec{B}(0,0,z) = \frac{\mu_0 M}{z} \left\{ \frac{h-z}{\sqrt{a^2 + (z-h)^2}} + \frac{z}{\sqrt{a^2 + z^2}} \right\} \hat{k}$  } 8 points

(B)  $B_z/\mu_0 M = 0.894$  (C)  $B_z/\mu_0 M = 0.485$

(C)  $B_z/\mu_0 M = 0.011$

(4) Exercise 9.13 Magnetized <sup>iron</sup> torus

(A)  $H_\phi = 800 \text{ A/m}$  (B)  $B_\phi = 5.5 \text{ T}$  } 6 points

(C)  $M_\phi = 4.4 \times 10^6 \text{ A/m}$

(5) Exercise 9.14 Current carrying wire in a reservoir of water:

(A)  $M_\phi = \chi_m I / 2\pi r$   $\leftarrow (I_{\text{free}}) \rightarrow$

(B)  $\vec{J}_B = 0$  and  $\vec{K}_b = \frac{\chi_m I}{2\pi r_0} \hat{k}$  } 6 points

(C)  $I = (1 + \chi_m) I_{\text{free}}$