Electromagnetic Radiation and Quantum Theory Questions KEY

What you will be given for the test:

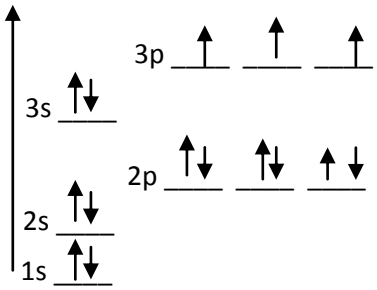
- A periodic table (you cannot use the blank one where you filled in the electron configuration)
- $c=\lambda v$
- $E=hv$
- $c=3.0\times10^{8}$ m/s
- $h=6.626\times10^{-34}$ J*s

For the test, you should be able to answer these questions….

1. What does ROY G. BV represent?
   The colors of the visible light portion of the electromagnetic spectrum.
2. How does the energy of a red photon compare to that of a blue photon? Explain.
   A blue photon has higher energy than a red photon. Blue photons have a shorter wavelength and therefore a higher frequency and higher energy.
3. According to the Bohr model of the hydrogen atom, how does the hydrogen atom emit light?
   When an electron absorbs energy, it jumps to a higher energy level. When the electron falls back down, energy is released from the atom in the form of light.
4. What is the difference between an electron at ground state and an excited electron?
   A ground state electron is the lowest possible energy for that electron. An excited electron is one that has absorbed energy and is in a higher energy level.
5. What accounts for different color lines (red, blue-green, blue, and violet) in the emission spectrum of the hydrogen atom?
   The electron releases different amounts of energy has it drops to different energy levels. Each of these drops in energies corresponds to a specific frequency and color of light.
6. Can two different elements produce the same identical emissions spectrum?
   No two elements can produce the same emission spectrum, it is similar to a fingerprint for an atom.
7. What is a “quantum” of energy?
   A small bundle of energy. Energy can be gained or lost in a quantum of energy. A photon contains a quantum of energy.
8. What kind of relationship do frequency and wavelength have? Energy and frequency?
   Wavelength and frequency are inversely related. Energy and frequency and directly related.
9. What speed does all light travel at?
   The speed of all light is 3.0×10^{8} m/s. ALL light travels at the speed no matter the frequency, wavelength, or energy of the light.
10. Be able to solve energy, frequency, and wavelength problems.
    The equations and constants will be given to you. Use worksheet #1 to practice.
11. What is the Heinsenberg Uncertainty Principle? What role does it play in determining where electrons reside in atoms?
    The Heisenburg Uncertainty Principle says that the location and path of motion of an electron cannot both be determined because the act of determining the location of an electron moves the electron. We shoot photons of light at electrons so that we can determine the probable location of an electron.
12. What is an energy level?
    The distance from the nucleus that an electron can be found.
13. What is a sublevel?
    Sublevels are within energy levels. They are s, p, d, and f
14. What is an orbital?
    Orbitals are probable locations in an energy level that electrons are likely to be found.
15. Describe the orbitals in the 4 sublevels. How do they differ from one another?

There is 1 s orbital, 3 p orbitals, 5 d orbitals, and 7 f orbitals. They have different shapes like the s orbital is a sphere and the p orbitals are dumbbell shaped.

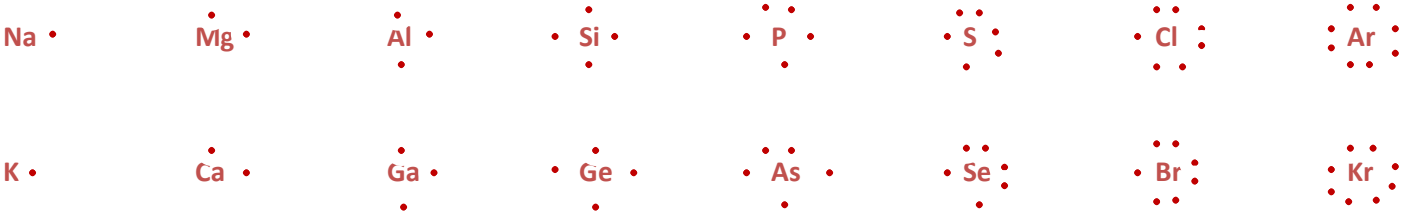
16. When filling atomic orbitals with electrons, describe the three principles you should follow.
    Aufbau's principle—electrons must fill in the lowest energy possible before moving to the next
    Pauli exclusion principle—two electrons can go in each orbital
    Hund's rule—there should be a maximum number of unpaired electrons in each sublevel before pairing the electrons.
17. How does a 1s orbital compare to a 2s orbital? How are they similar? How do they differ?
    All s orbitals are spherical in shape and the lowest energy orbital in any energy level. A 2s orbital is larger than a 1s orbital because it is in the second energy level.
18. What type of orbital starts each and every new energy level (n)?
    S
19. Identify the types of atomic orbitals found in the 4^{th} energy level (n=4)? How many of each type are present? How many total electrons can go in the 4^{th} energy level?
    1-s, 3-p, 5-d, 7-f. Since two electrons can go in each orbital, 32 electrons can go in the 4^{th} energy level.
20. What is the ending electron configuration for each group (1A-8A) on the periodic table?
    1A: ns^1, 2A: ns^2, 3A: $ns^2\ np^1$, 4A: $ns^2\ np^2$, 5A: $ns^2\ np^3$, 6A: $ns^2\ np^4$, 7A: $ns^2\ np^5$, 8A: $ns^2\ np^6$
21. Determine the total number of electrons that can occupy 1 s orbital, 3 p orbitals, 5 d orbitals, 7 f orbitals
    2, 6, 10, 14 respectively
22. How many electrons does it take to completely fill the third energy level?
    18
23. Identify the following elements given their ENDING electron configuration
    a. $1s^2$ He b. $3s^23p^5$ Cl c. $4s^23d^8$ Ni
24. Draw the vertical orbital diagram for the element phosphorus (P).



25. Draw the horizontal orbital diagram for calcium (Ca).

26. Be able to identify an element based on its electron configuration.
27. Write the full electron configuration for the following elements: B, V, Fe, Br, Sn
    B: $1s^2 2s^2 2p^1$
    V: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$
    Fe: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
    Br: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
    Sn: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$
28. Write the noble gas configurations for Y, At, I, Ba
    Y: $[Kr]5s^2 4d^1$
    At: $[Xe]6s^2 4f^{14} 5d^{10} 6p^5$
    I: $[Kr]5s^2 4d^{10} 5p^5$
    Ba: $[Xe]6s^2$

29. Write the electron configuration for S^{2-}, P^{3-}, K^{+}, Si^{4+}
    S^{2-} $1s^2 2s^2 2p^6 3s^2 3p^6$
    P^{3-} $1s^2 2s^2 2p^6 3s^2 3p^6$
    K^{+} $1s^2 2s^2 2p^6 3s^2 3p^6$
    Si^{4+} $1s^2 2s^2 2p^6$
30. What is a valence electron? Know that elements in the same group have the same number of valence electrons.
    Valence electrons are electrons in the outermost energy level. Group 1A has one valence electron, 2A has two, and so on.
31. Be able to tell how many valence electrons are in an atom based on the electron configuration.
    The outermost **energy level** tells the number of valence electrons.
32. Draw Lewis structures for all main group elements in the 3rd and 4th period.



33. In terms of electron configuration/orbital filling, explain why an atom will not have more than eight valence electrons.
    Before d and f orbitals can be filled to put more than eight electrons in an energy level, the s orbital from a higher energy level will be filled.
34. Choose one element on the periodic table with an exception and write its electron configuration.
    Exception: d block elements are more stable being half filled or full even if this means taking one electron from the s orbital right before it. nd^4 and nd^9 elements fit in this exception
35. Give one example of a paramatic element and diamagnetic element using electron configurations.
    Paramagnetic: had unpaired electrons
    Diamagnetic: has all paired electrons