Quantum Chemistry (Ch. 4) Test Review

This test will include all of the topics from chapter 4 (Electronic Structure). You are allowed to use one $8\frac{1}{2}'' \times 11''$ "cheat sheet" (both sides), which must be turned in with your test.

Vocabulary

- wave
- wavelength
- frequency
- electronic spectrum
- quantum
- ground state
- excited state
- Rutherford-Bohr Model of the atom
- photon
- luminescence
- fluorescence
- phosphorescence
- energy level
- sub-level
- orbital
- electron configuration
- Pauli Exclusion Principle
- aufbau principle
- Hund's Rule
- noble gases
- valence electrons
- Lewis dot diagram

Topics

- Waves & energy:
  - wavelength, frequency
  - electronic spectrum, ROYGBIV (in order of increasing energy)
  - emission spectrum
  - fluorescence, phosphorescence, triboluminescence
- electron energy levels, sublevels & orbitals
  - principal energy level (same as row # on periodic table)
  - sublevels (s, p, d, f)
  - orbitals (s has 1, p has 3, d has 5, f has 7; divide the number of columns in the periodic table section by 2.)
  - spin on electron (first electron in orbital has positive (up) spin, second has negative (down) spin.)
- electron configurations
  - orbital notation (arrow diagrams)
  - "standard" notation ($1s^2\,2s^2\,2p^6\,3s^2\ldots$)
  - noble gas configuration
- valence electrons
  - number of valence electrons
  - Lewis Dot diagrams
  - most common charge of ion

1. In the hydrogen atom, which of the following orbitals has the lowest energy?

   (a) 5s (b) 3p (c) 3d (d) 6d (e) 4p

2. Which one of the following subshells contains only one orbital?

   (a) 5d (b) 6f (c) 4s (d) 3d

3. Write the electron configuration for the atom Rb, using the appropriate noble-gas inner core for abbreviation.

   (a) $[\mathrm{Ne}]\,5s^1$ (b) $[\mathrm{Kr}]\,5s^1$ (c) $[\mathrm{Ar}]\,5s^1$ (d) $[\mathrm{Ne}]\,4s^1$ (e) $[\mathrm{Ar}]\,4s^1$ (f) $[\mathrm{Kr}]\,4s^1$

4. Identify the element that corresponds to the following electron configuration: $[\mathrm{Ar}]\,4s^2\,3d^{10}\,4p^4$.

   (a) Se (b) S (c) Ge (d) Cr (e) Br

5. Is energy emitted or absorbed when the electronic transition from energy level n = 3 to energy level n = 6 occurs in hydrogen?

   (a) emitted (b) absorbed

6. What is the lowest-numbered principal shell in which d orbitals are found?

   (a) 1 (b) 2 (c) 3 (d) 4 (e) 5

7. Of the following regions of the electromagnetic spectrum, which one has the highest energy?

   (a) X-rays (c) microwaves (e) ultraviolet radiation
   (b) radio waves (d) gamma rays (f) infrared radiation

8. An atom in the ground state

   (a) has all electrons in the n = 1 orbital.
   (b) is finely divided.
   (c) will not absorb electromagnetic radiation of any wavelength.
   (d) has all electrons in the lowest-energy orbits possible.

9. What is the maximum number of electrons that can occupy a 3d subshell?

   (a) 1 (b) 2 (c) 3 (d) 5 (e) 6 (f) 10

10. How many orbitals are there in a 4p subshell?

    (a) 1 (b) 2 (c) 3 (d) 4 (e) 5

11. How many sublevels are there in an energy level with n = 3?

    (a) 1 (b) 2 (c) 3 (d) 4 (e) 5