15-1 (D)　15-2 (B)　15-3 (B)　15-4 (C)　15-5 (C)

15-8 由 $\lambda_m T = b$ 得 $\lambda_m = 2.57\times10^{-7}\ m$

15-9 $M(T) = \sigma T^4$ 得 $T = 1416.1\ K$

15-10. $M(T)\cdot 4\pi d^2 = M_{表}(T)\cdot 4\pi r^2$

且 $M_{表}(T) = \sigma T^4$ 得 $T = 5802.7\ K$

15-11 $W = h\nu$ 得 $\nu_{钠} = 1.092\times10^{15}\ Hz$. $\nu_{铂} = 6.04\times10^{14}\ Hz$

15-12 $h\nu = h\nu_0 = \frac{1}{2}m_0 v_0^2$　$\nu = \frac{c}{\lambda}$ 得 $v_0 = 5.74\times10^5\ m/s$

15-13. 能量守恒 $h\frac{c}{\lambda} = h\frac{c}{\lambda'} + (m-m_0)c^2$.　$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$

得且有 $\Delta\lambda = \lambda' - \lambda = \lambda_C(1-\cos\theta)$

得 $\lambda' = 4.35\times10^{-3}\ nm$, $\theta = 63.6°$.

15-14 $E = h\nu$ 得 $\nu = 2.41\times10^{18}\ Hz$, $\lambda_0 = \frac{c}{\nu} = 0.124\ nm$

(1) $\Delta\lambda = \lambda - \lambda_0 = \lambda_C(1-\cos\theta)$ 得 $\Delta\lambda = 1.22\times10^{-3}\ nm$

$$\Delta\nu = \frac{c}{\lambda} - \frac{c}{\lambda_0} = \frac{c}{\lambda_0+\Delta\lambda} - \frac{c}{\lambda_0} = \frac{-c\Delta\lambda}{(\lambda_0+\Delta\lambda)\lambda_0} = -2.3\times10^{16}\ Hz$$

$\Delta E = h\nu - h\nu_0 = h\Delta\nu = -95.3\ eV$

(2) 电子动能 $E_k = \Delta E = 95.3\ eV$

电子动量 $E^2 = p^2c^2 + m_0^2c^4$ 其中 $E = m_0c^2 + E_k$ 得 $p = 5.27\times10^{-24}\ kg\cdot m/s$

$p\sin\theta - \frac{h\nu}{c}\sin\varphi = 0$ 得 电子运动方向 $\varphi = 59.1°$

15-15 (1) 见 $\Delta\lambda = \lambda_C(1-\cos\theta)$　$\lambda = \lambda_0 + \Delta\lambda = 0.1024\ nm$.

(2) 反冲电子动能 $E_k = \frac{hc}{\lambda_0} - \frac{hc}{\lambda} = 4.66\times10^{-17}\ J$

$\frac{h}{\lambda}\sin90° - \frac{h}{\lambda_0}\tan\varphi = 0$ 得 $\varphi = 44.05°$

15-16 (1) $E=h\nu=h\frac{c}{\lambda}$ $p=\frac{h}{\lambda}$ $mc^2=\frac{h}{\lambda c}$

$E_1=h\nu_1=\frac{hc}{\lambda_1}=1.33\times10^{-19}J$

$p_1=\frac{h}{\lambda_1}=4.42\times10^{-28}kg\cdot m/s$

$m_1=\frac{h}{\lambda_1 c}=1.47\times10^{-36}kg$

(2) $E_2=3E_1=3.99\times10^{-19}J$ $p_2=3p_1=1.33\times10^{-27}kg\cdot m\cdot s^{-1}$. $m_2=4.41\times10^{-36}kg$

(3) $E_3=9.97\times10^{-18}J$, $p_3=3.31\times10^{-26}kg\cdot m/s$ $m_3=1.1\times10^{-34}kg$

(4) $E_4=1.33\times10^{-15}J$ $p_4=4.42\times10^{-24}kg\cdot m/s$ $m_4=1.47\times10^{-32}kg$

15-18

$E_n=\frac{E_1}{n^2}$ $E_1=-13.6eV$

从 $n_i=5$ 跃迁到 $n_f=2$ $h\frac{c}{\lambda}=E_5-E_2$ 得 $\lambda=.434nm$

从 $n_f=2$ 跃迁至游离态. $E=-E_2=3.4eV$. 提供 3.4eV.

15-19 知 $E_n-E_1\le12.6eV$ 得 $n\le3.68$ 即 n 最大取 3.

故辐射 3→1, 3→2, 2→1 谱线

15-21. $\lambda=\frac{h}{p}\approx\frac{h}{m_0v}=.199\times10^{-5}nm$.

15-22. $E^2=p^2c^2+m_0^2c^4$ $\lambda=\frac{h}{p}=1.23nm$

15-23 方均根速率 $\sqrt{\frac{3RT}{M}}$ $\lambda=\frac{h}{p}=\frac{h}{m_i\sqrt{\frac{3RT}{M}}}=2.58\times10^{-2}nm$

15-25. $p=\frac{h}{\lambda}$ $P_{电}=P_{光}=3.22\times10^{-24}kg\cdot m\cdot s^{-1}$.

光子动能 $E_{k光}=pc=6.22keV$

电子动能 $E_{k电}=\frac{p^2}{2m}=37.8eV$

15-27. $\Delta x\Delta p\ge\hbar$ $\Delta p=m\Delta v$ 得 $\Delta v=2.3\times10^{6}m\cdot s^{-1}$

15-28 即 $\Delta x = 7.2\times10^{-5}\,m$.

$\Delta x\cdot\Delta p \geq \frac{h}{2\pi}$ 得 $\Delta p = 2.93\times10^{-20}\,kg\cdot m/s$, $\Delta v = \frac{\Delta p}{m} = 1.75\times10^{7}\,m/s$

15-29 (1) $\lambda = \frac{h}{mv} = 1.66\times10^{-35}\,m$ (2) $\Delta x\cdot m\cdot\Delta v \geq \frac{h}{2\pi}$ $\Delta v = 2.64\times10^{-29}\,m/s$

15-30 (1) $\Delta x = b = 0.1\,nm$ $\Delta x\,\Delta p_y \geq \frac{h}{2\pi}$ 得 $\Delta p_y = 1.06\times10^{-24}\,kg\cdot m\cdot s^{-1}$

15-34 (1) $E_1 = \frac{h^2}{8ma^2} = 1.51\times10^{-18}\,J$

(2). $\psi(x) = \sqrt{\frac{2}{a}}\sin\frac{n\pi}{a}x$ $\psi(x) = \sqrt{\frac{2}{a}}\sin\frac{2}{a}\pi x$

$|\psi(x)|^2 = \frac{2}{a}\sin^2\frac{2}{a}\pi x$

$\frac{d|\psi(x)|^2}{dx} = 0$ 得 $\frac{4}{a^2}\pi\sin\frac{4}{a}\pi x = 0$ 得 $x=0$, $x=\frac{a}{2}$, $x=a$ 时

即 $x=0$, $x=0.1nm$, $x=0.2nm$ 时概率最小为0.

15-36. (1) $E_n = \frac{n^2h^2}{8ma^2}$ $E = E_2 - E_1 = 112\,eV$.

(2). $\psi_1(x) = \sqrt{\frac{2}{a}}\sin\frac{\pi}{a}x$ $P_1 = \int_{x_1}^{x_2}|\psi(x)|^2\,dx = 3.8\times10^{-3}$

(3) $\psi_2(x) = \sqrt{\frac{2}{a}}\sin\frac{2\pi}{a}x$ $P_2 = \int_{x_1'}^{x_2'}|\psi_2(x)|^2\,dx = 0.25$

15-37. (1) L 可能值 0, 1, 2, 3, 4

(2) $m_L = 0, \pm1, \pm2, \pm3, \pm4, \pm5$ (3) n 最小为 5

(4) n=3 时 可能有 $2n^2 = 18$ 种状态.