1. Fill in the missing data in the table below.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Fe</th>
<th>Fr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic Number</td>
<td>32</td>
<td>92</td>
</tr>
<tr>
<td>Mass Number</td>
<td>58</td>
<td>222</td>
</tr>
<tr>
<td># of protons</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td># of neutrons</td>
<td>65</td>
<td>61</td>
</tr>
<tr>
<td># of electrons</td>
<td>24</td>
<td>46</td>
</tr>
<tr>
<td>Ionic charge</td>
<td>-3</td>
<td>+6</td>
</tr>
</tbody>
</table>

2. For each of the following, write the symbol of the element with its atomic number, atomic mass, and ionic charge if any.

A. Protons = 31
   Neutrons = 38
   Electrons = 28

B. Protons = 82
   Neutrons = 124
   Electrons = 82

C. Protons = 24
   Neutrons = 28
   Electrons = 20

3. In the Bohr model of the atom, under what circumstances may an electron emit (give off) energy? What determines the wavelength of the emitted energy?

4. Electron configuration notation, such as 3p₅, consists of coefficients, letters, and superscripts. What does each of these components represent?

5. Use the diagram above to answer the following questions related to the falling electrons A, B, C, and D.
   a. If A, B, and C give off visible light when they fall, what color might each emit?
   b. How does the frequency of energy emitted by D compare to C?
   c. Could D give off radio waves? Explain.
Elementary Dear Watson

6. The first chemical symbols were developed by John Dalton around 1800. He used a system of circles which was not entirely satisfactory. It was Jons Jakob Berzelius who devised a really satisfactory method. His chemical shorthand is still in use today. The atom of each element was represented by the first letter or letters of its name. Some symbols use the first letter of the Latin name of the element. The symbol for sodium is Na from the Latin natrium meaning soda.

What you do

Part 1: The solution to the mystery that follows depends on your knowledge of electron configurations, Dr. Watson. If an electron configuration is given, substitute the symbol of that element. Put each word into the story below. Do not fail me, good doctor. The solution must be in my hands by midnight a week hence, or the consequences could be devastating for your marks!

1. 1s²
2. Use the name of the element: 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s¹ 4d¹⁰
3. Use the name of the element: 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p⁶ 6s¹ 4f¹⁴ 5d¹⁰
4. [Kr] 5s² 4d¹⁰ 5p⁵
5. 1s² 2s² 2p² + 1s² 2s² 2p⁶ 3s² 3p⁶
6. Use the name of the element: 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d⁶
7. [Xe] 6s² 4f¹⁴
8. [Xe] 6s² 4f¹⁴ 5d¹⁰ + 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p⁶ 6s² 4f¹⁴ 5d¹⁰
9. 1s² 2s² 2p⁶ 3s² 3p⁶ + [Kr] 5s² 4d¹⁰ 5p¹ + 1s² 2s² 2p⁶ 3s² 3p¹
10. 1s² 2s²
11. 1s² 2s² 2p⁴ + 1s² 2s² 2p⁵
12. [Xe] 6s² 4f¹⁴ 5d¹⁰ + 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p³
13. [Kr] 5s² 4d¹⁰ 5p³
14. 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p¹
15. Use the name of the element: [Kr] 5s² 4d¹⁰ 5p³
16. [Rn] 7s² 6d¹⁰ 5f³ + 1s² 2s² 2p⁶ 3s² 3p³
17. 1s² 2s² 2p⁶ 3s² 3p⁴ + 1s² 2s² 2p⁴
18. [He] 2s² 2p⁴ + 1s² 2s² 2p³
19. [Kr] 5s² 4d¹⁰ 5p³
20. [Ar] 4s² 3d¹⁰ 4p³
21. 1s² 2s² 2p⁶ 3s² 3p⁶ 4s¹ + [Ne] + 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p⁶ 6s² 4f¹⁴ 5d¹⁰
22. 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² + 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁴
23. 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² + 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁴
24. 1s² 2s² 2p⁶ 3s² 3p⁴ + 1s² 2s² 2p⁴
25. 1s¹ + [He] 2s² 2p⁴ + [Xe] 6s² 4f¹⁴ 5d⁴

T’was the week before Christmas, when Inspector Lestrade came to me with a most distraught gentleman in tow. 1) _______ explained that the gentleman had purchased several pieces of 2)_______ and 3)_______ jewelry for his wife (or mistress 4)_______ surmised). This had disappeared during a street 5)_______ ride. The victim interrupted with, ‘You must 6)_______ this out before the 24th Mr. 7)_______! 8)_______ dare someone 9)_______ from me!’ By this time Lestrade seemed eager to 10)_______ rid 11)_______ our pompous victim, as 12)_______ 13)_______, 14)_______ private, the Inspector explained that he wasn’t personally 15)_______, but just wanted the theft cleared 16)_______ quickly 17)_______ he could get 18)_______ to matters
Part 2: Now that you have a good understanding of electron configurations, create your own story using 5 of the following words. Each word can only be used one time! NO REPEATS!! Please write your story giving the electron configurations of each word. Include the answer key for grading purposes.

<table>
<thead>
<tr>
<th>Poison</th>
<th>Erupt</th>
<th>Parachute</th>
<th>Passion</th>
<th>Unicorn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>Tank</td>
<td>Inoculate</td>
<td>Thesaurus</td>
<td>Phone</td>
</tr>
<tr>
<td>Pop</td>
<td>Walk</td>
<td>Pick</td>
<td>Bacon</td>
<td>Spoon</td>
</tr>
<tr>
<td>Can</td>
<td>Esophagus</td>
<td>Bones</td>
<td>Camp</td>
<td>Pan</td>
</tr>
<tr>
<td>Fry</td>
<td>Criminal</td>
<td>Tick</td>
<td>Fun</td>
<td>Pigeon</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Reason</td>
<td>Cooperation</td>
<td>Bonus</td>
<td>Ran</td>
</tr>
<tr>
<td>Class</td>
<td>Poison</td>
<td>Argentina</td>
<td>Iris</td>
<td>Clones</td>
</tr>
<tr>
<td>Lion</td>
<td>Coat</td>
<td>carbon</td>
<td>Snow</td>
<td>Tacos</td>
</tr>
<tr>
<td>cranky</td>
<td>sun</td>
<td>lick</td>
<td>assassin</td>
<td>responsibilities</td>
</tr>
</tbody>
</table>

Extra Credit

7. Calculate the energy of a photon of radiation with a wavelength of 6.4 x 10^2 nanometers. In what part of the electromagnetic spectrum is this radiation found? The speed of light is 3.00 x 10^8 m/s.

8. Choose any one of the following to research and write about. Include your references (more than one) with proper citation. Without proper citations this will not be accepted.
   a. Neutrons – in class you researched about the discovery of protons and electron, but how and when were neutrons discovered? Why were they more difficult to discover and what experiment lead to their discovery?
   b. Quarks – what are they and how were they discovered? How are they related to the other parts of the atom?
   c. Emission spectrum – what is it and how is it produced? What are at least 3 things that is can be used for?
   d. Dark matter – what is it, how is it related to regular matter? What questions would its discovery help answer? What is being done to discover dark matter?
   e. Millikan oil-drop experiment – describe the experiment and what it told us about the atom. What information did Millikan need to use from J.J. Thompson’s experiment?