Unit 6 Problem Set

Learning Objectives in this Assignment:

- *Describe the implications of wave mechanics and the quantization of electron energies and spin, including quantum numbers, atomic orbital energies, and the shapes of s, p and d orbitals*
- *Write full and condensed electron configurations, differentiate between core and valence electrons, draw orbital diagrams*
- *Explain the organization of the periodic table, group names, trends in metallic character, atomic radius, ionization energy, electron affinity, and electronegativity*
- *Bohr Model, Electromagnetic radiation?*

Read more about this topic: Chapter 6

1. An FM radio station found at 100.9 on the FM dial broadcasts at a frequency of 100.9 MHz. What is the wavelength of these radio waves in meters?

2. A bright violet light has a wavelength of 438.9 nm. What amount of energy, in eV (1 eV = 1.602×10^{-19} J), must be released by an electron in a mercury atom to produce a photon of this light?

3. One of the radiographic devices used in a dentist's office emits an X-ray with a wavelength of 2.17×10^{-11} m. What is the frequency of this X-ray (in PHz)?

4. A Blu-ray laser (wavelength of 405 nm) has a power of 5.81 milliwatts (1 watt = 1 J s^{-1}). How many photons of light are produced by the laser in 1 hour?

5. Using the Bohr model, determine the energy of an electron with $n = 6$ in a hydrogen atom. Report your answer in eV (1 eV = 1.602×10^{-19} J).

6. The electron volt (eV) is a convenient unit of energy for expressing atomic-scale energies. It is the amount of energy that an electron gains when subjected to a potential of 1 volt; (1 eV = 1.602×10^{-19} J). Using the Bohr model, determine the energy, in electron volts, of the photon produced when an electron in a hydrogen atom moves from the orbit with $n = 7$ to the orbit with $n = 4$.

7. Identify the subshell in which electrons with the following quantum numbers are found: $n = 2$, $l = 1$

8. Identify the subshell in which electrons with the following quantum numbers are found: $n = 4$ $l = 2$

Unit 6 Problem Set

9. Identify the subshell in which electrons with the following quantum numbers are found: $n = 3$, $l = 0$

10. Which element has the following electron configuration? $1s^2 2s^2 2p^3$d

11. Which element has the following electron configuration? $1s^2 2s^2 2p^6 3s^2 3p^2$

12. Which element has the following electron configuration? $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

13. Which element has the following electron configuration?
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^4$

14. Which element has the following electron configuration?
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^9$

15. Identify the element in each of the following cases

a. Which element would be expected to have a half-filled 2p subshell
b. Which element would be expected to have a half-filled 3p subshell?

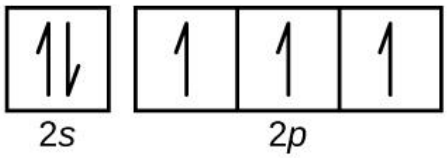
16. Identify the element in each of the following cases

a. Which element would be expected to have a half-filled 4p subshell
b. Which element would be expected to have a half-filled 5p subshell?

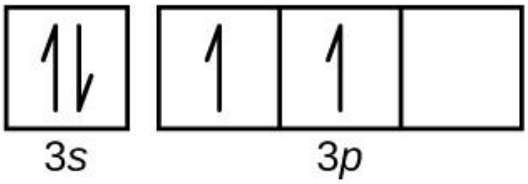
17. Identify the element in each of the following cases

a. Which element would be expected to have a half-filled 6p subshell
b. Which element would be expected to have a half-filled 7p subshell?

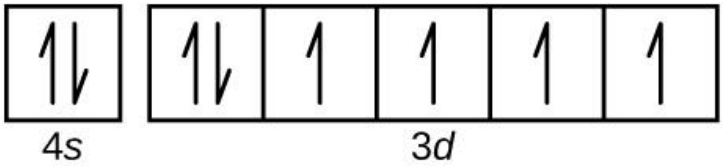
18. Which element is represented by the following valence shell electron configuration?



19. Which element is represented by the following valence shell electron configuration?

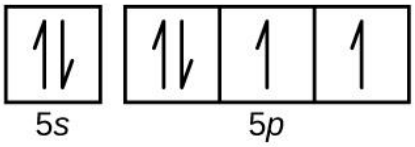


20. Which element is represented by the following valence shell electron configuration?

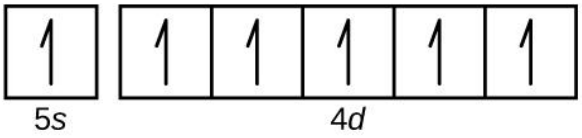


21. Which element is represented by the following valence shell electron configuration?

Unit 6 Problem Set



22. Which element is represented by the following valence shell electron configuration?



23. Based on their position on the periodic table, predict the periodic trends in the following scenarios

a. Which has the largest atomic radius: Mg, Sr, Si, Cl I
b. Which has the smallest atomic radius: Li, Rb, N, F, I

24. Based on their position on the periodic table, predict the periodic trends in the following scenarios

a. Which has the largest first ionization energy: Mg, Ba, B, O, Te
b. Which has the largest first ionization energy: Li, Cs, N, F, I