CHAPTER 2—RADIATION CONCEPTS

MULTIPLE CHOICE

1. The unit of mass is the
   a. m/sec.
   b. kg.
   c. mm.
   d. cc.

   ANS: B PTS: 1 DIF: Easy

2. An electron is ____ charged and has a mass of ____ amu(s).
   a. positively; 1
   b. negatively; 0.000548
   c. neutral; 1
   d. positively; 0.000548

   ANS: B PTS: 1 DIF: Easy

3. The orderly arrangement of elements in the periodic table is based upon
   a. atomic weights.
   b. mass number.
   c. neutron number.
   d. atomic number.

   ANS: D PTS: 1 DIF: Easy

4. Photon wavelength is
   a. inversely proportional to photon velocity.
   b. directly proportional to photon frequency.
   c. inversely proportional to photon frequency.
   d. usually designated by the letter *c*.

   ANS: C PTS: 1 DIF: Medium

5. All of the following are true of electromagnetic energies **EXCEPT**:
   a. They are illustrated as sinusoidal waves.
   b. They possess both wave and particle characteristics.
   c. The relationship between frequency and wavelength is direct and proportional.
   d. They are arranged in an orderly spectrum according to frequency and wavelength.

   ANS: C PTS: 1 DIF: Medium

6. The maximum number of electrons found in any energy level (shell) at any point in time is calculated by the formula
   a. V= I x R.
   b. W = F x D.
   c. N = amu x Z.
   d. $2n^2$.

   ANS: D PTS: 1 DIF: Medium

7. The sum of protons and neutrons in a nucleus is called the
   a. electron number.
   b. atomic weight.
   c. quantum number.
   d. mass number.

   ANS: D PTS: 1 DIF: Easy

8. Groups of the periodic table
   a. represent elements with the same outer electron configuration.
   b. are horizontal.
   c. represent elements with the same atomic density.

d. none of the above

ANS: A PTS: 1 DIF: Easy

9. Carbon has an atomic number of 6. One of its isotopes has a mass number of 14. The number of neutrons in this isotope is
   a. 6.
   b. 8.
   c. 14.
   d. 19.

   ANS: B PTS: 1 DIF: Medium

10. A period in the periodic table is
    a. represented by a column.
    b. vertical.
    c. the principal quantum number.
    d. determined by the valence electrons.

    ANS: C PTS: 1 DIF: Medium

11. In the excitation process, electrons in an atom are moved to a/an ____ energy state.
    a. lower
    b. higher
    c. incomplete
    d. all of the above

    ANS: B PTS: 1 DIF: Easy

12. The maximum number of electrons in a period with a principal quantum number of 4 is
    a. 6.
    b. 8.
    c. 18.
    d. 32.

    ANS: D PTS: 1 DIF: Medium

13. Isotopes have ____ mass numbers and ____ atomic numbers.
    a. the same; the same
    b. the same; different
    c. different; the same
    d. different; different

    ANS: C PTS: 1 DIF: Easy

14. In a vacuum, electromagnetic radiation
    a. has a velocity equal to the speed of light.
    b. x-ray energy may be bent by a crystalline lens.
    c. causes ionizations of air molecules.
    d. is altered by a strong magnetic field.

    ANS: A PTS: 1 DIF: Difficult

15. If the photon frequency of electromagnetic radiation is increased tenfold, then the
    a. velocity will increase times 10.
    b. velocity will decrease to 10.
    c. wavelength will increase times 10.
    d. wavelength will decrease to 1/10.

    ANS: D PTS: 1 DIF: Medium

16. Electromagnetic radiation with a frequency of 2,000 hertz would have a wavelength of
    a. 1/2,000 cm.
    b. 1.5×10^{-7} cm.
    c. 1.5×10^{7} cm.
    d. cannot be determined

ANS: C PTS: 1 DIF: Medium

17. The atomic number is the number of ____ contained in the nucleus.
    a. neutrons
    b. electrons
    c. protons
    d. positrons

    ANS: C PTS: 1 DIF: Easy

18. An isotope of boron has 5 protons and 6 neutrons. The atomic number of boron is
    a. 11.
    b. 10.
    c. 6.
    d. 5.

    ANS: D PTS: 1 DIF: Medium

19. An element with an atomic number of 22 has how many electrons in the second principal quantum number level (L shell)?
    a. 22
    b. 10
    c. 8
    d. 2

    ANS: C PTS: 1 DIF: Medium

20. Calculate the velocity of red light with a wavelength of approximately 4.0 nm (nm = 10^{-9}).
    a. 7.5×10^{-1} nm/sec
    b. 7.5×10^{18} nm/sec
    c. 1.2×10^{-17} nm/sec
    d. 1.2×10^{1} nm/sec

    ANS: B PTS: 1 DIF: Difficult

21. The nuclear particles that distinguish one element from another are the
    a. neutrons.
    b. protons.
    c. gamma particles.
    d. beta particles.

    ANS: B PTS: 1 DIF: Medium

22. An atom has an atomic number of 18 and a mass number of 38. Letting P = the number of protons and N = the number of neutrons, which of the following atoms is the isotope of this atom?
    a. P = 18, N = 20
    b. P = 18, N = 21
    c. P = 20, N = 18
    d. none of the above

    ANS: B PTS: 1 DIF: Difficult

23. If the frequency of a wave is 1,000 hertz and is traveling at 50,000 m/sec, then its wavelength is
    a. 0.05 m.
    b. 0.5 m.
    c. 5 m.
    d. 50 m.

    ANS: D PTS: 1 DIF: Difficult

24. According to the “rule of octets”
    a. eight energy levels have electrons.
    b. eight protons occupy the outermost shell.
    c. the valence shell is chemically inert.
    d. both a and c

    ANS: C PTS: 1 DIF: Difficult

25. Which of the following is not a basic characteristic of the wave equation?
    a. velocity
    c. frequency

b. wavelength
d. energy

ANS: D PTS: 1 DIF: Medium

26. If an electron is gained or lost from an atom, that atom becomes
a. an ion.
c. an isotope.
b. a new element.
d. unstable.

ANS: A PTS: 1 DIF: Easy

27. All of the following are energy forms **EXCEPT**
a. sound.
c. electrical.
b. thermal.
d. nuclear.

ANS: A PTS: 1 DIF: Medium

28. Quarks may behave according to the ____ theory.
a. string
c. relativity
b. quantum
d. electromagnetic

ANS: A PTS: 1 DIF: Medium

29. All of the following are true of the substance glucose ($C_6H_{12}O_6$) **EXCEPT**:
a. The smallest subdivision of this molecule is glucose.
b. It is a compound.
c. It consists of three elements.
d. It may be broken down into one atom of glucose.

ANS: D PTS: 1 DIF: Difficult

30. When comparing iodine (Z=53) with barium (Z=56),
a. barium has a lower k-shell binding energy.
b. iodine has more neutrons.
c. iodine has five (5) orbitals with electrons.
d. barium has fewer protons.

ANS: C PTS: 1 DIF: Difficult

MATCHING

Match the following atomic structure characteristics with the correct statement or definition.

a. electron
b. neutron
c. proton
d. binding energy
e. kinetic energy
f. atomic mass
g. atomic number
h. isotope

1. entirely concentrated in the nucleus
2. increases as the number of electrons and protons increases
3. A change in the number of these changes the identity of the element.
4. possesses a negative charge and minute mass
5. A gain or loss of this atomic particle creates an isotope.
6. Electrons moving around in specific orbitals demonstrates this energy.

1. ANS: F PTS: 1 DIF: Medium
2. ANS: D PTS: 1 DIF: Medium

3. ANS: C PTS: 1 DIF: Medium
4. ANS: A PTS: 1 DIF: Medium
5. ANS: B PTS: 1 DIF: Medium
6. ANS: E PTS: 1 DIF: Medium

Match the following items relating to the periodic table with the correct statement.

a. tungsten
b. valence
c. molybdenum
d. iodine
e. barium
f. lead
g. families (groups)
h. periods

7. elements having the same chemical characteristics
8. Its k-shell binding energy is -33.17 keV.
9. It is determined by the number of electrons in the outermost shell of an atom.
10. It has a mass number of 207.
11. Elements having the same principal quantum number are in this order.
12. an "L" to "K" transition would yield 31.45 keV of energy

7. ANS: G PTS: 1 DIF: Difficult
8. ANS: D PTS: 1 DIF: Difficult
9. ANS: B PTS: 1 DIF: Difficult
10. ANS: F PTS: 1 DIF: Difficult
11. ANS: H PTS: 1 DIF: Difficult
12. ANS: E PTS: 1 DIF: Difficult

Match the following items relating to the electromagnetic spectrum with the correct statement.

a. infrared energy
b. gamma rays
c. radio waves
d. ultraviolet energy
e. excitation
f. lambda
g. amplitude
h. velocity

13. the transference of energy to an atom
14. can be long wavelengths in kilometers
15. an expression of wavelength
16. the product of frequency and wavelength
17. expressed as the height of the wave
18. highly penetrating based upon frequency

13. ANS: E PTS: 1 DIF: Medium
14. ANS: C PTS: 1 DIF: Medium
15. ANS: F PTS: 1 DIF: Medium
16. ANS: H PTS: 1 DIF: Medium
17. ANS: G PTS: 1 DIF: Medium
18. ANS: B PTS: 1 DIF: Medium