Chapter 6

1. A radio station broadcasts on a frequency of 99.5 kilocycles/s. What is the wavelength of this radiation in km?
   A. $7.25 \times 10^3$ km
   B. $2.99 \times 10^7$ km
   C. $2.99 \times 10^4$ km
   D. 3.02 km
   E. none of these

2. When light of wavelength 420 nm is focused on a metal surface, electrons are ejected with a speed of $7.00 \times 10^5$ m/sec. The binding energy of a mole of electrons to the metal is
   A. $8.22 \times 10^4$ J/mole
   B. $1.50 \times 10^5$ J/mole
   C. $2.72 \times 10^2$ J/mole
   D. $5.63 \times 10^1$ J/mole
   E. None of the above is correct to within 5%

3. What is the energy possessed by one mole of x–ray photons if the wavelength of the x–ray is $1.00 \times 10^{-9}$ m?
   A. $1.3 \times 10^{-27}$ J
   B. $2.0 \times 10^{-16}$ J
   C. $1.2 \times 10^{-10}$ J
   D. $1.2 \times 10^{6}$ J
   E. $3.3 \times 10^{10}$ J

4. Green light of wavelength 516 nm is absorbed by an atomic gas. What is the energy difference between the two quantum states involved in the transition?
   A. $5.81 \times 10^{14}$ J
   B. $3.85 \times 10^{-19}$ J
   C. $1.28 \times 10^{-27}$ J
   D. $4.29 \times 10^{-38}$ J
   E. $1.43 \times 10^{-44}$ J

5. Which photon has an energy that is greater than the energy of a blue photon?
   A. microwave photon
   B. radio photon
   C. green photon
   D. infrared photon
   E. ultraviolet photon
6. If the Bohr model is used, what frequency of light would be required for ionization of hydrogen?

A. 6.17 \times 10^{14} \text{ Hz}
B. 1.31 \times 10^{3} \text{ Hz}
C. 3.29 \times 10^{15} \text{ Hz}
D. 4.31 \times 10^{10} \text{ Hz}
E. None of the above is within 5\% of the correct answer

7. Which of the following statements are true for the Bohr model of the hydrogen atom?

1. The radius of the orbit increases as the principal quantum number increases.
2. The energy required to ionize the atom increases as the principal quantum decreases.
3. Light emitted by the excited hydrogen atom corresponds to transitions from orbits of higher principal quantum number to lower principal quantum number.

A. 1 only
B. 1 and 2 only
C. 2 and 3 only
D. 1 and 3 only
E. 1, 2, and 3

8. Which of the following electron transitions in a hydrogen atom results in the greatest release of energy from the atom?

A. n = 3 to n = 4
B. n = 1 to n = 3
C. n = 6 to n = 4
D. n = 7 to n = 5
E. n = 2 to n = 5

9. At what velocity must a neutron, which weighs 1.67 \times 10^{-24} \text{ g}, be moving in order for it to exhibit a wavelength of 400 pm?

A. 9.92 \times 10^{2} \text{ m/s}
B. 9.92 \times 10^{-1} \text{ m/s}
C. 9.92 \times 10^{1} \text{ m/s}
D. 9.92 \times 10^{4} \text{ m/s}
E. 9.92 \times 10^{3} \text{ m/s}
10. For electron distributions, which of the following statements are true?

1. \( d \) orbitals have a spherical shape.
2. \( p \) orbitals have a high electron density at the nucleus.
3. \( s \) orbitals have no electron density at the nucleus.

A. 1 and 2
B. 2 only
C. 2 and 3
D. 3 only
E. None of the statements is true

11. Which series of quantum numbers describes the orbital in which the highest energy electron in potassium resides in the ground state?

<table>
<thead>
<tr>
<th>( n )</th>
<th>( \ell )</th>
<th>( m_{\ell} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>B. 3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C. 4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>D. 4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>E. None of these</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. An atom of phosphorus \(^{35}\)P has how many electrons with quantum number \( \ell = 1 \)?

A. 3
B. 9
C. 15
D. 5
E. None of the above

13. Which of the following could not be an orbital diagram for an atom in its ground state?

<table>
<thead>
<tr>
<th>1s</th>
<th>2s</th>
<th>2p</th>
<th>3s</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. (( \uparrow ) ( \uparrow )</td>
<td>(( \uparrow ) (( \uparrow ) (( \uparrow )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. (( \uparrow ) (( \uparrow ) (( \uparrow ) (( \uparrow ) (( \uparrow )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. (( \uparrow ) (( \uparrow ) (( \uparrow ) (( \uparrow )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. (( \uparrow ) (( \uparrow ) (( \uparrow ) (( \uparrow )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. (( \uparrow ) (( \uparrow ) (( \uparrow ) (( \uparrow )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14. Which of the following ground state electron configurations can be ruled out by the Pauli Exclusion Principle?

1. 1s$^3$ 2s$^2$ 2p$^5$
2. 1s$^2$ 2s$^2$ 2p$^7$ 3s$^2$
3. 1s$^2$ 2s$^2$ 2p$^6$ 3s$^2$ 3p$^6$ 4s$^2$ 3d$^{12}$
4. 1s$^2$ 2s$^2$ 2p$^6$ 3s$^2$ 3p$^6$

A. 1 only
B. 1 and 3 only
C. 1, 2, and 3 only
D. 1, 2, 3, and 4 only
E. 1 and 4 only

15. In the ground state electronic configuration of Cr, how many total shells, subshells and orbitals contain at least one electron, and how many unpaired electrons are present?

<table>
<thead>
<tr>
<th>Shells</th>
<th>Subshells</th>
<th>Orbitals</th>
<th>Unpaired Electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>4</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>B.</td>
<td>4</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>C.</td>
<td>4</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>D.</td>
<td>4</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>E.</td>
<td>4</td>
<td>7</td>
<td>14</td>
</tr>
</tbody>
</table>