8.6 End-of-Chapter Material

ADDITIONAL EXERCISES

1. What is the frequency of light if its wavelength is 1.00 m?

2. What is the wavelength of light if its frequency is 1.00 s^{-1}?

3. What is the energy of a photon if its wavelength is 1.00 meter?

4. What is the energy of a photon if its frequency is 1.00 s^{-1}?

5. If visible light is defined by the wavelength limits of 400 nm and 700 nm, what is the energy range for visible light photons?

6. Domestic microwave ovens use microwaves that have a wavelength of 122 mm. What is the energy of one photon of this microwave?

7. Use the equation for the wavelengths of the lines of light in the H atom spectrum to calculate the wavelength of light emitted when *n* is 7 and 8.

8. Use the equation for the wavelengths of the lines of light in the H atom spectrum to calculate the wavelengths of light emitted when *n* is 5 and 6.

9. Make a table of all the possible values of the four quantum numbers when the principal quantum number *n* = 5.

10. Make a table of all the possible values of m_ℓ and m_s when $\ell = 4$. What is the lowest value of the principal quantum number for this to occur?

11. a. Predict the electron configurations of Sc through Zn.
    b. From a source of actual electron configurations, determine how many exceptions there are from your predictions in part a.

12. a. Predict the electron configurations of Ga through Kr.
    b. From a source of actual electron configurations, determine how many exceptions there are from your predictions in part a.

13. Recently, Russian chemists reported experimental evidence of element 117. Use the periodic table to predict its valence shell electron configuration.

14. Bi (atomic number 83) is used in some stomach discomfort relievers. Using its place on the periodic table, predict its valence shell electron configuration.

15. Which atom has a higher ionization energy (IE), O or P?

16. Which atom has a higher IE, F or As?

17. Which atom has a smaller radius, As or Cl?

18. Which atom has a smaller radius, K or F?

19. How many IEs does an H atom have? Write the chemical reactions for the successive ionizations.

20. How many IEs does a Be atom have? Write the chemical reactions for the successive ionizations.

21. Based on what you know of electrical charges, do you expect Na^+ to be larger or smaller than Na?

22. Based on what you know of electrical charges, do you expect Cl^- to be larger or smaller than Cl?

ANSWERS

1. $3.00 \times 10^{8}\ s^{-1}$

3. 1.99×10^{-22} J

5. 4.97×10^{-19} J to 2.84×10^{-19} J

7. 3.97×10^{-7} m and 3.89×10^{-7} m, respectively

9.

n	ℓ	m_ℓ	m_s
5	0	0	1/2 or −1/2
5	1	−1, 0, 1	1/2 or −1/2
5	2	−2, −1, 0, 1, 2	1/2 or −1/2
5	3	−3, −2, −1, 0, 1, 2, 3	1/2 or −1/2
5	4	−4, −3, −2, −1, 0, 1, 2, 3, 4	1/2 or −1/2

11. a. The electron configurations are predicted to end in $3d^1$, $3d^2$, $3d^3$, $3d^4$, $3d^5$, $3d^6$, $3d^7$, $3d^8$, $3d^9$, and $3d^{10}$.

    b. Cr and Cu are exceptions.

13. Element 117's valence shell electron configuration should be $7s^2 7p^5$.

15. O

17. Cl

19. H has only one IE: $H \rightarrow H^+ + e^-$

21. smaller