This exam is composed of 25 questions. Go initially through the exam and answer the questions you can answer quickly. Then go back and try the ones that are more challenging to you and/or that require calculations.

As discussed on the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

1. Which radiation below has the longest wavelength (don’t use your calculator!)?
   1) blue light (6.8x10^{14} Hz)  
   2) green light (6.0x10^{14} Hz)  
   3) red light (4.5x10^{14} Hz)  
   4) gamma rays (2.4x10^{20} Hz)  
   5) x-rays (5.0x10^{18} Hz)

2. A local AM radio station broadcasts at an energy of 5.55x10^{-31}. Does this number likely represent:
   1) kJ/photon  
   2) kJ/mole  
   3) kJ/atom  
   4) kJ/song played

3. Calculate the frequency at which the above radio station is broadcasting.
   1) 1.39 MHz  
   2) 838 KHz  
   3) 1.39 KHz  
   4) 838 Mhz  
   5) Cant’ tell
4. Consider the diagram at right. The transition labeled A is best described as:
   1) emission  2) absorption  
   3) ionization  4) electron capture

5. In the same diagram, the energy of transition B is best described as:
   1) absorption energy  2) emission energy  
   3) ionization energy  4) electron affinity

6. The magnetic quantum number \( m_l \) specifies:
   1) subshell orbital shape  2) orbital orientation  
   3) transition probability  4) orbital karma  
   5) energy and distance from nucleus

7. The angular momentum quantum number \( l \) specifies:
   1) subshell orbital shape  2) orbital orientation  
   3) transition probability  4) orbital karma  
   5) energy and distance from nucleus

8. The principle quantum number \( n \) specifies:
   1) subshell orbital shape  2) orbital orientation  
   3) transition probability  4) orbital karma  
   5) energy and distance from nucleus

9. The orbital depicted at right is what type of orbital?
   1) 3dz  2) 2px  
   3) 3px  4) 2py  5) 3py

10. The orbital depicted at right is what type of orbital?
    1) 3dz  2) 2px  
    3) 3px  4) 2py  5) 3py
11. The correct spectroscopic notation for sulfur (S) is:
   1) 1s²2s²2p⁶3s²3p²
   2) 1s²2s²2p⁶3s²3p³
   3) 1s²2s²2p⁶3s²3p⁴
   4) 1s²2s²2p⁶3s²3p⁵
   5) 1s²2s²2p⁶3s²3p⁶

12. The correct spectroscopic notation for sulfur ion (S²⁻) is:
   1) 1s²2s²2p⁶3s²3p²
   2) 1s²2s²2p⁶3s²3p³
   3) 1s²2s²2p⁶3s²3p⁴
   4) 1s²2s²2p⁶3s²3p⁵
   5) 1s²2s²2p⁶3s²3p⁶

13. If an element with the valence configuration 4s²3d⁷ loses 3 electrons, these electron(s) would be removed from the following subshell(s).
   1) 4s
   2) 3d
   3) 4s and 3d
   4) 3p
   5) 4p

14. If an element with the valence configuration 4s¹3d⁵ loses 1 electron, the electron would be removed from the following subshell(s). Think carefully about this one!
   1) 4s
   2) 3d
   3) 4s and 3d
   4) 3p
   5) 4p

15. Which of the following elements has the greatest difference between the second and third ionization energies?
   1) C
   2) Mg
   3) Ar
   4) Na
   5) F

16. Which molecule below does not exist?
   1) BeF₂
   2) CaF₂
   3) MgO₂
   4) KCl
   5) BeCl₂

17. Which of the following correctly compares atomic sizes?
   1) Ar < Na < Al < Si < P
   2) Ar < S < P < Si < Mg
   3) Na < Al < Si < P < Ar
   4) S < P < Si < Mg < Ar
   5) none of the above

18. Which of the following correctly compares ionic/atomic sizes?
   1) Ne < O < C < Mg²⁺ < Na⁺
   2) C < O < Ne < Na⁺ < Mg²⁺
   3) Mg²⁺ < Na⁺ < Ne < C < O
   4) Al³⁺ < Mg²⁺ < Na⁺ < O < C
   5) none of the above
19. The molecule HF can be thought of as having both ionic and covalent character. Given that statement, which of the following is likely to best describe the charge on each atom?

<table>
<thead>
<tr>
<th>H</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>-1.0 +1.0</td>
</tr>
<tr>
<td>2)</td>
<td>-0.7 +0.7</td>
</tr>
<tr>
<td>3)</td>
<td>0.0 0.0</td>
</tr>
<tr>
<td>4)</td>
<td>+0.7 -0.7</td>
</tr>
<tr>
<td>5)</td>
<td>+1.0 -1.0</td>
</tr>
</tbody>
</table>

20. Which of the following is most likely to be the correct assignment of effective nuclear charges for a 2s electron in each of the atoms below?

<table>
<thead>
<tr>
<th>B</th>
<th>C</th>
<th>N</th>
<th>O</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>3.58</td>
<td>4.22</td>
<td>4.85</td>
<td>5.49</td>
</tr>
<tr>
<td>2)</td>
<td>6.13</td>
<td>5.49</td>
<td>4.85</td>
<td>4.22</td>
</tr>
<tr>
<td>3)</td>
<td>2.58</td>
<td>3.22</td>
<td>3.85</td>
<td>4.49</td>
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<tr>
<td>4)</td>
<td>5.13</td>
<td>4.49</td>
<td>3.85</td>
<td>3.22</td>
</tr>
</tbody>
</table>

21. The CO bond in the molecule CH₃OH is best described as a:

1) ionic bond  
2) single bond  
3) double bond  
4) triple bond  
5) the molecule doesn’t exist

22. Draw the Lewis structure for CO₂

Your resulting molecule has a total of:

1) Two single bonds  
2) Two double bonds  
3) One single and one double bond  
4) One double and one triple bond  
5) Two triple bonds
23. Draw the Lewis structure for \( \text{CO}_3^{2-} \).
   Your resulting molecule has a total of:
   1) Three single bonds  
   2) Three double bonds  
   3) One single and two double bonds  
   4) One double and two single bonds  
   5) Three double bonds

24. The CN bond in HCN is a:
   1) single bond  
   2) double bond  
   3) triple bond  
   4) ionic bond

25. The correct designator for this course is:
   1) PolSci 101  
   2) Chem 363  
   3) Chem 111  
   4) Sports 01