



班级: it01

姓名: 谷逸朗

编号: 2020010869 科目: 物理

第 1 页

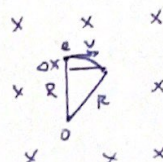
4. 已知: $U = 2 \times 10^4 \text{ V}$, $l = 0.2 \text{ m}$, $B = 0.5 \times 10^{-4} \text{ T}$

求: 偏转 Δx

解: 速度 $v = \sqrt{\frac{2eU}{m}} = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 2 \times 10^4}{9.1 \times 10^{-31}}} = 8.4 \times 10^7 \text{ m/s}$

轨道半径 $R = \frac{mv}{eB} = \frac{9.1 \times 10^{-31} \times 8.4 \times 10^7}{1.6 \times 10^{-19} \times 0.5 \times 10^{-4}} = 9.6 \text{ m}$

偏转距离 $\Delta x = R - \sqrt{R^2 - l^2} \approx \frac{l^2}{2R} = \frac{0.2^2}{2 \times 9.6} = 2 \times 10^{-3} \text{ m}$



10. 已知: E, B, B' , $l_{40} = 27.2 \text{ cm}$, $l_{30} = 32.86 \text{ cm}$, $m_{40} = 16 \mu$

求: (1) $m = \frac{8BB'l}{2E}$, (2) m_{30} .

解: 可以通过速度选择器的离子满足 $qVB = qE \Rightarrow v = \frac{E}{B}$

进入磁场半径 $R = \frac{l}{2} = \frac{mv}{qB'} \Rightarrow m = \frac{qB'l}{2v} = \frac{8BB'l}{2E}$

(2) 由(1)知 $m \propto l$, 故 $m_{30} = \frac{l_{30}}{l_{40}} \cdot m_{40} = \frac{32.86}{27.2} \times 16 \mu = 18.0 \mu$.

18. 已知: $N = 200$, $a = 150 \text{ mm} = 0.15 \text{ m}$, $B = 4 \text{ T}$, $I = 8 \text{ A}$

求: (1) 磁矩 m , (2) 力矩最大值 M_{\max}

解: (1) $m = NIS = 200 \times 8 \times (0.15)^2 = 36 \text{ A} \cdot \text{m}^2$

(2) $M_{\max} = mB = 36 \times 4 = 144 \text{ N} \cdot \text{m}$.

22. 已知: 长 l , 宽 b , 距载 a 载电流 I , 线圈电流 I_1

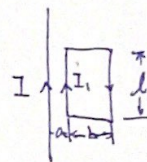
求: 磁力 F , 磁力矩 m .

解: 线圈左侧受力 $F_1 = B_1 I_1 l = \frac{\mu_0 I}{2\pi a} \cdot I_1 l$, 方向向右

线圈右侧受力 $F_2 = B_2 I_1 l = \frac{\mu_0 I}{2\pi(a+b)} I_1 l$, 方向向右.

线圈上下受力相消, 故 $F = F_1 - F_2 = \frac{\mu_0 I b \cdot I_1 l}{2\pi a(a+b)}$, 方向向左.

由于线圈各边受力共面, 故 $m = 0$.



25. 已知: $d = 5 \text{ cm} = 0.05 \text{ m}$, $I_1 = I_2 = 30 \text{ A}$, $v = 1 \times 10^{-3} \text{ m/s}$

求: 磁力 F_m , 电力 F_e

解: 导线单位长度受磁力 $F_m = \frac{\mu_0 I_1 I_2}{2\pi d} = \frac{4\pi \times 10^{-7} \times 30 \times 30}{2\pi \times 0.05} = 3.6 \times 10^{-3} \text{ N/m}$.

没有正偏子时, 受电力 $F_e = \frac{\lambda_1 \cdot \lambda_2}{2\pi \epsilon_0 d} = \frac{\mu_0 c^2}{2\pi d} \cdot \frac{I_1}{v_1} \cdot \frac{I_2}{v_2} = \frac{c^2}{v^2} \cdot F_m = \frac{(3 \times 10^8)^2}{(10^3)^2} \times 3.6 \times 10^{-3} = 3.2 \times 10^{20} \text{ N/m}$.