Project Advance Chemistry 106 Study Questions
on Material in *General Chemistry*, Brown, LeMay, and Bursten

Chapter 6. Electronic Structure of Atoms.
Fall Semester 1996

1. What is the wavelength of light that has a frequency of 1.20×10^{13} Hz?

   (a) 2.50×10^{-5} μm

   (b) 12.0 μm

   (c) 0.0400 μm

   (d) 25.0 μm

   (e) none of the above.

2. Electromagnetic radiation of which of the following wavelengths is of the lowest energy?

   (a) 623 nm

   (b) 532 nm

   (c) 526 nm

   (d) 493 nm

   (e) 277 nm

3. What is the energy (in J) of a photon of electromagnetic radiation that has a wavelength of 9.0 meters? ($c = 3.00 \times 10^{8}$ m/s, $h = 6.63 \times 10^{-34}$ J·s.)

   (a) 2.2×10^{-26}

   (b) 6.0×10^{-23}

   (c) 4.5×10^{25}

   (d) 2.7×10^{9}

   (e) none of the above.

4. In the Bohr model of the atom

   (a) electron paths are designated by the Rydberg constant R_H

   (b) electron path energies are quantized

   (c) electrons can travel in paths of any energy

   (d) electrons travel in circular paths called orbitals

   (e) electrons are contained in the nucleus.

5. Which of the following transitions in the Bohr hydrogen atom model affords emission of the highest-energy photon?

   (a) $n_i = 6 \rightarrow n_f = 1$
   (b) $n_i = 4 \rightarrow n_f = 1$
   (c) $n_i = 3 \rightarrow n_f = 6$
   (d) $n_i = 1 \rightarrow n_f = 6$
   (e) $n_i = 6 \rightarrow n_f = 3$

6. Which one of the following electron transitions would result in the loss of energy from a hydrogen atom?

   (a) n=7 to n=5
   (b) n=1 to n=2
   (c) n=7 to n=9
   (d) n=5 to n=6
   (e) none of the above would result in the loss of energy.

7. What is the maximum number of different spectral lines that could be produced by electrons going from n=3 to the ground state by all possible paths in hydrogen atoms?

   (a) 2
   (b) 4
   (c) 3
   (d) 1
   (a) 1½

8. Calculate the energy change (in J) that would accompany an electronic transition in a hydrogen atom from n=2 to n=3. ($R_H = 2.18 \times 10^{-18}$ J.)

   (a) 3.0×10^{-19}
   (b) -3.0×10^{-19}
   (c) -7.9×10^{-19}
   (d) 4.0×10^{-19}
   (e) none of the above.

9. The existence of discrete (quantized) energy levels in an atom may be inferred from

   (a) experiments on the photoelectric effect.
   (b) diffraction of electrons by crystals.
   (c) X-ray diffraction by crystals.
   (d) atomic line spectra.
   (e) none of these.

10. The de Broglie wavelength of an electron is 8.7×10^{-11} m. The mass of this electron is 9.1×10^{-31} kg. What is the velocity (in m/s) of this electron? ($h = 6.63 \times 10^{-31}$ J·s.)

    (a) 8.4×10^{3}
    (b) 8.4×10^{6}
    (c) 1.2×10^{-7}
    (d) 6.9×10^{-54}
    (e) none of the above.

11. Determine the wavelength (in m) of a 7.5 g bullet traveling at 700 m/s.

    (a) 1.3×10^{-34}
    (b) 6.2×10^{-29}
    (c) 1.3×10^{-27}
    (d) 7.7×10^{33}
    (e) none of the above.

12. The values of the principal quantum number and the azimuthal quantum number of the electrons in a 3*d* subshell are

    (a) 3,3
    (b) 3,2
    (c) 2,3
    (d) 2,2
    (e) 2,1

13. What is the value of the *n* quantum number for the outermost electrons in a Br atom in the ground state?

    (a) 5
    (b) 2
    (c) 3
    (d) 4
    (e) 6

14. The probability of finding an electron at a node in a hydrogen-atom 2*s* orbital is

    (a) 0.00
    (b) 1.00
    (c) 0.50
    (d) 0.25
    (e) 0.75

15. What is the maximum number of electrons in an atom that can have the following quantum numbers: $n=1$, $m_s = +½$?

    (a) 8

    (b) 4

    (c) 2

    (d) 1

    (e) 3

16. Which one of the following elements has one or more unpaired electrons in the ground state?

    (a) mercury

    (b) cadmium

    (c) calcium

    (d) zirconium

    (e) neon

17. Which one of the following has the orbitals listed in order of increasing energy?

    (a) $1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p$

    (b) $1s < 2s < 3s < 4s < 2p < 3p < 4p < 3d$

    (c) $1s < 2s < 2p < 3s < 3p < 4s < 4p < 3d$

    (d) $1s < 2s < 2p < 3s < 3p < 3d < 4s < 4p$

    (e) $1s < 2s < 2p < 3s < 3p < 4p < 4s < 3d$

18. How many electrons populate the (complete) $3p$ electron subshell in the ground state of atomic xenon?

    (a) 10

    (b) 36

    (c) 6

    (d) 2

    (e) 8

19. Which orbital diagram represents a violation of the Pauli Exclusion Principle?

(a) 

(b) 

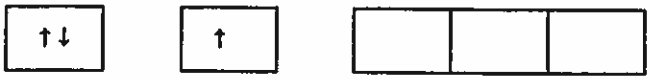
(c) 

(d) 

(e) none of the above.

20. Which orbital diagram represents an atom in its ground state?

I. 

II. 

III. 

IV. 

(a) both I and III
(b) both II and III
(c) both I and II
(d) both II and IV
(e) all configurations represent an atom in its ground state.

21. The possible values of the orbital quantum number of a 3*p* electron are

(a) 0, 1, 2

(b) 1, 2, 3

(c) +½, -½

(d) -1, 0, +1

(e) none of these.

22. The correct electron configuration for Be^- is

(a) [Br] $3d^{10}4s^24p^6$
(b) [Ar] $3d^{10}4s^24p^5$
(c) [Br] $4s^23d^{10}4p^5$
(d) [Ar] $3d^{10}4s^24p^6$
(e) none of these.

23. Which of the following subshells is correctly designated?

(a) $1p^5$
(b) $3s^3$
(c) $3f^2$
(d) $4d^{11}$
(e) none of these.

24. The existence of discrete (quantized) energy levels in an atom may be inferred from

(a) experiments on the photoelectric effect.
(b) diffraction of electrons by crystals.
(c) X-ray diffraction by crystals.
(d) atomic line spectra.
(e) none of these.

25. The ground state electron configuration of Sc is:

(a) $1s^22s^22p^63s^23p^63d^3$
(b) $1s^22s^22p^63s^23p^64s^23d^1$
(c) $1s^22s^22p^62d^{10}3s^1$
(d) $1s^21p^62s^22p^63d^5$
(e) none of these.