Practice Multiple Choice Questions

1. The number of neutrons in an atom of radioactive C–14 is:
   a) 6    c) 8
   b) 12   d) 14

2. When a radioactive nucleus emits a beta particle:
   a) the atom’s mass number increases by 1
   b) the atomic number increases by 1
   c) the atom’s mass number decreases by 1
   d) the atomic number decreases by 1

3. Which of the following particles has the smallest mass?
   a) an alpha particle
   b) a proton
   c) a beta particle
   d) a neutron

4. What is the mass number of an isotope of hydrogen consisting of 1 proton, 1 electron, and 2 neutrons?
   a) 1
   b) 2
   c) 3
   d) 4

5. The average atomic mass reported on the Periodic Table for each element is:
   a) the average of the mass numbers of all of the isotopes of that element
   b) the mass number of the most abundant isotope of that element
   c) the weighted average mass of all of the isotopes of that element
   d) all of the above

6. Three isotopes of element “X” occur in nature: 60.0% of the atoms have mass 110.0 u, 30.0% of atoms have mass 105.0 u and 10.0% of atoms have mass 100.0 u. Calculate the average atomic mass of element X.
   a) 102.5 u
   b) 107.5 u
   c) 105.0 u
   d) 315.0 u

7. A single burst of light is released from an atom. Which statement explains what happened in the atom?
   a) an electron changed from a particle to a wave
   b) an electron moved from a higher to a lower energy level
   c) an electron moved from a lower to a higher energy level
   d) two electrons in the atom collided

8. The characteristic bright line spectrum of an element is produced when:
   a) the nucleus of the atom is excited
   b) electrons are raised to higher energy levels
   c) excited electrons drop back to lower energy levels
   d) an atom emits a beta particle

9. Which of the following was used to disprove Rutherford’s model of the atom?
   a) the cathode ray tube
   b) the gold-foil experiment
   c) the bright line spectrum of hydrogen
   d) a Geiger counter used to detect radioactivity

10. Why must we use the quantum mechanical theory to describe the location of electrons in an atom?
    a) it is impossible to know both the location and orbit (trajectory) of an electron
    b) all of the electrons in a principle quantum level are exactly the same distance from the nucleus
    c) electrons attract each other
    d) electrons lose energy as they move further from the nucleus

11. When n = 3, you know that:
    a) this energy level can hold a maximum of 36 electrons
    b) there will be three different types of orbitals (sublevels) in this energy level
    c) there will be 18 orbitals in this principal quantum level
    d) all of the above
12. What is the maximum number of electrons that can occupy the 4p sublevel of an atom?
   a) 6  
   b) 8  
   c) 2  
   d) 10

13. The maximum number of electrons in the 3d sublevel is:
   a) 6  
   b) 8  
   c) 2  
   d) 10

14. Which two particles have the same electron configuration?
   a) Cl⁻ and F⁻  
   b) Cl⁻ and Ne  
   c) Cl⁻ and Ca²⁺  
   d) Cl⁻ and K

15. Which of the following provided evidence that electrons in atoms are found in discrete energy levels?
   a) patterns in their electronegativities  
   b) patterns in their densities  
   c) patterns in their atomic radii  
   d) the bright line spectra that is unique to each element

16. What is the maximum number of electrons that can occupy the second principal energy level?
   a) 6  
   b) 18  
   c) 8  
   d) 32

17. The structure of an alpha particle is the same as a(n):
   a) lithium atom  
   b) hydrogen nucleus  
   c) electron  
   d) helium nucleus

18. What is the total number of electrons in a Mg²⁺ ion?
   a) 10  
   b) 12  
   c) 2  
   d) 24

19. Which atom has the strongest attraction for a new electron?
   a) Cl  
   b) Br  
   c) F  
   d) I

20. Which of the following particles has a negative charge?
   a) a lithium ion  
   b) an aluminum ion  
   c) an alpha particle  
   d) a beta particle

21. What is the total number of orbitals in the first principal energy level?
   a) 1  
   b) 3  
   c) 2  
   d) 4

22. Which element requires the least amount of energy to remove its outermost electron?
   a) Li  
   b) Ba  
   c) Mg  
   d) Ca

23. The maximum number of electrons that can be held in any principal energy level (n) is equal to:
   a) n  
   b) n²  
   c) 2n  
   d) 2n²

24. How many types of orbitals are found in the fourth principal quantum level?
   a) 1  
   b) 3  
   c) 2  
   d) 4

25. Which orbitals do electrons enter after the 4s orbital is filled?
   a) 4p  
   b) 3d  
   c) 4d  
   d) 5s
26. Neon atoms produce a characteristic bright line spectrum when their electrons:
   a) return to lower energy levels  
   b) orbit the nucleus in a single energy level  
   c) remain in their normal energy levels and move faster  
   d) remain in their normal energy levels and move slower

27. Which of the following best describes a Group II metal?
   a) it will react with water to produce a basic solution  
   b) it will react with acid to produce oxygen gas  
   c) it will tend to gain electrons to form an ion with a 2+ charge  
   d) all of the above

28. An element has the electron configuration: \(1s^2 2s^2 2p^6 3s^2 3p^4\). You would expect that:
   a) the element will form ions with a 2+ charge  
   b) the element will react with water to produce an acidic solution  
   c) a solution of this element in water will change the colour of phenolphthalein to pink  
   d) all of the above will occur

29. An element has the electron configuration \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2\). This element is found in:
   a) the fourth period and Group VIIB  
   b) the fifth period and Group IIA  
   c) the sixth period and Group VIIIB  
   d) the sixth period and Group IIA

30. An element has the electron configuration \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^1\). It is in:
   a) Group VIIIB and the seventh period  
   b) Group 17 and the sixth period  
   c) Group IA and the seventh period  
   d) Group VIIA and the fifth period

31. When a non-metal oxide is dissolved in water and indicators are added to this solution:
   a) bromothymol blue will turn blue and phenolphthalein will turn pink  
   b) bromothymol blue will turn blue and phenolphthalein will turn colourless  
   c) bromothymol blue will turn yellow and phenolphthalein will turn pink  
   d) bromothymol blue will turn yellow and phenolphthalein will turn colourless

32. A clear, colourless gas "pops" when tested with a burning splint. The gas is:
   a) oxygen  
   b) hydrogen  
   c) carbon dioxide  
   d) helium

33. Which of the following metals is the most metallic?
   a) calcium  
   b) barium  
   c) titanium  
   d) platinum

34. Which of the following ions is isoelectronic with \(P^-\)?
   a) \(C^{1+}\)  
   b) \(S^{2-}\)  
   c) \(K^{1-}\)  
   d) \(Y^{3-}\)

35. Which of the following is/are isoelectronic with a \(Ca^{2+}\) ion?
   a) \(K^{1+}\)  
   b) \(Ar\)  
   c) \(C^{1+}\)  
   d) all of the above

36. The elements in the “s” block on the Periodic Table:
   a) will tend to lose electrons  
   b) will react with an acid to form hydrogen gas  
   c) will form positive ions  
   d) all of the above

37. Which Noble Gas is found in the fifth period?
   a) I  
   b) Xe  
   c) Kr  
   d) Rb

38. Which Alkaline Earth metal is located in the third period?
   a) Ca  
   b) Na  
   c) Sc  
   d) Mg
39. Which of the following lists of elements includes only Halogens?
   a) N, O, F and Ne
   b) Cl, Br, I and F
   c) He, Ne, Ar, and Kr
   d) Li, Na, K and Rb

40. Which of the following lists includes only elements from the D block?
   a) Na, Mg, Li and Sr
   b) C, N, P and Se
   c) Cr, Ti, Ag and Zn
   d) Ce, Eu, Th and U

41. In which “block” is silicon found on the Periodic Table?
   a) the “s” block
   b) the “p” block
   c) the “d” block
   d) the “f” block

42. Which Group on the Periodic Table has electron configurations that end in $s^2p^5$?
   a) Group IIA
   b) Group VB
   c) Group VIIA
   d) Group VIIB

43. The metals Li, Na, K and Rb represent:
   a) a period
   b) a group
   c) an octave
   d) a heavy metal band

44. In which of the following do all of the particles have the same number of electrons?
   a) F, Ne, Na
   b) O$^-$, S$^{2-}$, Se$^{2-}$
   c) Se$^{2-}$, Kr, Rb$^{+}$
   d) Ca$^{2+}$, Fe$^{3+}$, Zn$^{2+}$

45. Which of the electron configurations represents an element in the same Group as silicon?
   a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^10 5p^2$
   b) $1s^2 2s^2 2p^6 3s^2 3p^6 5s^2 4d^10 5p^2$
   c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^10 5p^2$
   d) $1s^2 2s^2 2p^6 3s^2 3p^6 5s^2 4d^10 5p^2$

46. After the 5s orbital of an atom is filled, the next electron will be found in the:
   a) 4d orbital
   b) 5d orbital
   c) 4f orbital
   d) 5p orbital

47. Which of the following electron configurations is correct for zirconium (Zr)?
   a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4p^6 5s^2 4d^2$
   b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$
   c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$
   d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4f^2$

48. Which of the following electron configurations is correct for scandium?
   a) $1s^2 2s^2 2p^6 3s^2 3p^3$
   b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^3$
   c) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$
   d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^3 3d^1$

49. Which of the following orbitals does not exist?
   a) 1s
   b) 2p
   c) 2d
   d) 3p

50. The maximum number of electrons in the second principle quantum level is:
   a) 2
   b) 6
   c) 8
   d) 18

51. How many electrons can be designated (named) 3d?
   a) 3
   b) 6
   c) 8
   d) 10

52. How many electron-containing orbitals, in total, does a neutral strontium atom have in its ground state?
   a) 38
   b) 19
   c) 18
   d) 5
53. Which of the following electron configurations represents a non-metal?
   a) $1s^22s^22p^63s^23p^64s^23d^6$
   b) $1s^22s^22p^63s^23p^5$
   c) $1s^22s^22p^63s^23p^64s^1$
   d) $1s^22s^22p^63s^23p^64s^23d^104p^65s^24d^{10}5p^66s^24f^{11}$

54. Which of the following atoms has the highest electronegativity?
   a) Ar
   b) Mg
   c) Ca
   d) P

55. Which of the following statements is incorrect?
   a) electronegativity decreases down a group
   b) atomic radius increases down a group
   c) atomic radius increases left to right across a period
   d) first ionization energy decreases down a group

56. Which of the following explains why atomic radius decreases from left to right across a period?
   I) increasing shielding effect
   II) decreasing shielding effect
   III) increasing $Z_{eff}$
   IV) decreasing $Z_{eff}$
   a) I and III
   b) II and III
   c) II and IV
   d) III only

57. Which of the following explains why the reactivity of metals increases down a group?
   I) increasing shielding effect
   II) decreasing shielding effect
   III) increasing $Z_{eff}$
   IV) decreasing $Z_{eff}$
   a) I only
   b) I and III
   c) IV only
   d) I and IV

58. The greater the electronegativity of an element, the greater the tendency to:
   a) gain electrons
   b) gain protons
   c) lose electrons
   d) lose protons

59. Which of the following elements is the least metallic?
   a) sodium
   b) rubidium
   c) potassium
   d) cesium

60. Which of the following Group VIIA (Group 17) elements has the lowest tendency to gain electrons?
   a) fluorine
   b) bromine
   c) iodine
   d) chlorine

61. The element in Period 3 with the most metallic character is:
   a) sodium
   b) potassium
   c) aluminum
   d) phosphorus

62. The Alkaline Earth element having the largest atomic radius is found in Period:
   a) 1
   b) 6
   c) 2
   d) 7

63. The element in Period 3 that has the highest ionization energy is:
   a) a Noble gas
   b) an Alkali metal
   c) a halogen
   d) an Alkaline Earth metal

64. Which of the following elements has the highest electronegativity?
   a) phosphorus
   b) oxygen
   c) sulfur
   d) sodium
65. Which element has the highest ionization energy?  
   a) barium  c) magnesium  
   b) calcium  d) strontium  

66. As you move down the Group VIIA (Group 17) from fluorine to astatine:  
   a) electronegativity decreases and the atomic radius increases  
   b) electronegativity decreases and the atomic radius decreases  
   c) electronegativity increases and the atomic radius decreases  
   d) electronegativity increases and the atomic radius increases  

67. In a given period on the Periodic Table, the element with the lowest first ionization energy is always:  
   a) an Alkaline Earth metal  c) an Alkali metal  
   b) a halogen  d) a Noble gas  

68. The atoms of the most reactive non-metals have:  
   a) small atomic radii and high ionization energies  c) small atomic radii and low ionization energies  
   b) large atomic radii and low ionization energies  d) large atomic radii and high ionization energies  

69. Proceeding from left to right in Period 2 of the Periodic Table, the atomic radius of the elements generally:  
   a) decreases  c) increases  
   b) remains the same  d) increases to the middle, and then decreases  

70. Which element in Period 3 has the highest first ionization energy?  
   a) Na  c) Ar  
   b) Cl  d) Mg  

71. Which compound contains an alkali metal and a halogen?  
   a) CaCl₂  c) CaS  
   b) RbCl  d) Rb₂S  

72. The atomic radius of magnesium is smaller than the atomic radius of sodium. This is mainly because the magnesium atom has:  
   a) a larger net nuclear charge  c) a smaller net nuclear charge  
   b) more principal energy levels  d) fewer principal energy levels  

73. The pair of elements with the most similar chemical properties are:  
   a) Mg and S  c) Ca and Br  
   b) Mg and Ca  d) S and Ar  

74. Which of the following elements has the lowest electronegativity?  
   a) carbon  c) fluorine  
   b) nitrogen  d) oxygen  

75. Which of the following statements apply to most non-metals? They have:  
   a) low ionization energy and good electrical conductivity  
   b) high ionization energy and poor electrical conductivity  
   c) low ionization energy and poor electrical conductivity  
   d) high ionization energy and good electrical conductivity  

76. Fluorine has a higher ionization energy than oxygen because fluorine has a:  
   a) smaller net nuclear charge  c) larger net nuclear charge  
   b) smaller shielding effect  d) larger shielding effect  

77. Which element is the most malleable?  
   a) gold  c) hydrogen  
   b) sulfur  d) radon
78. Which is the most reactive non-metal on the Periodic Table of the Elements?  
   a) Fr  
   b) I  
   c) F  
   d) Cl  

79. In Period 2, as the elements are considered from left to right, there is a decrease in:  
   a) ionization energy  
   b) metallic character  
   c) average atomic mass  
   d) electronegativity  

80. Atoms of metallic elements tend to:  
   a) gain electrons and form negative ions  
   b) lose electrons and form negative ions  
   c) gain electrons and form positive ions  
   d) lose electrons and form positive ions  

81. The reactivity of the Alkali metals generally increases with:  
   a) increasing atomic radius  
   b) increasing shielding effect  
   c) increasing atomic number  
   d) all of the above  

82. Which electron configuration represents an element having the highest first ionization energy?  
   a) 1s¹  
   b) 1s² 2s¹  
   c) 1s²  
   d) 1s² 2s²  

83. The amount of energy required to remove the outermost electron from an atom in the gaseous phase is the definition for:  
   a) kinetic energy  
   b) ionization energy  
   c) potential energy  
   d) electronegativity  

84. How many types of orbitals are there in the third principal energy level?  
   a) 1  
   b) 3  
   c) 9  
   d) 18  

85. The number of valence electrons in an atom with the electron configuration 1s² 2s² 2p⁶ 3s² 3p⁴ is:  
   a) 6  
   b) 16  
   c) 2  
   d) 4  

86. An atom with the electron configuration 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p⁶ 5s² 4d¹⁰ 5p³ is most likely to:  
   a) gain three electrons to form a 3+ ion  
   b) gain three electrons to form a 3- ion  
   c) lose three electrons to form a 3+ ion  
   d) lose three electrons to form a 3- ion  

87. The total number of d orbitals in the third principal energy level is:  
   a) 1  
   b) 3  
   c) 5  
   d) 7  

88. What is the electron configuration for a Be²⁺ ion?  
   a) 1s¹  
   b) 1s² 2s¹  
   c) 1s²  
   d) 1s² 2s²  

89. According to the trends on the Periodic Table, which of the following metals is the most reactive?  
   a) Co  
   b) Pt  
   c) Cd  
   d) Os  

90. Which statement best describes the pattern in electronegativity of elements on the Periodic Table?  
   a) electronegativity increases as shielding effect increases  
   b) electronegativity increases as reactivity of metals increases  
   c) electronegativity increases as ionization energy decreases  
   d) electronegativity increases as atomic radius decreases
Unit 2 Review: Atomic Theory and Periodic Table

1. Definitions. Be able to write full definitions for the following terms. Include an additional piece of information or an example:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>atomic number</td>
<td>The number of protons in an atom's nucleus</td>
</tr>
<tr>
<td>electronegativity</td>
<td>The tendency of an atom to attract electrons</td>
</tr>
<tr>
<td>ionization energy</td>
<td>The energy required to remove an electron from an atom</td>
</tr>
<tr>
<td>mass number</td>
<td>The sum of the masses of the protons and neutrons in an atom</td>
</tr>
<tr>
<td>average atomic mass</td>
<td>The average mass of all isotopes of an element</td>
</tr>
<tr>
<td>element</td>
<td>A chemical element with a unique atomic number</td>
</tr>
<tr>
<td>isoelectronic</td>
<td>Elements with the same number of valence electrons</td>
</tr>
<tr>
<td>orbital</td>
<td>A region in an atom where electrons can be found</td>
</tr>
<tr>
<td>atomic radius</td>
<td>The distance from the nucleus to the outermost electron</td>
</tr>
<tr>
<td>ion</td>
<td>An atom with a net positive or negative charge</td>
</tr>
<tr>
<td>isotope</td>
<td>A variant of an element with a different number of neutrons than protons</td>
</tr>
<tr>
<td>radioisotope</td>
<td>A radioactive isotope of an element</td>
</tr>
</tbody>
</table>

2. Review the material from “Review Questions for Atomic Theory Quiz #1”. You will be asked to write out definitions only from the terms listed above. You need to understand and be able to apply the other terms.

3. Why, for some elements, can a lack of reactivity be a desirable property? (see Lab #2) Give 2 examples.

4. Silicon has the following three isotopes: the most abundant (92.23%) is Si-28 with an actual atomic mass of 27.9769 u; 4.67% is Si-29 with an actual atomic mass of 28.9765 u and rest is Si-30 with an actual atomic mass of 29.9738 u. What is the average atomic mass of silicon? (answer: 28.09 u)

5. Write the balanced nuclear equations for the following nuclear reactions:
   a) plutonium-238 undergoes alpha decay
   b) lead-214 undergoes beta decay
   c) oxygen-18 undergoes beta decay
   d) thorium-230 undergoes alpha decay
   e) thorium-234 undergoes beta decay

6. Review the material from “Practice Questions: The Quantum Mechanical Model of the Atom”.

7. What is the essential difference between the model of the atom proposed by Bohr and the Quantum Mechanical Model?

8. Explain the significance of:
   a) the number of protons in an atom’s nucleus
   b) the number of neutrons in an atom’s nucleus
   c) the number and arrangement of electrons in an atom

9. Explain why all of the isotopes of an element have the same chemical reactivity.

10. Draw a flow chart showing how changes in atomic theory have centred around discoveries about electrons.

11. State Heisenberg’s Uncertainty Principle. How is this related to the Quantum Theory?

12. What does “n” represent? Which atomic model(s) include “n”?

13. Answer the following questions about electron arrangement in atoms
   a) The number of different types of orbitals when n = 5 is ________________.
   b) The number of “s” orbitals in the seventh main energy level (n = 7) is ________________.
   c) The maximum number of electrons that can fit in the third energy level (n = 3) is ________________.
   d) The number of electrons that can be held in the 5-p orbitals (n = 5) is ________________.
   e) The number of different types of orbitals when n = 3 is ________________.
   f) The number of “p” orbitals in the fourth main energy level (n = 4) is ________________.
   g) The maximum number of electrons that can fit in the fifth energy level (n = 5) is ________________.
   h) The number of electrons that can be held in the 3-d orbitals (n = 3) is ________________.
   i) The number of different types of orbitals when n = 4 is ________________.
   j) The maximum number of electrons that can fit in the second energy level (n = 2) is ________________.

14. Write electron configurations for:
   a) aluminum   b) bromine   c) cesium
15. Distinguish between a group and a period on the Periodic Table.

16. Understand how electron configurations are related to an element’s position on the Periodic Table.
   a) What is the last term for the electron configuration of calcium? __________
   b) Which group does rubidium belong to? __________ Which period? __________
   c) What is the last term for the electron configuration of sulfur? __________
   d) Which group does iodine belong to? __________ Which period? __________
   e) How many electrons are in the outer energy level of fluorine? __________
   f) Which group does argon belong to? __________ Which period? __________

17. Be able to write ionization reactions for metals and non-metals.
   a) Write electron configurations to show the ionization reactions for Na, Ca, Al, S, Cl, O, and P.
   b) List three ions that are isoelectronic with Ne: __________, __________ and __________
   c) List three atoms or ions that are isoelectronic with Na $^{1+}$ __________, __________ & __________

18. Be able to predict physical and chemical properties of metals and non-metals. Include the following:
   a) when a metal reacts with water, the type of solution that is produced
   b) when a metal reacts with acid, the type of gas that is produced
   c) when a non-metal reacts with water, the type of solution that is produced

19. Be familiar with the elements from different groups. Prepare a chart summarizing the properties of the elements of Group I, Group II, Group VII and Group VIII with regard to:
   a) Group’s common name
   b) metal or non-metal
   c) usual state(s) at room temperature
   d) malleable or brittle
   e) conductor or non-conductor of electricity
   f) does it react with air?
   g) does it react with water? what are the products?
   h) does it produce an acidic, basic or neutral solution when dissolved in water?

20. Explain how the electron arrangement of the elements of Group I is related to the chemical properties of the Group I elements.

21. Explain how the electron arrangement of the elements of Group VIIA (Group 17) is related to the chemical properties of these elements.

22. Use the concepts of shielding effect and net nuclear attraction to explain the following trends on the Periodic Table. Discuss the trends within a period, and within a group.
   a) electronegativity
   b) reactivity of metals
   c) reactivity of non-metals
   d) ionization energy
   e) atomic radius

23. Use the concepts of shielding effect net nuclear attraction to explain why:
   a) oxygen is more reactive than selenium
   b) argon has a smaller atomic radius than sodium
   c) copper is more electronegative than calcium
   d) it takes more energy to remove an electron from a nitrogen atom than from a phosphorus atom
   e) strontium is more reactive than calcium

24. We have used two chemical indicators in this course, so far: phenolphthalein (phth) and bromothymol blue. Describe what you will see when each is added to the following solutions:
   a) a metal added to water
   b) a metal oxide in water
   c) a non-metal in water
   d) a non-metal oxide in water
For the following theoretical elements on the Periodic Table, answer these questions:

<table>
<thead>
<tr>
<th>Rx</th>
<th>Go</th>
<th>Fy</th>
<th>Tt</th>
<th>Bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lu</td>
<td>Pi</td>
<td>Xr</td>
<td>Ci</td>
<td></td>
</tr>
</tbody>
</table>

a) Write the electron configurations for Go, Tt and Xr.
b) Which is more reactive: Fn or Go? Explain.
c) Which is the largest atom: Lu, Pi or Xr? Explain.
d) Which is more reactive: Tt, Ci or Bn? Explain.
e) Which element has the lowest ionization energy: Go, Fy or Tt? Explain.
f) Which element will tend to lose electrons most easily: Lu, Pi or Xr? Explain.
g) Which element will have the strongest attraction for a new electron: Fy, Xr, Tt, Ci or Bn? Explain.
h) What gas is produced when Fn reacts with water?
i) When Fn reacts with water, will the resulting solution be acidic, basic or neutral? Explain.
j) What ion will Tt tend to form during chemical reactions? Lu? Go?
k) Write the chemical formula of the metal oxide that will be produced when Lu reacts with oxygen.
l) How many valence electrons does the neutral atom of Fn have? Tt? Pi?
m) Which two elements could be metalloids?

Random Questions:
1. How many valence electrons do nitrogen and phosphorus have?
2. How many elements are there in the fourth period of the Periodic Table?
3. The atomic number of a mythical element called “Tassium” (Ts) is 117.
   a) What is the probable electron configuration of Tassium?
   b) In which family (group) will Tassium be found? In which period will Tassium be found?
4. Metals tend to ___________ electrons, while non-metals tend to ___________ electrons.
5. The elements whose electron configurations end in s²p⁶ belong to which group on the P.T.?
6. Identify the most metallic element on the Periodic Table. To which family does it belong?
7. Identify the most non-metallic element on the Periodic Table. To which family does it belong?
8. In a family of metals, where are the most reactive elements located?
9. Which group contains the elements that have the highest ionization energy? The lowest ionization energy?
10. Which element in each group has the largest atomic radius? a) B, Li, or F b) K, Li or Na
11. Which element in each group has the lowest ionization energy? a) B, Li, or F b) K, Li or Na
12. What ion will each of the following elements most likely form? Mg, Cl, N, Ar, Al, S, Na
13. When calcium reacts with water, the solution produced is (acidic, basic).
14. The gas produced when lithium reacts with water is ________________.
15. Magnesium oxide solution turns bromothymol blue what colour? ________________
16. The element in Group II with the highest ionization energy is ________________.
17. The most reactive halogen is ________________.
18. A solution of bromine in water is (acidic, basic). Bromothymol blue will turn ________________.
19. Non-metals generally form (positive, negative) ions.
20. The most stable electron configurations are found for Group ________________
21. Cesium is more reactive than lithium. Explain this in terms of their electron arrangements.
22. Fluorine is more reactive than chlorine. Explain this in terms of their electron arrangements.
23. In which energy level are the valence electrons of each of the following elements found? I, Ca, Ga, F, Fr.
### Atomic Theory and Periodic Table Review (cont.)

1. Complete the chart:

<table>
<thead>
<tr>
<th>Name of Element</th>
<th>Symbol for Element</th>
<th>Atomic Number</th>
<th>Number of Protons</th>
<th>Number of Electrons</th>
<th>Number of Neutrons</th>
<th>Mass Number</th>
<th>Total Electric Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td></td>
<td>25</td>
<td>23</td>
<td>23</td>
<td>56</td>
<td>3</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>12</td>
<td>14</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-19</td>
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<td>18</td>
<td></td>
<td>21</td>
<td>0</td>
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<tr>
<td>Mg-27</td>
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<td>18</td>
<td></td>
<td>21</td>
<td>32</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>Scandium</td>
<td></td>
<td>34</td>
<td></td>
<td>36</td>
<td>79</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

2. Complete the chart:

<table>
<thead>
<tr>
<th>Quantum Level (Principal Energy Level)</th>
<th>Maximum Number of Electrons that can fit in this Quantum Level</th>
<th>Total Number of Orbitals in this Quantum Level</th>
<th>How Many Types of Orbitals are there in this Quantum Level</th>
<th>Names of the Orbitals in this Quantum Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
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</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

3. Circle the element in each pair that has the **highest** electronegativity:
   a) lithium or cesium                      d) titanium or cobalt
   b) fluorine or bromine                    e) boron or nitrogen
   c) calcium or beryllium                   f) potassium or chlorine

4. Circle the element in each pair that has the **largest** atomic radius
   a) calcium or sulfur                      d) strontium or bromine
   b) barium or vanadium                     e) zinc or rubidium
   c) neon or lithium                        f) potassium or scandium

5. Circle the element in each pair that has the **lowest** ionization energy
   a) argon or boron                         d) calcium or iron
   b) barium or magnesium                   e) silicon or chlorine
   c) lithium or sodium                     f) chlorine or selenium

6. Circle the element in each pair that is the **most** reactive
   a) sodium or potassium                   e) barium or scandium
   b) scandium or cobalt                    f) strontium or cesium
   c) iodine or fluorine                    g) oxygen or selenium
   d) lead or radon                         h) argon or sodium