Respostas dos Exercícios - Lista III

Física III - FGE211

1^o Semestre de 2017

1. (a) $\vec{\nabla}\cdot\vec{F}=0 \quad , \quad \vec{\nabla}\times\vec{F}=-2\hat{k}$

   (b) $\vec{\nabla}\cdot\vec{G}=0 \quad , \quad \vec{\nabla}\times\vec{G}=\vec{0} \quad , \quad \vec{G}=\vec{\nabla}\phi \quad , \quad \phi=(2x+3z)y$

   (c) $\vec{\nabla}\cdot\vec{H}=4x \quad , \quad \vec{\nabla}\times\vec{H}=-4z\hat{j}$

2. (a) 21 kV

   (b) 2320 V

   (c)
$$\varphi(\rho,z)=\frac{\lambda}{4\pi\epsilon_0}\left[\text{arcsenh}\left(\frac{z+a}{\rho}\right)-\text{arcsenh}\left(\frac{z-a}{\rho}\right)\right] \tag{1}$$

3. (a)

   Dentro
$$E=\frac{A}{2\epsilon_0} \quad , \quad \varphi=\frac{Ar}{2\epsilon_0} \tag{2}$$

   Fora
$$E=\frac{AR^2}{2\epsilon_0 r^2} \quad , \quad \varphi=\frac{AR^2}{\epsilon_0 r} \tag{3}$$

   (b)

   Dentro
$$E=\frac{\rho_0 r}{3\epsilon_0} \quad , \quad \varphi=\frac{\rho_0 r^2}{6\epsilon_0} \tag{4}$$

   Fora
$$E=\frac{\rho_0 R^3}{3\epsilon_0 r^2} \quad , \quad \varphi=\frac{\rho_0 R^3}{6\epsilon_0 r} \tag{5}$$

4. (a)
$$U(z)=\frac{pq}{4\pi\epsilon_0 z^3} \quad , \quad p=Qd \tag{6}$$

   (b)
$$\vec{F}=\frac{qp}{4\pi\epsilon_0 z^3}\hat{k} \tag{7}$$

   (c)
$$\vec{F}=10^{-11}\text{N}\hat{k} \quad , \tag{8}$$

   a força atua no sentido positivo de $\hat{k}$, portanto, é atrativa.

5. (a)

$$\varphi = \left(\frac{r_a r_b}{r_a - r_b}\right)\frac{(\varphi_a - \varphi_b)}{r} + \left(\frac{r_a\varphi_a - r_b\varphi_b}{r_a - r_b}\right) \tag{9}$$

(b)

$$\varphi = \frac{r_b\varphi_b}{r} \tag{10}$$

5.

$$\varphi(x,y,z) = \frac{q}{4\pi\epsilon_0}\left[\frac{1}{(x^2+y^2+(z-d)^2)^{1/2}} - \frac{1}{(x^2+y^2+(z+d)^2)^{1/2}}\right] \tag{11}$$

☛ Problema desafio:
Raio da casca esférica: R,
Densidade superficial de carga: σ

(a)

$$V = \frac{\sigma R}{4\epsilon_0} \tag{12}$$

(b)

$$v_\infty = \sqrt{\frac{\sigma R q}{2m\epsilon_0}} \tag{13}$$