<10.5>

For n=1 states: $|1\,0\,0\,\frac{1}{2}>$ $|1\,0\,0-\frac{1}{2}>$ and the energy is $\frac{-me^4}{2\hbar^2}$.

For n=2 states: $|2\,0\,0\,\frac{1}{2}>$ $|2\,0\,0-\frac{1}{2}>$ $|2\,1\,1\,\frac{1}{2}>$ $|2\,1\,1-\frac{1}{2}>$

$|2\,1\,0\,\frac{1}{2}>$ $|2\,1\,0-\frac{1}{2}>$ $|2\,1-1\,\frac{1}{2}>$ $|2\,1-1-\frac{1}{2}>$ and the energy is $\frac{-me^4}{2\hbar^2\times 4}$.

<9.11>

Magnetic dipole for a circular current is given by $\vec{\mu}=\frac{I}{c}\vec{A}$,so $I=\frac{\mu c}{A}=\frac{\mu c}{\pi r^2}=3.2\times 10^{-4}\,A$

<9.19>

(a) $\Delta E=E_{\uparrow}-E_{\downarrow}=-\mu_{\uparrow}B-(-\mu_{\downarrow}B)=(\frac{-e}{m_e})\vec{S}_{\downarrow}\cdot\vec{B}-(\frac{-e}{m_e})\vec{S}_{\uparrow}\cdot\vec{B}$

$=\frac{e}{m_e}\cdot\frac{\hbar}{2}B+\frac{e}{m_e}\cdot\frac{\hbar}{2}B=\frac{e\hbar B}{m_e}=0.13\times 10^{-22}\,J$

(b) The energy of the photon should be $0.13\times 10^{-22}\,J$, and its wavelength is given by

$\lambda=\frac{hc}{E}=1.5\mathrm{cm}$. This is microwave radiation.

<10.7>

(a) 10 .

(b) 14.

(c)2(2l+1)

<10.18>

(a) $U=-Z_{eff}(r)\frac{ke^2}{r}$

$E=2\frac{ke^2}{r}=49.2\mathrm{eV}$

(b) 73.8eV

<13.6>

(a) 8

(b) 1

(c)There are 8 atoms per cube, but each is shared by 8 cubes. So, if fact there is one atom per cube.

<13.7>

(a) $\sqrt{2}\,r_0$

(b) 12

(c) Na^+

<13.15>

There are two kinds of atoms in this FCC structure: the ones at the conner and the ones at the center of each face. In one cube ,there are 8 atoms at the conner and 6 atoms at the face center. each atom at the conner is shared by 8 cubes and each atom at face center is shared by 2 cubes. So the total atom per cube is $\frac{8}{8}+\frac{6}{2}=4$.

<13.20>

(a) $\frac{\frac{4}{3}\pi(\frac{a}{2})^3}{a^3}=\frac{\pi}{6}$

(b) $4\mathrm{r}=\sqrt{2}\,a$

$$\frac{\frac{4}{3}\pi(\frac{\sqrt{2}}{4}a)^3\cdot 4}{a^3}=\frac{\pi}{6}$$

<13.25>

(a) $N=\frac{(1\,\mu\,m)^3}{(1\,cm)^3}\times 2.33\frac{g/cm^3}{28\mathrm{g}/mol}\times 6.02\times 10^{23}/mol=5\times 10^{10}$

(b) $\Delta E=\frac{1\,eV}{4\times 5\times 10^{10}}=5\,time 10^{-12}\,eV$

(c) $N=\frac{(1\mathrm{c}\,m)^3}{(1\,cm)^3}\times\frac{2.33\mathrm{g}/cm^3}{28\mathrm{g}/mol}\times 6.02\times 10^{23}/mol=5\times 10^{21}$ and

$\Delta E=\frac{1\,eV}{4\times 5\times 10^{21}}=5\,time 10^{-23}\,eV$

<13.33>

$$\Delta E=\frac{hc}{\lambda}=1.4\,eV$$

<14.7>

(a) n type

(b) p type

(c)n type

<14.11>

$$n=\frac{N}{10^6}=\frac{2.33\,g/cm^3}{28\mathrm{g}/mol}\times 6.02\times 10^{23}/mol\times 10^{-6}=5.01\times 10^{16}/cm^3$$

<15.33>

$$\Delta S=\frac{\Delta U+p\Delta V}{T}=\frac{\frac{3}{2}kt\cdot(2-1)\cdot N+0}{T}=\frac{3}{2}kN$$

<15.39>

$$<\mathrm{E}>=\frac{\int_0^{E_F}\rho(E)E\,dE}{\int_0^{E_F}rho(E)\,dE}=\frac{\int_0^{E_F}CE^{\frac{3}{2}}dE}{\int_0^{E_F}CE^{\frac{1}{2}}dE}=\frac{\frac{2}{5}E^{\frac{5}{2}}}{\frac{2}{3}E^{\frac{3}{2}}}=\frac{3}{5}E^F$$

<16.1>

${}^{1}_{1}H_0$, ${}^{3}_{2}He_1$, ${}^{7}_{3}Li_4$, ${}^{20}_{10}Ne_{10}$, ${}^{40}_{18}Ar_{22}$, ${}^{63}_{29}Cu_{34}$, ${}^{206}_{82}Pb_{124}$

<16.9>

$$\frac{V_{atom}}{V_{nuleus}}=\frac{\frac{4}{3}\pi(R_{atom})^3}{\frac{4}{3}\pi(R_{nuleus})^3}=10^{14}$$

$$\frac{\rho_{atom}}{\rho_{nucleus}}=10^{-14}$$

<16.13>

$$\lambda=\frac{hc}{\Delta E}=6.24\times10^{-14}\,m$$

$$\lambda=\frac{hc}{\Delta E}=6.3\times10^{-9}\,m$$

<16.17>

$$K_{min}\approx\frac{3\hbar^2\pi^2}{2ma^2}=11.3\text{MeV}$$

<16.32>

$$B=a_{vol}A-a_{surf}A^{\frac{3}{2}}-a_{coul}\frac{Z^2}{A^{\frac{1}{3}}}-a_{sym}\frac{(Z-N)^2}{A}+\epsilon\frac{a_{pair}}{A^{\frac{1}{2}}}=87.8\text{Mev}$$

where $\epsilon=1$ for Z=6 N=6.