Chapter 6 Extra Credit Worksheet Name: _____

1. An FM radio station found at 103.1 on the FM dial broadcasts at a frequency of $1.031 \times 10^{8}\ s^{-1}$ (103.1 MHz). What is the wavelength of these radio waves in meters?

2. A bright violet line occurs at 435.8 nm in the emission spectrum of mercury vapor. What is the frequency of this light?

3. Light with a wavelength of 614.5 nm looks orange. What is the energy, in joules, per photon of this orange light?

4. When rubidium ions are heated to a high temperature, two lines are observed in its line spectrum at wavelengths (a) 7.9×10^{-7}m and (b) 4.2×10^{-7} m. What are the frequencies of the two lines? What color do we see when we heat a rubidium compound?

5. One of the radiographic devices used in a dentist's office emits an X-ray of wavelength 2.090×10^{-11} m. What is frequency of this X-ray?

6. The eyes of certain reptiles pass a single visual signal to the brain when the visual receptors are struck by photons of a wavelength of 850 nm. If a total energy of 3.15×10^{-14} J is required to trip the signal, what is the minimum number of photons that must strike the receptor?

7. Using the Bohr model, determine the energy of an electron with $n = 6$ in a hydrogen atom.

8. Using the Bohr model, determine the wavelength when an electron in n = 1 is excited to n = 3.

9. How are the Bohr model and the quantum mechanical model of the hydrogen atom similar? How are they different?

10. What are the allowed values for each of the four quantum numbers: n, l, m_l, and m_s?

11. Answer the following questions:

(a) Without using quantum numbers, describe the differences between the shells, subshells, and orbitals of an atom.

(b) How do the quantum numbers of the shells, subshells, and orbitals of an atom differ?

12. Identify the subshell in which electrons with the following quantum numbers are found:

(a) $n = 3$, $l = 2$

(b) $n = 1$, $l = 0$

(c) $n = 4$, $l = 3$

13. Using complete subshell notation (not abbreviations, $1s^2 2s^2 2p^6$, and so forth), predict the electron configuration of each of the following atoms:

(a) C

(b) P

(c) V

(d) Sb

(e) Sm

14. Draw the orbital diagram for the valence shell of each of the following atoms:

(a) C

(b) P

15. Using complete subshell notation ($1s^2 2s^2 2p^6$, and so forth), predict the electron configurations of the following ions.

(a) N^{3-}

(b) Ca^{2+}

(c) S^{-}

(d) Cs^{2+}

(e) Cr^{2+}

(f) Gd^{3+}

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

17. Which ion with a +1 charge has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$? Which ion with a –2 charge has this configuration?

18. Which of the following atoms contains only three valence electrons: Li, B, N, F, Ne?

19. Circle the atoms with two unpaired electrons.

(a) Mg (b) Si (c) S

20. Place the following in order of increasing atomic radius.

As O Br

A) As < Br < O
B) O < As < Br
C) Br < As < O
D) As < O < Br
E) O < Br < As

21. Place the following in order of increasing radius.

Ca^{2+} S^{2-} Cl^{-}

A) $Ca^{2+} < Cl^{-} < S^{2-}$
B) $Cl^{-} < Ca^{2+} < S^{2-}$
C) $S^{2-} < Cl^{-} < Ca^{2+}$
D) $Ca^{2+} < S^{2-} < Cl^{-}$

22. Place the following in order of decreasing radius.

Te^{2-} F^{-} O^{2-}

A) $F^{-} > O^{2-} > Te^{2-}$
B) $F^{-} > Te^{2-} > O^{2-}$
C) $Te^{2-} > O^{2-} > F^{-}$
D) $Te^{2-} > F^{-} > O^{2-}$
E) $O^{2-} > F^{-} > Te^{2-}$

23. Place the following in order of increasing IE_1.

N F As

A) N < As < F
B) As < N < F
C) F < N < As
D) As < F < N
E) F < AS < N

24. Place the following in order of decreasing metallic character.

P As K

A) P > As > K
B) As > P > K
C) K > P > As
D) As > K > P
E) K > As > P

25. Choose the paramagnetic species from below.

A) Ti^{4+} B) O C) Ar

26. Give the set of four quantum numbers that could represent the electron gained to form the Br^- ion from the Br atom.

A) $n = 4$, $l = 2$, $m_l = 1$, $m_s = -\frac{1}{2}$

B) $n = 4$, $l = 0$, $m_l = 1$, $m_s = +\frac{1}{2}$

C) $n = 4$, $l = 1$, $m_l = 1$, $m_s = -\frac{1}{2}$

D) $n = 3$, $l = 2$, $m_l = 2$, $m_s = +\frac{1}{2}$

E) $n = 5$, $l = 1$, $m_l = -1$, $m_s = +\frac{1}{2}$