



4300270

Gabarito – Lista de Exercícios 3
 Energia Eletrostática,
 Potencial Elétrico

E3.1 $U = -4,35 \times 10^{-18} \text{ J} = -27,2 \text{ eV}$.

E3.2 $U = 8,98 \text{ MJ}$.

E3.3 $U = 1,5 \times 10^{-13} \text{ J} = 0,96 \text{ MeV}$.

E3.6 $U = 6,5 \text{ } \mu\text{J}$.

E3.11 (A) 35 J/C; (B) 38 J/C.

E3.12 Sejam Q e a a carga total e o raio da esfera. Usando a lei de Gauss:

$$E(r) = \begin{cases} \frac{Q}{4\pi\epsilon_0} \frac{1}{r^2}, & \text{para } r \geq a, \\ \frac{Q}{4\pi\epsilon_0} \frac{r}{a^3}, & \text{para } r < a. \end{cases}$$

Assim,

$$V(R) = - \int \mathbf{E} \cdot d\mathbf{s} = - \int_{\infty}^R E(r) dr$$

Para $R \geq a$:

$$V(R) = - \frac{Q}{4\pi\epsilon_0} \int_{\infty}^R \frac{dr}{r^2} = \frac{Q}{4\pi\epsilon_0 R}$$

Para $R < a$:

$$V(R) = - \frac{Q}{4\pi\epsilon_0} \int_{\infty}^a \frac{dr}{r^2} - \frac{Q}{4\pi\epsilon_0} \int_a^R \frac{r dr}{a^3} = \frac{Q}{4\pi\epsilon_0 a} \left(1 + \frac{a^2 - R^2}{2a^2} \right).$$

(A) $V(R=a=5,0 \text{ cm}) = \frac{Q}{4\pi\epsilon_0 a} = 540 \text{ V}$;

(B) $V(R=2,0 \text{ cm} < a) = \frac{Q}{4\pi\epsilon_0 a} \left(1 + \frac{a^2 - R^2}{2a^2} \right) = 767 \text{ V}$.

E3.14 $\mathbf{E}(z) = -2az \hat{\mathbf{z}}$, para $|z| \leq L$, e $\mathbf{E}(z) = 0$, para $|z| > L$.

P3.4 $U = \frac{q^2}{8\pi\epsilon_0} \frac{|R_2 - R_1|}{R_1 R_2}$.

P3.5 $5,9 \times 10^7 \text{ m/s}$.

P3.9 $F = \frac{Q^2}{4\pi\epsilon_0 d^2} \frac{Rr}{(R+r)^2}$.

P3.15 $U = \frac{3}{5} \frac{Q^2}{4\pi\epsilon_0 R}$