**Unit 2: Homework**

1. Calculate the wavelength (in nm) of the red light emitted by a barcode scanner that has a frequency of
4.62 × 1014 s–1.
2. A laser dazzles the audience in a rock concert by emitting green light with a wavelength of 515 nm. Calculate the frequency of the light.
3. A nitrogen gas laser pulse with a wavelength of 337 nm contains 3.83 mJ of energy. How many photons does it contain?

4. Arrange the three types of electromagnetic radiation—visible light, X-rays, and microwaves—in order of increasing

**a.** wavelength. **b.** frequency. **c.** energy per photon.

1. What are the quantum numbers and names (for example, 2*s*, 2*p*) of the orbitals in the *n* = 4 principal level? How many *n* = 4 orbitals exist?
2. These sets of quantum numbers are each supposed to specify an orbital. One set, however, is erroneous. Which one and why?

**a.** *n* = 3; *l* = 0; *ml* = 0 **b.** *n* = 2; *l* = 1; *ml* = –1

**c.** *n* = 1; *l* = 0; *ml* = 0 **d.** *n* = 4; *l* = 1; *ml* = –2

1. Determine the wavelength of light emitted when an electron in a hydrogen atom makes a transition from an orbital in *n* = 6 to an orbital in *n* = 5.
2. Determine the wavelength of the light absorbed when an electron in a hydrogen atom makes a transition from an orbital in which *n* = 2 to an orbital in which *n* =
3. Two samples of carbon dioxide are decomposed into their constituent elements. One sample produces 25.6 g of oxygen and 9.60 g of carbon, and the other produces 21.6 g of oxygen and 8.10 g of carbon. Show that these results are consistent with the law of definite proportions.

10. Nitrogen forms several compounds with oxygen, including nitrogen dioxide and dinitrogen monoxide. Nitrogen dioxide contains 2.28 g oxygen to every 1.00 g nitrogen, while dinitrogen monoxide contains 0.570 g oxygen to every 1.00 g nitrogen. Show that these results are consistent with the law of multiple proportions.

11. **a.** What are the atomic number (*Z*), mass number (*A*), and symbol of the chlorine isotope with 18 neutrons?

b.How many protons, electrons, and neutrons are present in an atom of Cr-24?

c. What are the atomic number, mass number, and symbol for the carbon isotope with seven neutrons?

12. Write electron configurations for each element.

**a.** Mg **b.** P **c.** Br **d.** Al

13. Write electron configurations for each element.

**a.** Cl **b.** Si **c.** Sr **d.** O

14. Write the orbital diagram for sulfur and determine the number of unpaired electrons.

15. Write the orbital diagram for Ar and determine the number of unpaired electrons.

16. Write the electron configuration for Ge. Identify the valence electrons and the core electrons.

17. On the basis of periodic trends, choose the larger atom in each pair (if possible):

**a.** Sn or I **b.** Ge or Po **c.** Cr or W **d.** F or Se

18. Write the electron configuration and orbital diagram for each ion and determine whether each is diamagnetic or paramagnetic.

**a.** Al3+ **b.** S2– **c.** Fe3+

19. Choose the larger atom or ion from each pair.

**a.** S or S2– **b.** Ca or Ca2+ **c.** Br –  or Kr

20. On the basis of periodic trends, determine which element in each pair has the higher first ionization energy (if possible).

**a.** Al or S **b.** As or Sb **c.** N or Si **d.** O or Cl