

1.质点运动学答案

一、选择题

C B D D B A

二、填空题

7. 8m, 10m

8. $h_1 v / (h_1 - h_2)$

9. $16Rt^2$, 4rad/s^2

10. 20m/s

11. 8m/s, 35.8m/s^2

三、计算题

12. 解: (1) 由运动方程, 得正交坐标方程为 $\frac{x^2}{3} + y^2 = 1$, 故轨迹为抛物线.

(2) 质点速度、加速度为: $\boldsymbol{v} = -\frac{\sqrt{3}}{4}\pi \sin \frac{\pi}{4}t \boldsymbol{i} + \frac{\pi}{4} \cos \frac{\pi}{4}t \boldsymbol{j}$

$$\boldsymbol{a} = -\frac{\sqrt{3}}{16}\pi^2 \cos \frac{\pi}{4}t \boldsymbol{i} - \frac{\pi^2}{16} \sin \frac{\pi}{4}t \boldsymbol{j} = -\frac{\pi^2}{16}(\sqrt{3} \cos \frac{\pi}{4}t \boldsymbol{i} + \sin \frac{\pi}{4}t \boldsymbol{j}) = -\frac{\pi^2}{16} \boldsymbol{r}.$$

(3) 速度: $v = \sqrt{v_x^2 + v_y^2} = \frac{\sqrt{2}}{4}\pi \text{ m/s}$, 方向: $\tan \theta = \frac{v_y}{v_x} = -\frac{\sqrt{3}}{3}$,

加速度: $a = \sqrt{a_x^2 + a_y^2} = \frac{\sqrt{2}}{16}\pi^2 \text{ m/s}^2$, 方向: $\tan \alpha = \frac{a_y}{a_x} = \frac{\sqrt{3}}{3}$.

13. 解: $x = 2t^2 + \frac{1}{2}t^3 + 5$

所以 $t = 10 \text{ s}$ 时 $v_{10} = 4 \times 10 + \frac{3}{2} \times 10^2 = 190(\text{m} \cdot \text{s}^{-1})$

$x_{10} = 2 \times 10^2 + \frac{1}{2} \times 10^3 + 5 = 705(\text{m})$

14. 解: $t = \sqrt{\frac{R}{c}} - \frac{b}{c}$

15. 解: $a_n = \frac{v^2}{\rho} \quad \therefore \rho = \frac{v^2}{a_n} = \frac{v_0^2}{g \cos \alpha}$

16. 解: $\bar{v}_{\text{船}} = \bar{v}_{\text{雨}} = 8 \text{ m} \cdot \text{s}^{-1}$

2.质点动力学答案:

一、选择题

C C C B B

二、填空题

6. $0 \quad 2g$

7. f_0

8. $1/\cos^2\theta$

9. 5.2 N

10. $mg/\cos\theta \quad \sin\theta\sqrt{\frac{gl}{\cos\theta}}$

三、计算题

11. 解: (1) $v = v_0 e^{-Kt/m}$

(2) $x_{\max} = mv_0 / K$

12. 解: $a = g[1 - (v/v_0)^2] = 3.53 \text{ m/s}^2$

13. 解: $v = \sqrt{6k/(mA)}$

14. 解: $l = h / \sin\theta = 2.92 \text{ m}$ 时, 最省力

15. 解: $a_t = g \sin\theta$

3.质点的动量、能量答案

一、选择题

A C C C C C

二、填空题

7. $(2m/s)\vec{i}$

8. 5 m/s

9. $\vec{i} - 5\vec{j}$

10. $18 \text{ J} \quad 6 \text{ m/s}$

11. $-Gm_1m_2(\frac{1}{a} - \frac{1}{b})$

12. -0.207

三、计算题

13. 解: $\overline{F} = 2mv \cos\alpha / \Delta t$

14. 解: $I = \sqrt{I_x^2 + I_y^2} = 0.739 \text{ N}\cdot\text{s}$

方向: $\tan\theta_1 = I_y / I_x \quad \theta_1 = 202.5^\circ$ (θ_1 为与 x 轴正向夹角)

$$15. \text{解: } W = \int dW = \int_0^l -9kc^{\frac{2}{3}}x^{\frac{4}{3}}dx = \frac{-27kc^{\frac{2}{3}}l^{\frac{7}{3}}}{7}$$

$$16. \text{解: } E_p = k/(2r^2)$$

$$17. \text{解: } \frac{1}{2}mv^2 = E_{k0} + mgx \sin \alpha - \frac{1}{2}kx^2 - \frac{(mg \sin \alpha)^2}{2k}$$

4.刚体的转动（1）答案

一、选择题

A C B C C

二、填空题

$$6. \quad 0.15 \text{ m} \cdot \text{s}^{-2} \quad 1.26 \text{ m} \cdot \text{s}^{-2}$$

$$7. \quad J_1 = 2m \left(\frac{\sqrt{2}}{2}a \right)^2 + m(\sqrt{2}a)^2 = 3ma^2, \quad J_2 = 2ma^2 + m(\sqrt{2}a)^2 = 4ma^2$$

$$8. \quad 3ML^2/4 \quad mgL/2 \quad 2g/(3L)$$

9. 铁圆板先停

$$10. \quad 24 \text{ rad/s}$$

三、计算题

$$11. \text{解: } t=40 \text{ s}$$

$$12. \text{解: } \beta = \frac{2g}{19r}$$

$$13. \text{解: } F=157\text{N}$$

$$14. \text{解: (1)} \quad t = \frac{J \ln 2}{k}$$

$$(2) \quad N = \frac{J\omega_0}{4\pi k}$$

$$15. \text{解: (1)} \quad F_{T1} = 340 \text{ N}, \quad F_{T2} = 316 \text{ N}, \quad a = R\alpha = 3 \text{ m/s}^2.$$

$$(2) \quad m_1 \text{ 到达地面的时间为 } t = \sqrt{\frac{2h}{a}} = \sqrt{\frac{2 \times 1}{3}} \text{ s} = 0.816 \text{ s}.$$

5.刚体的转动（2）答案

一、选择题

C B D B E

二、填空题

6. $3\omega_0$

7. $\omega = -\frac{mv}{6m'R}, v' = \omega R = -\frac{mv}{6m'}$

8. $\frac{6mv_0}{(3M+4m)l}$

9. $-4.19\text{N}\cdot\text{m} \quad -7896\text{J}$

10. 3, $\theta = \arccos \frac{1}{3}$

三、计算题

11.解: $\omega = \frac{mv_0(R+l)\cos\alpha}{J+m(R+l)^2}$, 其中 $J = 2mR^2 + 5m(l+R)^2 + \frac{1}{3}3ml^2$

12.解: $\omega = -\frac{2R_2}{R_1^2 + 2R_2^2}v$

13.解: (1) $\omega_b = \frac{J_0}{J_0 + J_1}\omega_a = \frac{M}{M + 2m}\omega_a$

(2) $\omega_c = \frac{J_0}{J_0 + J_2}\omega_a = \frac{MR^2}{MR^2 + 2mr^2}\omega_a$

14.解: (1) $n \approx 200 \text{ rev/min}$

(2) $\int M_A dt = J_A(\omega - \omega_A) = -4.19 \times 10^{-2} \text{ N}\cdot\text{m}\cdot\text{s}$

$\int M_B dt = J_B(\omega - 0) = 4.19 \times 10^{-2} \text{ N}\cdot\text{m}\cdot\text{s}$

15.解: $\theta = \arccos(0.388) = 67.19^\circ$.

6.力学综合与拓展练习答案

一、选择题

B E D B B C

二、填空题

7. $-\frac{g}{2} \quad \frac{2\sqrt{3}}{3g}v^2$

8. $\sqrt{\frac{K}{mr}} \quad -\frac{K}{2r}$

9. $0.01\text{kg}\cdot\text{m}^2 \quad 0.0942\text{N}\cdot\text{m}$

10. $1\text{N}\cdot\text{m}\cdot\text{s} \quad 1\text{m/s}$

$$11. \quad \omega = \frac{2mv}{(5m + 2m')R}$$

三、计算题

12.解：运动员在水中达到的深度约 4.9m，所以跳水池的水深应该为 5m 左右比较合理。

13.解：略

$$14.解：(1) \quad \omega = \sqrt{\frac{P}{k}(1 - e^{-\frac{2kt}{J}})}$$

$$(2) \quad \omega_m = \sqrt{\frac{P}{k}}$$

$$(3) \quad \theta = \frac{J}{k} \sqrt{\frac{P}{k}}$$

$$15.解：t = \frac{2m_2(v_1 + v_2)}{\mu m_1 g}$$

$$16.解：(1) \quad x_1 = \frac{2mg}{k} = \frac{2 \times 5 \times 9.8}{200} = 0.49 \text{ (m)}$$

$$(2) \quad x_0 = 0.245m, \quad v_0 = 1.31m/s$$

$$17.解：\omega_0 = \frac{\sqrt{2gh}}{2R} \cos \theta, \quad \omega = \frac{1}{2R} \sqrt{\frac{g}{2}(h + 4\sqrt{3}R)}, \quad \beta = \frac{g}{2R}$$

7.静电场(1)答案

一、选择题

B C C A D

二、填空题

6. 0

$$7. \quad \text{水平向左、} E = \frac{mgtg\theta}{q}$$

$$8. \quad x = 2a$$

$$9. \quad \lambda_1 d / (\lambda_1 + \lambda_2)$$

$$10. \quad \frac{2qy\vec{j}}{4\pi\epsilon_0(a^2 + y^2)^{3/2}} \quad \pm \frac{\sqrt{2}a}{2}$$

三、计算题

$$11.解：E = \frac{q}{4\pi\epsilon_0 L} \left(\frac{1}{d} - \frac{1}{d+L} \right)$$

$$12.解：E = E_x = Q / (2\pi^2 \epsilon_0 R^2)$$

13.解: (1) $\vec{E} = \frac{\lambda r_0}{2\pi\epsilon_0 x(r_0 - x)} \vec{i}$

(2) $\vec{F}_+ = \lambda \vec{E}_-(r_0) = \frac{\lambda^2}{2\pi\epsilon_0 r_0} \vec{i}$, $\vec{F}_- = -\lambda \vec{E}_+(r_0) = -\frac{\lambda^2}{2\pi\epsilon_0 r_0} \vec{i}$

14.解: $\vec{E} = \frac{-Q}{\pi^2 \epsilon_0 R^2} \vec{j}$

15.解: $R = \sqrt{3}a$

8.静电场(2)答案

一、选择题

D B D A D

二、填空题

6. $E\pi R^2$

7. $-Q/\epsilon_0$

8. $(q_1 + q_4)/\epsilon_0$, q_1 、 q_2 、 q_3 、 q_4 , 矢量和

9. $\sigma/(2\epsilon_0)$, 向左; $3\sigma/(2\epsilon_0)$, 向左; $\sigma/(2\epsilon_0)$, 向右.

10. $E\cos\theta$

三、计算题

11.解: $\Phi = 1 \text{ N} \cdot \text{m}^2/\text{C}$

12.解: $E_1 = Ar^2/(4\epsilon_0)$, ($r \leq R$)

$E_2 = AR^4/(4\epsilon_0 r^2)$, ($r > R$)

13.解: $|x| < d/2$ 时, $E_1 = \rho \cdot |x|/\epsilon_0$

$|x| > d/2$ 时, $E_2 = \frac{\rho \cdot d}{2\epsilon_0}$

14.解: (1) 对 $r < R_1$ 的区域: $E=0$

对 $R_1 < r < R_2$ 的区域: $E = \frac{\lambda_1}{2\pi\epsilon_0 r}$

对 $r > R_2$ 的区域: $E = \frac{\lambda_1 + \lambda_2}{2\pi\epsilon_0 r}$

(2) $E = \frac{\lambda}{2\pi\epsilon_0 r}$ $R_1 < r < R_2$
 0 $r > R_2$

$$15. (1) \sigma' = -\left(\frac{R_2}{R_1}\right)^2 \sigma$$

$$(2) \text{ 在 } r < R_1 \text{ 区域: } E = E_1 + E_2 = 0 + 0 = 0$$

$$\text{在 } R_1 < r < R_2 \text{ 区域: } E = E_1 + E_2 = \frac{4\pi R_1^2 \sigma'}{4\pi \epsilon_0 r^2} + 0 = -\frac{\sigma}{\epsilon_0} \left(\frac{R_2}{r}\right)^2$$

9. 静电场(3)答案

一、选择题

A C B D C

二、填空题

$$6. q / (6\pi \epsilon_0 R)$$

$$7. 0, \frac{\lambda}{2\epsilon_0}$$

$$8. \sigma R / 2\epsilon_0$$

$$9. \int_L \vec{E} \cdot d\vec{l} = 0, \text{ 单位正电荷在静电场中沿闭合路径绕行一周, 电场力做功为 } 0, \text{ 保守力}$$

$$10. (3\sqrt{3}qQ)/(2\pi\epsilon_0 a)$$

三、计算题

$$11. \text{解: } U = \frac{\sigma}{2\epsilon_0} (R - \sqrt{R^2 + x^2})$$

12. 解:

$$V = -\frac{\sigma}{\epsilon_0} x \quad (-a < x < a)$$

$$V = \frac{\sigma}{\epsilon_0} a \quad (x < -a)$$

$$V = -\frac{\sigma}{\epsilon_0} a \quad (x > a)$$

$$13. \text{解: } V = \frac{q}{8\pi\epsilon_0 l} \ln\left(1 + \frac{2l}{a}\right)$$

$$14. \text{解: } (1) (\lambda/2\pi\epsilon_0) \ln(r_2/r_1)$$

(2) 略

$$15. \text{解: } V = 3Q(R_2^2 - R_1^2) / [8\pi\epsilon_0(R_2^3 - R_1^3)]$$

10. 静电场(4)答案

一、选择题

BAADD

二、填空题

6. U_0

7. 不变, 减小

8. 是, 是, 垂直, 等于

9. 会, 矢量

10. 增大, 增大

三、计算题

11. 解: (1) 球电势 $U_A = \frac{q}{4\pi\epsilon_0 r} - \frac{q}{4\pi\epsilon_0 R_1} + \frac{q+Q}{4\pi\epsilon_0 R_2}$

球壳电势 $U_B = \frac{q+Q}{4\pi\epsilon_0 R_2}$

$$\therefore U_{AB} = U_A - U_B = \frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} - \frac{1}{R_1} \right)$$

$$(2) U_{AB} = \frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} - \frac{1}{R_1} \right)$$

$$(3) U_{AB} = U_A - U_B = 0$$

12. 解: (1) $q_c = -\frac{2}{3}q_A = -2 \times 10^{-7} C$, $q_B = -\frac{1}{3}q_A = -1 \times 10^{-7} C$

$$(2) U_A = E_{AC} d_{AC} = 2.3 \times 10^3 (V)$$

13. 解: $Q_B = QR_1 R_2 / (R_1 R_2 + R_2 R_3 - R_1 R_3)$

$$V_A = -Q(R_2 - R_1) / [4\pi\epsilon_0 (R_1 R_2 + R_2 R_3 - R_1 R_3)]$$

14. 解: (1) $\sigma_1 = \sigma_4 = (Q_1 + Q_2) / (2S) = 2.66 \times 10^{-8} C/m^2$ $\sigma_2 = -\sigma_3 = (Q_1 - Q_2) / (2S) = 0.89 \times 10^{-8} C/m^2$

(2) $U_{AB} = 1000 V$

15. 解: (1) 由静电感应和高斯定理可知, 球壳内表面带电 $-q$, 外表面带电 $q+Q$ 。

$$(2) U = \frac{-q}{4\pi\epsilon_0 a}$$

$$(3) U = \frac{q}{4\pi\epsilon_0 r} + \frac{-q}{4\pi\epsilon_0 a} + \frac{q+Q}{4\pi\epsilon_0 b} = \frac{q}{4\pi\epsilon_0} \left(\frac{1}{r} - \frac{1}{a} + \frac{1}{b} \right) + \frac{Q}{4\pi\epsilon_0 b}。$$

11. 静电场(5)答案

一、选择题

C A D C B

二、填空题

6. $R_1/R_2, 4\pi\epsilon_0(R_1+R_2), R_2/R_1$.

7. $2U/3$

8. $1/\epsilon_r, \epsilon_r$

9. 2:1, 1:2

10. 增大, 增大

三、计算题

11. 解: (1) $\Delta W = W - W_0 = Q^2 d / (2\epsilon_0 S)$

(2) $A = -A_e = -(W_0 - W) = W - W_0 = Q^2 d / (2\epsilon_0 S)$

12. 解: (1) $C = \frac{Q}{U} = 4\pi\epsilon_0 R$

$$(2) W = \frac{Q^2}{2C} = \frac{Q^2}{8\pi\epsilon_0 R}$$

$$(3) E = \frac{Q}{4\pi\epsilon_0 R^2} \leq Eg \quad Q_M = 4\pi\epsilon_0 R^2 Eg$$

13. 解: (1) $C = Q/U = \frac{(2\pi\epsilon_0\epsilon_r L)}{\ln(b/a)}$

$$(2) W = \frac{1}{2} C U^2 = \frac{Q^2}{4\pi\epsilon_0\epsilon_r L} \ln(b/a)$$

14. 解: (1) 在 $r < R_1$ 和 $R_2 < r < R_3$ 区域 $W_1 = \frac{Q^2}{8\pi\epsilon_0} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$

$$\text{在 } r > R_3 \text{ 区域 } W_2 = \frac{Q^2}{8\pi\epsilon_0} \frac{1}{R_3}$$

$$(2) W = W_1 = \frac{Q^2}{8\pi\epsilon_0} \left(\frac{1}{R_1} - \frac{1}{R_2} \right) = 1.01 \times 10^{-4} \text{ J}$$

$$(3) C = 4.49 \times 10^{-12} \text{ F}$$

$$15. \text{解: } W = \frac{\pi\epsilon_0\epsilon_r U_{12}^2 l}{[\ln(r_2/r_1)]^2} = 1.9 \times 10^{-2} \text{ J}$$

12. 稳恒磁场(1)答案

一、选择题:

A A B C C

二、填空题:

6. $\frac{\mu_0 I}{4\pi a}$ 向里

7. $\frac{\mu_0 I}{4R}$ 向里

8. $-\frac{\mu_0 I}{4\pi R}(\bar{j} + \bar{k}) - \frac{3\mu_0 I}{8R}\bar{i}$

9. $B = \frac{\mu_0 I}{2R} \sqrt{1 + \frac{1}{\pi^2}}$

10. $\frac{\mu_0 I \theta}{4\pi} \left(\frac{1}{R_2} - \frac{1}{R_1} \right)$ 方向垂直纸面朝里

三、计算题

11. 解: $\frac{I_1}{I_2} = \frac{2}{3}$

12. 解: $B = \frac{\mu_0 I}{8R} + \frac{\mu_0 I}{2\pi R} = \frac{\mu_0 I}{2R} \left(\frac{1}{4} + \frac{1}{\pi} \right)$ 方向 \otimes

13. 解: $B = \frac{\mu_0 \delta}{2\pi} \ln \frac{a+b}{b}$ 方向: 向里

14. 解: $B = \frac{\mu_0 \sigma \omega R}{2}$

15. 解: $B = B_x = \frac{\mu_0 I}{\pi^2 R}$ 方向: Ox 轴负向。

13. 稳恒磁场(2)答案

一、选择题:

C E B B D

二、填空题:

6. 0, $B \cdot S_{ab0d}$, $B \cdot S_{ab0d}$;

7. $\mu_0 I, 0, \mu_0 2I;$

8. 0

9. $0, -\mu_0 I$

10. $-\frac{1}{2}\pi R^2 \cdot B \quad (\oint_{S_1} \vec{B} \cdot d\vec{S} = -\oint_{S_2} \vec{B} \cdot d\vec{S})$

三、计算题

11.解: (1) 环外: $B=0$; 环内任一处磁场为: $B = \frac{\mu_0 NI}{2\pi r}$, 方向为切向

(2) $\therefore \Phi = \frac{\mu_0 NIh}{2\pi} \int_{\frac{D_2}{2}}^{\frac{D_1}{2}} \frac{dr}{r} = \frac{\mu_0 NIh}{2\pi} \ln \frac{D_1}{D_2}$

12.解: (1) $B_i = \frac{1}{2}\mu_0(i_1^2 + i_2^2 - 2i_1 i_2 \cos \theta)^{1/2}$

(2) $B_o = \frac{1}{2}\mu_0(i_1^2 + i_2^2 + 2i_1 i_2 \cos \theta)^{1/2}$

(3) $B_i = \frac{1}{2}\sqrt{2}\mu_0 i \sqrt{1 - \cos \theta} = 0$

$B_o = \frac{1}{2}\sqrt{2}\mu_0 i \sqrt{1 + \cos \theta} = \mu_0 i$

13.解: $B = \frac{\mu_0 I}{2\pi x} + \frac{\mu_0 I}{2\pi(3a - x)}$

14.解: $\frac{\Phi_{S_1}}{\Phi_{S_2}} = 1$

15.解: $B = \frac{\mu_0 I}{3\pi R}$

14.稳恒磁场(3)答案

一、选择题

D B A D C

二、填空题

6. $0.0785\text{N}\cdot\text{m}$, 向上, 0.0785J ;

7. $\frac{mv}{qB}, \frac{2\pi m}{qB}$, 顺;

8. $\sqrt{2}aIB$;

9. $F = \sqrt{2}BIR$ ，方向沿 Y 轴正向；

10. 向右运动。

三、计算题

11.解: $\frac{F_e}{F_m} = \frac{1}{\epsilon_0 \mu_0 v^2} = \frac{c^2}{v^2}$

12.解: 须加外力 $F' = 0.2N$ ，方向向左

13.解: $eE = evB \Rightarrow v = \frac{E}{B} = 3750m/s$

14.解: $F = \frac{\mu_0 I_1 I_2}{2}$ ，方向: 垂直 I_1 向右

15.解: $F = B_0 j = \frac{1}{2}(B_1 + B_2) \cdot \frac{B_2 - B_1}{\mu_0} = \frac{B_2^2 - B_1^2}{2\mu_0}$ ，根据右手螺旋可知受力方向向左

15.电磁感应(1)答案

一、选择题

DBDCD

二、填空题

6. 16.5C

7. $\mu_0 n I_0 \omega \pi a^2 \cos \omega t$

8. $\frac{1}{\pi} \times 10^2$

9. 变化磁场，闭合的

10. Oa 段电动势方向由 a 指向 O ， $-\frac{1}{2}B\omega L^2$ ， 0 ， $-\frac{1}{2}\omega Bd(2L-d)$ 。

三、计算题

11.解: (1) $\epsilon_{ab} = \int_a^b (\vec{v} \times \vec{B}) \cdot d\vec{l} = \int_a^b v \cdot \frac{\mu_0 I_0}{2\pi r} \cdot dr = -\frac{\mu_0 I_0 v}{2\pi} \ln \frac{l_1}{l_0}$ ，(a 点电势高)

(2) $\epsilon_i = -\frac{d\Phi}{dt} = -\frac{\mu_0 I_0}{2\pi} v \ln \frac{l_0 + l_1}{l_0} (\cos \omega t - \omega t \sin \omega t)$

12.解: (1) $\epsilon_{AB} = \int_A^B (\vec{v} \times \vec{B}) \cdot d\vec{l} = vBl = 8V$ ，B 点电势高。

$$\epsilon_{CD} = \int_C^D (\vec{v} \times \vec{B}) \cdot d\vec{l} = v_2 Bl = 4V，D 点电势高$$

(2) $U_{AB} = U_A - U_B = -6V$ ， $U_{CD} = U_C - U_D = -6V$

(3) $U_{O_1} - U_{O_2} = 0$

13.解: $\varepsilon_{MeN} = -\frac{\mu_0 I v}{2\pi} \ln \frac{a+b}{a-b}$ 方向 $N \rightarrow M$

$$U_M - U_N = -\varepsilon_{MN} = \frac{\mu_0 I v}{2\pi} \ln \frac{a+b}{a-b}$$

14.解: $\varepsilon = \frac{\mu_0 I b}{2\pi a} (\ln \frac{a+d}{d} - \frac{a}{a+d})v$ 方向: $ACBA$ (即顺时针)

15.解: (1) $\varepsilon_i = B \tan \theta v^2 t$ 在导体 MN 内 ε_i 方向由 M 向 N .

(2) $\varepsilon_i = K v^3 \tan \theta (\frac{1}{3} \omega t^3 \sin \omega t - t^2 \cos \omega t)$

$\varepsilon_i > 0$, 则 ε_i 方向与所设绕行正向一致, $\varepsilon_i < 0$, 则 ε_i 方向与所设绕行正向相反.

16.电磁感应(2)答案

一、选择题

D C D A C

二、填空题

6. $-L \frac{dI}{dt} = 50V$,

7. 无感应电流, 无感应电流;

8. $<$

9. $1:16$.

10. 变化磁场产生感生电场; 变化电场产生位移电流 \rightarrow 产生感生磁场;

三、计算题:

11.解: (1) $M = \frac{\Psi}{I} = N \frac{\mu_0 l}{2\pi} \ln 2$.

(2) $M = 0$

12.解: $L = \frac{\Psi}{I} = \mu_0 n^2 V$

13.解: $a_a = a_c = 4.4 \times 10^7 \text{ m/s}^2$

$a_b = 0$

14.解: $L = \frac{N\Phi}{I} = \frac{\mu_0 N^2 h}{2\pi} \ln \frac{R_1}{R_2}$

15.解: $\varepsilon = S dB / dt = (\frac{1}{2} R^2 \theta - \frac{1}{2} \overline{Oa}^2 \cdot \sin \theta) dB / dt = 3.68 \text{ mV}$ 方向: 沿 $adcb$ 绕向

17.振动(1)答案

一、选择题

C B B D D

二、填空题

6. $\pi/4$ $x = 2 \times 10^{-2} \cos(\pi t + \pi/4)$ (SI)

7. 3.43 s $-2\pi/3$

8. $\frac{4\pi}{3}$; 4.5 cm/s^2 ; $x = 0.02 \cos(\frac{3}{2}t - \frac{\pi}{2})$

9. 0.61 s

10. 2.72 s

三、计算题

11.解: (1) $F = ma = 5 \text{ (N)}$

(2) $F_m = ma_m = 10 \text{ N}$ 此时质点最大位移处即 $x = 0.2 \text{ m}$ 或 $x = -0.2 \text{ m}$

12.解: (1) $\nu = \frac{\omega}{2\pi} = 0.5 \text{ Hz}$

(2) $A = 8.8 \text{ cm}$ $\varphi = 180^\circ + 46.8^\circ = 226.8^\circ = 3.96 \text{ rad}$ (或 -2.33 rad)

13.解: $x = 0.05 \cos(7t + 0.64)$ (SI)

14.解: $x = 0.1 \cos(5\pi t/12 + 2\pi/3)$ (SI)

15.解: $\omega = \sqrt{\frac{k}{(J/R^2) + m}} = \sqrt{\frac{kR^2}{J + mR^2}}$

18.振动(2)答案

一、选择题

C D B D B

二、填空题

6. $0.08\sqrt{10} \approx 0.25 \text{ m}$; $0.08\sqrt{5} \approx 1.78 \text{ m}$; 0.2 J

7. $A/2$ -0.5π

8. 最大；为零

9. 20 cm; $\Delta\varphi = 0$

$$10. A = \sqrt{A_1^2 + A_2^2 + 2A_1A_2 \cos \Delta\varphi}$$

三、计算题

11.解：（1） $x = 0.1 \cos(7.07t)$

$$(2) F = 30 N$$

$$(3) \Delta t = 0.074 s$$

12.解：（1） $A = 0.08 m$

$$(2) x = \pm \frac{A}{\sqrt{2}} = \pm 0.0566 m$$

$$(3) v = \pm 0.8 m/s$$

13.解： $E = 2\pi^2 mA^2 / T^2$

14.解：（1） $x = 0.170 m$

(2) $v = \mp 3.26 m/s$, $E_k = 5.31 \times 10^{-4} J$,

$$E_p = \frac{1}{2} Kx^2 = 1.77 \times 10^{-4} J \quad E = E_k + E_p = 7.08 \times 10^{-4} J$$

$$15.解： x = A \cos(\omega t + \varphi) = \frac{mv}{\sqrt{k(M+m)}} \cos\left(\sqrt{\frac{k}{M+m}} t + \frac{\pi}{2}\right)$$

19.波动(1)答案

一. 选择题

C B A A D

二、填空题

6. $\frac{12}{35}\pi$

7. 0.5 m

8. $y = A \cos[2\pi(\nu t + \frac{x+L}{\lambda}) + \frac{\pi}{2}]$ $t_1 + \frac{L}{\lambda\nu} + \frac{k}{\nu}, \quad k = 0, \pm 1, \pm 2, \dots$ [只写 $t_1 + L/(\lambda\nu)$ 也可以]

9. $x=0$ 点的相位传到 x 所用时间; x 点振动的初相位 $\frac{\omega x}{u}$; 媒质质点偏离平衡位置的距离

10. 2.4 m 6.0 m/s

三、计算题

11.解: (1) $y = A \cos[2\pi(250t + \frac{x}{200}) + \frac{1}{4}\pi]$ (SI)

(2) $y_1 = A \cos(500\pi t + \frac{5}{4}\pi)$

振动速度表达式是: $v = -500\pi A \cos(500\pi t + \frac{5}{4}\pi)$ (SI)

12.解: (1) $y = 0.3 \cos(4\pi t - \pi + \pi x/5)$ (SI)

(2) $y = 0.3 \cos(4\pi t - \pi x/5)$ (SI) D 点振动方程均为: $y_D = 0.3 \cos(4\pi t - 14\pi/5)$

13.解: $y = 0.10 \cos\left[165\pi\left(t - \frac{x}{330}\right) \mp \pi\right]$

14.解: (1) $y_P = 0.02 \cos\left[\frac{\pi}{2}\left(t - \frac{25}{5}\right) - \frac{\pi}{2}\right] = 0.02 \cos(\frac{\pi}{2} - \pi)$

(2) $y = 0.02 \cos\left[\pi - \frac{\pi x}{10}\right]$

15.解: (1) $y_0 = \sqrt{2} \times 10^{-2} \cos(\frac{1}{2}\pi t + \frac{1}{3}\pi)$ (SI)

(2) $y = \sqrt{2} \times 10^{-2} \cos[2\pi(\frac{1}{4}t - \frac{1}{4}x) + \frac{1}{3}\pi]$ (SI)

(3) $t = 1$ s 时, 波形表达式:

$$y = \sqrt{2} \times 10^{-2} \cos(\frac{1}{2}\pi x - \frac{5}{6}\pi) \quad (\text{SI})$$

20.波动(2)答案

一、选择题

C C D B A

二、填空题

6. 相同; $4\pi/3$

7. $y = 12.0 \times 10^{-2} \cos(\frac{1}{2}\pi x) \cos 20\pi t$ (SI)

$x = (2n+1)$ m, 即 $x = 1$ m, 3 m, 5 m, 7 m, 9 m

$x = 2n$ m, 即 $x = 0$ m, 2 m, 4 m, 6 m, 8 m, 10 m

8. 0

9. 2

10. 动能最大, 势能最大

三、计算题

11.解: $y_{\text{反}} = 0.01 \cos[(4t - \frac{16}{3}\pi) + \frac{2\pi(x-5)}{\lambda} + \pi] = 0.01 \cos(4t + \pi x - \frac{4\pi}{3})$

12.解: (1) $y_2 = 0.05 \cos[2\pi(\frac{t}{0.05} + \frac{x}{4})]$

(2) $y = y_1 + y_2 = 2A \cos \frac{2\pi}{\lambda} \cos \omega t = 0.10A \cos(\frac{\pi x}{2}) \cos(40\pi t)$

$\pi \frac{x}{2} = \pm \frac{1}{2}\pi(2k+1) \Rightarrow x = \pm(2k+1) \quad k = 0, 1, 2, \dots$

$\Rightarrow x = 1 \text{ m}, -1 \text{ m}, 3 \text{ m}, -3 \text{ m}$

13.解: (1) 反射波的波方程 $y_2 = A \cos \omega[(t - \frac{x}{u}) + \pi]$

(2) 合成波方程 $y = y_1 + y_2 = 2A \cos(\frac{\omega x}{u} - \frac{\pi}{2}) \cos(\omega t + \frac{\pi}{2})$

14.解: $\lambda_{\text{max}} = 10 \text{ cm}$

15.解: 干涉静止点的坐标是 $x = 1, 3, 5, 7, 9, 11 \text{ m}$ 及 $x > 11 \text{ m}$ 各点

21.光的干涉(1)答案

一、选择题

D B C C C B

二、填空题

7. 0.45 mm

8. 7.32 mm

9. 0.75

10. $2\pi(n-1)e/\lambda$ 4×10^3

11. $n(r_2 - r_1)$

12. 3λ 1.33

三、计算题

13.解: (1) $\Delta x = 20 D \lambda / a = 0.11 \text{ m}$

(2) $k = (n-1)e/\lambda = 6.96 \approx 7$ 零级明纹移到原第7级明纹处

14.解: (1) $d = 10 D \lambda / \Delta x = 0.910 \text{ mm}$

(2) $l = 20 D \lambda / d = 24 \text{ mm}$

(3) 不变

15.解: $k\lambda = \frac{dl}{D} = 4 \times 10^{-3} \text{ mm} = 4000 \text{ nm}$

故当 $k=10$

$\lambda_1 = 400 \text{ nm}$

$k=9$

$\lambda_2 = 444.4 \text{ nm}$

$k=8$

$\lambda_3 = 500 \text{ nm}$

$k=7$

$\lambda_4 = 571.4 \text{ nm}$

$k=6$

$\lambda_5 = 666.7 \text{ nm}$

这五种波长的光在所给观察点最大限度地加强.

16.解: (1) $dx/D \approx k\lambda$

$x \approx Dk\lambda/d = (1200 \times 5 \times 500 \times 10^{-6} / 0.50) \text{ mm} = 6.0 \text{ mm}$

(2) $x' = D[(n-1)l + k\lambda]/d = 1200[(1.58-1) \times 0.01 \pm 5 \times 5 \times 10^{-4}] / 0.50 \text{ mm} = 19.9 \text{ mm}$

22.光的干涉(2)答案

一、选择题

C B C A B B

二、填空题

7. $5\lambda / (2n\theta)$

8. $\frac{9\lambda}{4n_2}$

9. r_1^2/r_2^2

10. 225

11. 539.1

三、计算题

12.解: $e = 7.78 \times 10^{-4} \text{ mm}$

13.解: $\Delta l = l_1 - l_2 = 9\lambda(1 - 1/n)/4\theta = 1.61 \text{ mm}$

14.解: 明纹数为 16

15.解: (1) $\lambda = 500 \text{ nm}$

(2) 在 OA 范围内可观察到的明环数目为 50 个

16. 解: $r = \sqrt{R(k\lambda - 2e_0)}$ (k 为整数, 且 $k > 2e_0 / \lambda$)

23. 光的衍射(1)答案

一、选择题

D B C C D

二、填空题

6. 4 第一 暗

7. 2π 暗

8. 30° 参考解: $a \sin \varphi = \frac{5}{2} \lambda$, $\varphi = 30^\circ$

9. 5.2×10^{-7}

10. 1.34m

三、计算题

11. 解: (1) $\Delta x_0 = 2f \tan \varphi_1 = 2f \lambda / a = 1.2 \text{ cm}$

(2) $x_2 = f \tan \varphi_2 \approx f \sin \varphi_2 = 2f \lambda / a = 1.2 \text{ cm}$

12. 解: $f \approx a \Delta x / \lambda = 400 \text{ mm}$

13. 解: (1) $a = \lambda$, $\sin \varphi = \lambda / \lambda = 1$, $\varphi = 90^\circ$

(2) $a = 10\lambda$, $\sin \varphi = \lambda / 10 \lambda = 0.1$ $\varphi = 5^\circ 44'$

(3) $a = 100\lambda$, $\sin \varphi = \lambda / 100 \lambda = 0.01$ $\varphi = 34'$

14. 解: $\varphi = \sin^{-1}(\pm k\lambda / a + \sin \theta)$ $k = 1, 2, \dots (k \neq 0)$

24. 光的衍射(2)答案

一、选择题

B B B D A

二、填空题

6. 10λ

7. 625 nm

8. 0, ± 1 , ± 3 ,

9. 1

10. 0.170 nm

三、计算题

11. 解: (1) $a + b = \frac{3\lambda_1}{\sin 30^\circ} = 3.36 \times 10^{-4} \text{ cm}$

(2) $\lambda_2 = 420 \text{ nm}$

12. 解: $\Delta x = x_1 - x_1' = f(\tan \varphi_1 - \tan \varphi_1') = f(\lambda - \lambda') / d = 1 \text{ cm}$

13. 解: 第二级光谱被重叠的波长范围是 600 nm---760 nm

14. 解: (1) $a + b = \frac{k\lambda}{\sin \varphi} = 2.4 \times 10^{-4} \text{ cm}$

(2) $a = (a + b) / 3 = 0.8 \times 10^{-4} \text{ cm}$

(3) 实际呈现 $k=0, \pm 1, \pm 2$ 级明纹

15.解: (1) $\lambda'=510.3 \text{ nm}$

(2) $\Delta\varphi = \varphi_2'' - \varphi_2' = 25^\circ$

25.光的偏振答案

一、选择题

A B C B D

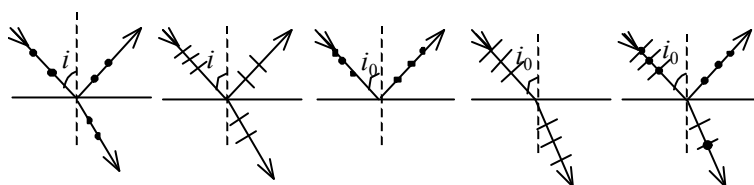
二、填空题

6. 2 1/4

7. 平行或接近平行

8. $\sqrt{3}$

9.



10. 37° 垂直于入射面

三、计算题

11.解: (1) $\theta=45^\circ$

(2) P_1 与 P_2 偏振化方向的夹角 $\theta=22.5^\circ$ P_2 转过的角度为 $(45^\circ - 22.5^\circ) = 22.5^\circ$

12.解: 在 $\alpha = A/2$ 处取得极值, 且显然是极大值

13.解: (1) 设入射光中自然光强度为 I_0 , 则总强度为 $2I_0$

穿过 P_1 后有光强比: $I_1/(2I_0) = 5/8 = 0.625$, 穿过 P_1 、 P_2 之后: $I_2/(2I_0) = 5/16 = 0.313$

(2) $I_1'/(2I_0) = 0.9I_1/(2I_0) = 0.563$, $I_2'/(2I_0) = 0.253$

14.解: $\theta = 11.8^\circ$

15.解: (1) $n = 1.56 / \tan 48.09^\circ = 1.40$

(2) $r = 0.5\pi - 48.09^\circ = 41.91^\circ$

26. 气体动理论(1)答案

一、选择题

CAADC

二、填空题

6. 气体分子的大小与气体分子之间的距离比较, 可以忽略不计.
除了分子碰撞的一瞬间外, 分子之间的相互作用力可以忽略.
分子之间以及分子与器壁之间的碰撞是完全弹性碰撞.

7. $3.2 \times 10^{17} / \text{m}^3$

8. $1.33 \times 10^5 \text{ Pa}$

9. $1.04 \text{ kg} \cdot \text{m}^{-3}$

10. $\bar{w} = \frac{3}{2} kT$ 气体的温度是分子平均平动动能的量度.

三、计算题

11. 解: $N\bar{\epsilon}_t = N \cdot \frac{3}{2} kT = \frac{N}{N_A} N_A \cdot \frac{3}{2} kT = n'RT \cdot \frac{3}{2} \frac{N_A kT}{RT} = \frac{3}{2} \times 1 \times 10^5 \times 1 = 1.5 \times 10^5 J$

12. 解: (1) $p = 2E / (iV) = 1.35 \times 10^5 \text{ Pa}$

(2) $\bar{w} = 3E / (5N) = 7.5 \times 10^{-21} \text{ J}$ $T = 2E / (5Nk) = 362 \text{ K}$

13. 解: (1) O_2 : $3 \times \frac{1}{2} kT_{O_2} \geq m_{O_2} gr \Rightarrow T_{O_2} \geq 1.6 \times 10^5 K$

H_2 : $3 \times \frac{1}{2} kT_{H_2} \geq m_{H_2} gr \Rightarrow T_{H_2} \geq 1.1 \times 10^4 K$

(2) 在同样的温度条件下, 氢分子具有较大的平均速率, 更容易逃逸出大气层

14. 解: (1) $\Delta E = \frac{i}{2} Nk\Delta T = \frac{1}{2} Mv^2 = 2.00 \times 10^3 J$

(2) $\Delta \bar{\epsilon}_k = \frac{i}{2} k\Delta T = 1.33 \times 10^{-22} J$

15. 解: $\frac{E_{H_2}}{E_{He}} = \frac{\frac{5}{2} pV}{\frac{3}{2} pV} = \frac{5}{3}$

27. 气体动理论(2)答案

一、选择题

BADCC

二、填空题

6. 氩 氦

7. 分布在 $v_p \sim \infty$ 速率区间的分子数在总分子数中占的百分率 分子平动动能的平均值.

8. 495 m/s

9. $2000 \text{ m} \cdot \text{s}^{-1}$ $500 \text{ m} \cdot \text{s}^{-1}$

10. \bar{Z} 减小而 $\bar{\lambda}$ 增大.

三、计算题

11.解: (1) 表示分子的平均速率;

(2) 表示分子速率在 $v_p \rightarrow \infty$ 区间的分子数占总分子数的百分比;

(3) 表示分子速率在 $v_p \rightarrow \infty$ 区间的分子数.

$$12.\text{解: } N_A = \frac{3RT}{m \cdot v_{rms}^2} = 6.15 \times 10^{23} \text{ mol}^{-1}$$

$$13.\text{解: } \frac{\Delta N}{N} = 8.3\%$$

$$14.\text{解: (1) } \bar{Z} = 5.42 \times 10^7 \text{ s}^{-1}$$

$$(2) \bar{\lambda} = 6 \times 10^{-5} \text{ cm}$$

$$15.\text{解: (1) } \bar{\lambda} = 6.9 \times 10^{-8} \text{ m}$$

$$(2) \bar{Z} = 6.45 \times 10^9 \text{ s}^{-1}$$

28.热力学(1)答案

一、选择题

D A B B A

二、填空题

6. 一个点 一条曲线 一条封闭曲线

7. 体积、温度和压强 分子的运动速度(或分子运动速度, 或分子的动量, 或分子的动能)

8. 166 J

9. 500 700

10. $-|W_1|$ $-|W_2|$

三、计算题

$$11.\text{解: (1) } W=0 \quad Q = \Delta E = \frac{M}{M_{mol}} C_V (T_2 - T_1) = 623 \text{ J}$$

$$(2) \quad Q = \frac{M}{M_{mol}} C_p (T_2 - T_1) = 1.04 \times 10^3 \text{ J} \quad \Delta E \text{ 与(1) 相同} \quad W = Q - \Delta E = 417 \text{ J}$$

$$(3) \quad Q=0, \Delta E \text{ 与(1) 同} \quad W = -\Delta E = -623 \text{ J}$$

12.解: (1) 略

$$(2) \quad Q = \nu C_p (T_2 - T_1) = 1.25 \times 10^4 \text{ J}$$

$$(3) \quad \Delta E = 0$$

$$(4) \text{ 据 } Q = W + \Delta E$$

$$\therefore \quad W = Q = 1.25 \times 10^4 \text{ J}$$

$$13.\text{解: (1) } \Delta E = C_V (T_2 - T_1) = \frac{5}{2} (p_2 V_2 - p_1 V_1)$$

$$(2) \quad W = \frac{1}{2} (p_2 V_2 - p_1 V_1)$$

$$(3) \quad Q = \Delta E + W = 3 (p_2 V_2 - p_1 V_1)$$

(4) 摩尔热容 $C = \Delta Q / \Delta T = 3R$

14. 解: (1) $\Delta E = 7.48 \times 10^3 \text{ J}$

(2) $W = -\Delta E = -7.48 \times 10^3 \text{ J}$

(3) $n = p_2 / (kT_2) = 1.96 \times 10^{26} \text{ 个/m}^3$

15. 解: $\gamma = \frac{C_p}{C_v} = \frac{C_v + R}{C_v} = 1.40$

29. 热力学(2)答案

一、选择题

A D D A A

二、填空题

6. AM AM 、 BM

7. 200 J

8. 40 J 140 J

9. 功变热 热传导

10. 状态几率增大 不可逆的

三、计算题

11. 解: (1) $A \rightarrow B$: $W_1 = 200 \text{ J}$.

$$\Delta E_1 = 750 \text{ J}$$

$$Q = W_1 + \Delta E_1 = 950 \text{ J}.$$

$B \rightarrow C$: $W_2 = 0$

$$\Delta E_2 = -600 \text{ J}$$

$$Q_2 = W_2 + \Delta E_2 = -600 \text{ J}$$

$C \rightarrow A$: $W_3 = -100 \text{ J}$

$$\Delta E_3 = -150 \text{ J}$$

$$Q_3 = W_3 + \Delta E_3 = -250 \text{ J}$$

(2) $W = W_1 + W_2 + W_3 = 100 \text{ J}$

$$Q = Q_1 + Q_2 + Q_3 = 100 \text{ J}$$

12. 解: $\eta = 1 - \frac{Q_2}{Q_1} = 1 - \frac{T_C}{T_B} = 25\%$

13. 解: (1) $Q_1 = RT_1 \ln(V_2 / V_1) = 5.35 \times 10^3 \text{ J}$

(2) $W = \eta Q_1 = 1.34 \times 10^3 \text{ J}$

(3) $Q_2 = Q_1 - W = 4.01 \times 10^3 \text{ J}$

14. 解: (1) $Q_{ab} = -6.23 \times 10^3 \text{ J}$ (放热)

$$Q_{bc} = 3.74 \times 10^3 \text{ J} \quad (\text{吸热})$$

$$Q_{ca} = 3.46 \times 10^3 \text{ J} \quad (\text{吸热})$$

(2) $W = (Q_{bc} + Q_{ca}) - |Q_{ab}| = 0.97 \times 10^3 \text{ J}$

(3) $Q_1 = Q_{bc} + Q_{ca}$, $\eta = W / Q_1 = 13.4\%$

15. 解: $\Delta S = \int_1^2 \frac{dQ}{T} = \frac{Q_T}{T} = \nu R \ln \frac{V_2}{V_1} = 2.00 \times 8.31 \times \ln \frac{0.04}{0.02} = 1.15 \text{ J/K}$

30.相对论(1)答案

一、选择题

DDCCB

二、填空题

7. c

8. 尾部

9. 0.866s

10. 0.976c

11. C A

三、计算题

12.解: (1) $v = -1.5 \times 10^8 \text{m/s}$

$$(2) \Delta x' = \frac{\Delta x - v\Delta t}{\sqrt{1 - \frac{v^2}{c^2}}} = 5.2 \times 10^4 \text{m}$$

13.解: $\tau = 7.5 \times 10^{-9} \text{s}$

14.解: $v = 0.816c$ S系中米尺的长度 $l = 0.707l_0$

15.解: $\Delta t' = 8.89 \times 10^{-8} \text{s}$

16.解: $v_{\max} = 0.992c$, $v_{\min} = 0.213c$

31.相对论(2)答案

一、选择题

BDACA

二、填空题

6. $>$

7. $1.673 \times 10^{-26} \text{kg}$ $1.51 \times 10^{-9} \text{J}$ $4.99 \times 10^{18} \text{kgm/s}$ $1.36 \times 10^{-9} \text{J}$

8. 2.57×10^3 3.21×10^5

9. $m_0 c^2 (n-1)$

10. 1.02MeV

三、计算题

$$11. \text{解: (1) } m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = 1.25 \text{kg}$$

$$(2) \text{甲: } E = m_0 c^2 = 9 \times 10^{16} \text{J} \quad \text{乙: } E = mc^2 = 1.125 \times 10^{17} \text{J}$$

$$12. \text{解: } \therefore \rho = \frac{m}{V} = \frac{m_0}{V_0 \left(1 - \frac{v^2}{c^2}\right)}$$

$$13. \text{解: } \Delta m = 0.284 m_0, \quad \Delta E = 0.284 m_0 c^2$$

14.解: (1) $t = 2.92 \times 10^{-8} \text{s}$

(2) $l' = 2.37 \text{m}$

32.量子物理(1)答案

一、选择题

D D C C D B

二、填空题

7. 16 $\frac{1}{2}$

8. 2.5 3.97×10^{14}

9. π 0

10. 10.2eV

三、计算题

11.解: $T_E = 289K$

12.解: $\frac{1}{2}mv^2 = 2 \text{ eV}$ $U=2V$ $\lambda_{\max} = 296\text{nm}$

13.解: $n_0 = \frac{P\lambda}{4\pi l^2 hc}$, $m = 3.33 \times 10^{-36} \text{ kg}$

14.解: (1) $\lambda = \lambda_0 + \Delta\lambda = 0.1024\text{nm}$

(2) $E_k = mc^2 - m_0c^2 = 291\text{eV}$

15.解: $\nu = 2.93 \times 10^{15} \text{ Hz}$

33.量子物理(2)答案

一、选择题

C A C A D

二、填空题

6. $\frac{h}{2eRB}$

7. 250cm

8. 粒子在 t 时刻在(x,y,z)处出现的概率密度 单值、有限、连续 $\iiint |\Psi|^2 dx dy dz = 1$

9. $\frac{1}{2}a$

10. $\left(-\frac{\hbar^2}{2\mu} \frac{\partial^2}{\partial x^2} + U \right) \Psi = i\hbar \frac{\partial \Psi}{\partial t}$

三、计算题

11.解: $E_{K\text{电子}} = \frac{1}{2}m_e v^2 = \frac{p^2}{2m_e} = 37.8\text{eV}$ $E_{K\text{光子}} = mc^2 - m_0c^2 = h\frac{c}{\lambda} = 6.22\text{keV}$

12.解: $v = 2.8 \times 10^8 \text{ m/s}$ $\lambda = 8.85 \times 10^{-13} \text{ m}$

13.解: $d = 9.68cm$

14.解: E 的可能值为: $E_1=13.6eV$, $E_2=-3.4eV$, $E_3=-1.51eV$

$$\text{相应的概率: } P_1 = \left| \frac{2}{\sqrt{10}} \right|^2 = \frac{2}{5} \quad P_2 = \left| \frac{1}{\sqrt{10}} \right|^2 + \left| \frac{\sqrt{2}}{\sqrt{10}} \right|^2 = \frac{3}{10}$$

$$\text{能量平均值: } \overline{E} = P_1 E_1 + P_2 E_2 + P_3 E_3 = -6.913eV$$

15.解: $A = \sqrt{\frac{2}{a}}$