

April 4, 2008

Quiz 6 - PHY244 (Modern Physics)

Print (Hugely) Last Name: _____

Solution :

Show detailed work to receive full scores.

First name: _____

Giving or receiving aid is cause for dismissal from the university.

$m_e c^2 = 511000 \text{ eV}$, $c = 3 \times 10^8 \text{ m/s}$, $hc = 1240 \text{ nm}\cdot\text{eV}$, $e = 1.6 \times 10^{-19} \text{ C}$,

${}^A_Z X_N : A = N + Z ; E_n = E_1 n^2$

♡ Give the electronic configurations of the ground states of the following atoms: ${}_9\text{F}$ and ${}_{10}\text{Ne}$. The example of ${}_4\text{Be}$ is shown for your reference. ${}_4\text{Be} : 1s^2, 2s^2$.

${}_9\text{F} : 1s^2 2s^2 2p^5$

${}_{10}\text{Ne} : 1s^2 2s^2 2p^6$

$\uparrow \text{---} E_4 = 16E_1$

♠ The ground state energy of a single electron in a one-dimensional box is 0.07 eV (relative to the zero potential at the bottom of the potential well). Now the box is occupied with seven electrons and their mutual Coulomb repulsion can be ignored. Apply Pauli exclusion principle to this assemble and calculate its total ground state energy.

$\text{---} E_3 = 9E_1$

$\uparrow\downarrow \text{---} E_2 = 4E_1$

$\uparrow\downarrow \text{---} E_1 = 1E_1$

$\text{---} E = 0$

$E(\text{total}) = [16 + 2(9 + 4 + 1)] E_1$
 $= 44E_1$
 $= 44 \times 0.07 \text{ eV}$
 $= 3.08 \text{ eV}$

◇ Find the number of neutrons in each nucleus of the following cases,

(a) an α particle.

$N = 2$

(b) deuterium, and

$N = 1$

(c) ${}_{92}^{238}\text{U}$

$N = 146$