Stuff for Monday, April 23, 2012

- PS #7 and Quiz #4 returned up front. Class average: ?.?
- PS #8 due today. 1094 on Wednesday. Quiz #5 Thursday.
- Q1–Q11 Midterm: Any 2 hours from 6:30pm to 10:00pm on Wed., May 2.
- Handouts: Midterm study guide, wave function drawing

Quantum numbers for filling atomic levels:

1. n specifies the energy level $\Longrightarrow n = 1, 2, 3, \ldots$
2. l specifies the *magnitude* of the electron's orbital angular momentum
   $\Longrightarrow l = 0, 1, \ldots n-1 = s, p, d, f, g, \ldots \quad (L = \sqrt{l(l+1)}\hbar)$
3. m specifies the z component of that angular momentum ($L_z = m\hbar$)
   $\Longrightarrow m = -l, -l+1, \ldots, l-1, l$ ($2l+1$ values)
4. m_s specifies the z component of the electron's spin ($S_z = m_s\hbar$)
   $\Longrightarrow m_s = +1/2$ or $-1/2$

- $n_r = n - l$ is the number of *radial* bumps
- selection rule for photon transitions: $\Delta l = \pm 1$

Energy eigenfunctions of the hydrogen atom

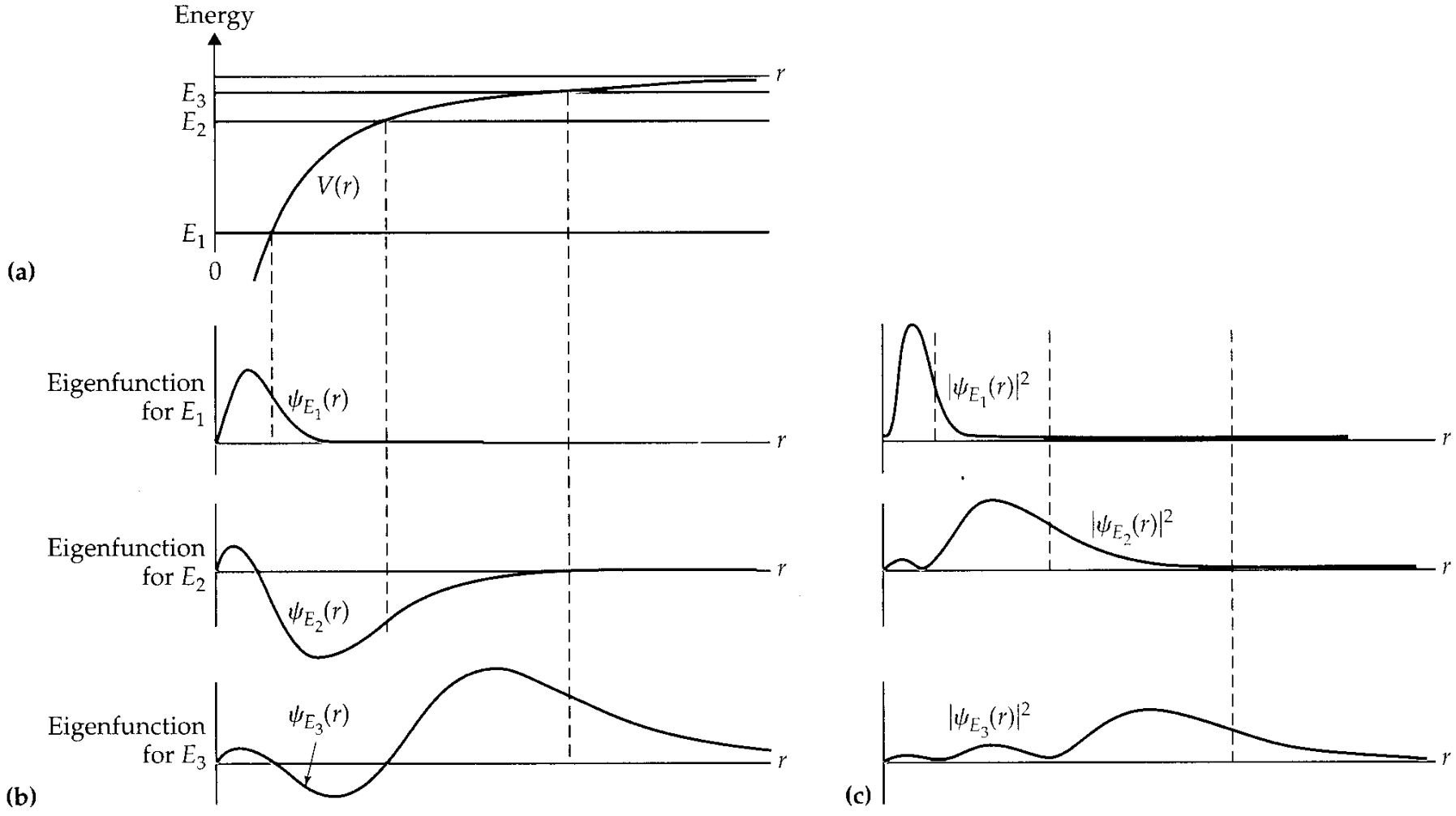
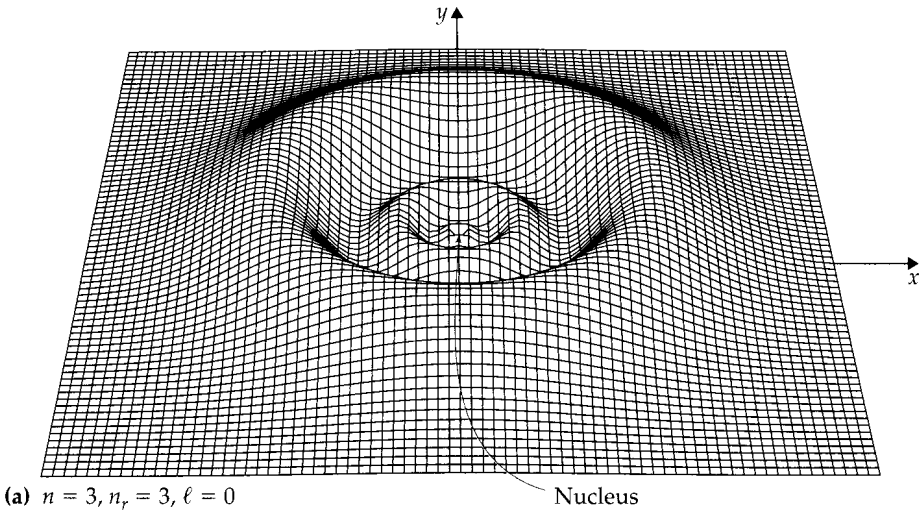


Figure Q9.1

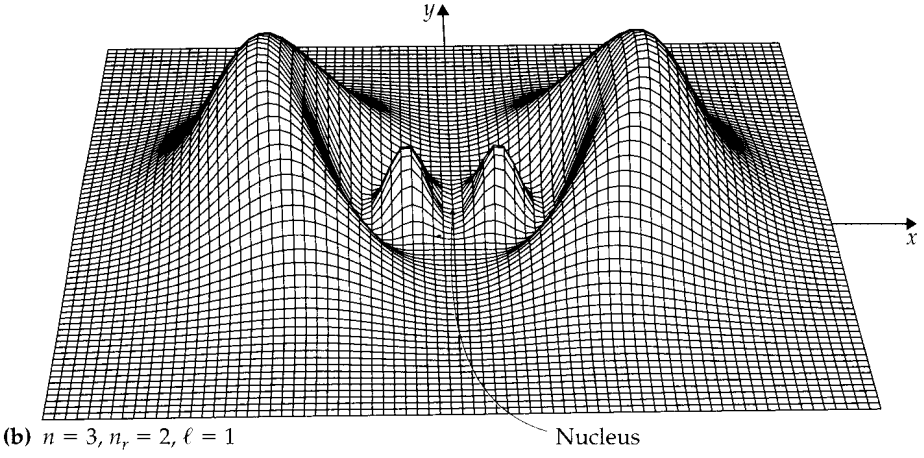
(a) A graph of the potential energy of an electron in a hydrogen atom. (b) The energy eigenfunctions for the three lowest energy states of radial motion. (c) The absolute squares of those wavefunctions.

- $l = 0$ (s-wave) radial wave functions and absolute squares

Plots of $|\mathrm{Re}\Psi(x, y, z = 0)|^2$ for hydrogen $n = 3$

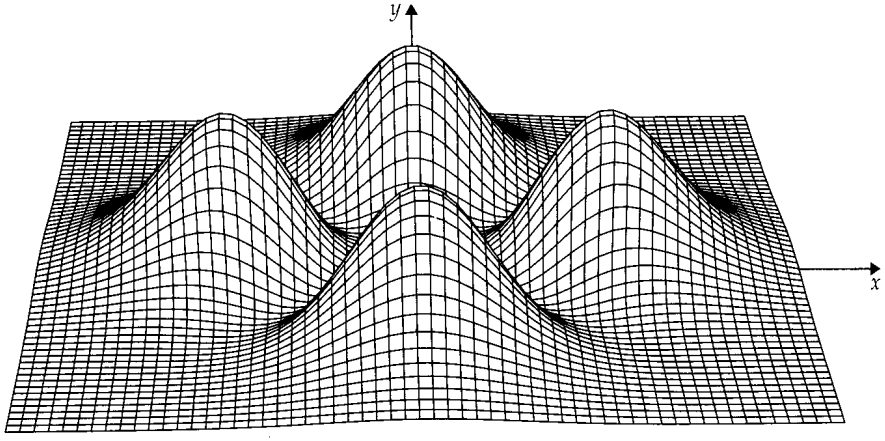


(a) $n = 3, n_r = 3, \ell = 0$



(b) $n = 3, n_r = 2, \ell = 1$

- $n = n_r + l$ with $n_r = 1, 2, \ldots$ and $l = 0, 1, \ldots$
- Here $(n_r, l) = (3, 0)$, $(2, 1)$, and $(1, 2)$



(c) $n = 3, n_r = 1, \ell = 2$

Figure Q9.2

Plots of the square of the (real part of the) electron energy eigenfunctions in hydrogen (evaluated in the *xy* plane) for $n = 3$ and various values of ℓ. Note how as ℓ increases, the number of radial bumps n_r decreases.