6.1 Multiple-Choice and Bimodal Questions

1) Electromagnetic radiation travels through vacuum at a speed of _____ m/s.

A) 186,000
B) 125
C) 3.00×10^{8}
D) 10,000
E) It depends on wavelength.

2) The wavelength of light that has a frequency of $1.20\times10^{13}\,s^{-1}$ is _____ m.

A) 25.0
B) 2.50×10^{-5}
C) 0.0400
D) 12.0
E) 2.5

3) Ham radio operators often broadcast on the 6-meter band. The frequency of this electromagnetic radiation is _____ MHz.

A) 500
B) 200
C) 50
D) 20
E) 2.0

4) What is the frequency (s^{-1}) of electromagnetic radiation that has a wavelength of 0.53 m?

A) 5.7×10^{8}
B) 1.8×10^{-9}
C) 1.6×10^{8}
D) 1.3×10^{-33}
E) 1.3×10^{33}

5) The energy of a photon of light is _____ proportional to its frequency and _____ proportional to its wavelength.

A) directly, directly
B) inversely, inversely
C) inversely, directly
D) directly, inversely
E) indirectly, not

6) Of the following, _____ radiation has the shortest wavelength.

A) X-ray
B) radio
C) microwave
D) ultraviolet
E) infrared

7) What is the frequency of light (s^{-1}) that has a wavelength of $1.23\times10^{-6}\,cm$?

A) 3.69
B) 2.44×10^{16}
C) 4.10×10^{-17}
D) 9.62×10^{12}
E) 1.04×10^{-13}

8) What is the frequency of light (s^{-1}) that has a wavelength of $3.12\times10^{-13}\,cm$?

A) 3.69
B) 2.44×10^{16}
C) 9.62×10^{12}
D) 4.10×10^{-17}
E) 1.04×10^{-13}

9) What is the wavelength of light (nm) that has a frequency of $3.22\times10^{14}\,s^{-1}$?

A) 932
B) 649
C) 9.66×10^{22}
D) 9.32×10^{-7}
E) 1.07×10^{6}

10) What is the wavelength of light (nm) that has a frequency $4.62\times10^{14}\,s^{-1}$?

A) 932

B) 649
C) 1.39×10^{23}
D) $1.54\ \times10^{-3}$
E) 1.07×10^{6}

11) The wavelength of a photon that has an energy of 5.25×10^{-19} J is _____ m.

A) 3.79×10^{-7}
B) 2.64×10^{6}
C) 2.38×10^{23}
D) 4.21×10^{-24}
E) 3.79×10^{7}

12) The energy of a photon that has a wavelength of 9.0 m is _____ J.

A) 2.2×10^{-26}
B) 4.5×10^{25}
C) 6.0×10^{-23}
D) 2.7×10^{9}
E) 4.5×10^{-25}

13) The frequency of a photon that has an energy of 3.7×10^{-18} J is _____ s^{-1}.

A) 5.6×10^{15}
B) 1.8×10^{-16}
C) 2.5×10^{-15}
D) 5.4×10^{-8}
E) 2.5×10^{15}

14) The energy of a photon that has a wavelength of 12.3 nm is _____ J.

A) 1.51×10^{-17}
B) 4.42×10^{-23}
C) 1.99×10^{-25}
D) 2.72×10^{-50}
E) 1.62×10^{-17}

15) The energy of a photon that has a wavelength of 13.2 nm is _____ J.

A) 9.55×10^{-25}
B) 1.62×10^{-17}
C) 1.99×10^{-25}
D) 4.42×10^{-23}
E) 1.51×10^{-17}

16) The energy of a photon that has a frequency of $8.21\times10^{15}s^{-1}$ is _____ J.

A) 8.08×10^{-50}
B) 1.99×10^{-25}
C) 5.44×10^{-18}
D) 1.24×10^{49}
E) 1.26×10^{-19}

17) The energy of a photon that has a frequency of $1.821\times10^{16}s^{-1}$ is _____ J.

A) 5.44×10^{-18}
B) 1.99×10^{-25}
C) 3.49×10^{-48}
D) 1.21×10^{-17}
E) 5.44×10^{-18}

18) What is the frequency (s^{-1}) of a photon that has an energy of 4.38×10^{-18} J?

A) 436
B) 6.61×10^{15}
C) 1.45×10^{-16}
D) 2.30×10^{7}
E) 1.31×10^{-9}

19) What is the wavelength (angstroms) of a photon that has an energy of 4.38×10^{-18} J?

A) 454
B) 2.30×10^{7}
C) 6.89×10^{15}
D) 1.45×10^{-16}
E) 1.31×10^{-9}

20) A mole of red photons of wavelength 725 nm has _____ kJ of energy.

A) 2.74×10^{-19}
B) 4.56×10^{-46}
C) 6.05×10^{-3}
D) 165
E) 227

21) A mole of yellow photons of wavelength 527 nm has _____ kJ of energy.

A) 165
B) 227
C) 4.56×10^{-46}
D) 6.05×10^{-3}
E) 2.74×10^{-19}

22) It takes 254 kJ/mol to eject electrons from a certain metal surface. What is the longest wavelength of light (nm) that can be used to eject electrons from the surface of this metal via the photoelectric effect?

A) 471
B) 233
C) 165
D) 725
E) 552

23) Of the following, _____ radiation has the longest wavelength and _____ radiation has the greatest energy.
gamma ultraviolet visible

A) ultraviolet, gamma
B) visible, ultraviolet
C) gamma, gamma
D) visible, gamma
E) gamma, visible

24) What color of visible light has the longest wavelength?

A) blue
B) violet
C) red
D) yellow
E) green

25) Of the following, _____ radiation has the shortest wavelength and _____ radiation has the greatest energy.
gamma ultraviolet visible

A) gamma, visible
B) visible, gamma
C) visible, ultraviolet
D) ultraviolet, gamma
E) gamma, gamma

26) What color of visible light has the highest energy?

A) violet
B) blue
C) red
D) green
E) yellow

27) Which one of the following is considered to be ionizing radiation?

A) visible light
B) radio waves
C) X-rays
D) microwaves
E) infrared radiation

28) Of the following transitions in the Bohr hydrogen atom, the _____ transition results in the emission of the highest-energy photon.

A) $n = 1 \rightarrow n = 6$
B) $n = 6 \rightarrow n = 1$
C) $n = 6 \rightarrow n = 3$
D) $n = 3 \rightarrow n = 6$
E) $n = 1 \rightarrow n = 4$

29) Using Bohr's equation for the energy levels of the electron in the hydrogen atom,

determine the energy (J) of an electron in the n = 4 level.

A) -1.36×10^{-19}
B) -5.45×10^{-19}
C) -7.34×10^{18}
D) -1.84×10^{-29}
E) $+1.84\times10^{-29}$

30) An electron in a Bohr hydrogen atom has an energy of -1.362×10^{-19} J The value of n for this electron is _____.

A) 1
B) 2
C) 3
D) 4
E) 5

31) The energy (J) required for an electronic transition in a Bohr hydrogen atom from n = 2 to n = 3 is _____ J.

A) 4.00×10^{-19}
B) 3.00×10^{-19}
C) -3.00×10^{-19}
D) -7.90×10^{-19}
E) 4.60×10^{14}

32) Calculate the energy (J) change associated with an electron transition from n = 2 to n = 5 in a Bohr hydrogen atom.

A) 6.5×10^{-19}
B) 5.5×10^{-19}
C) 8.7×10^{-20}
D) 4.6×10^{-19}
E) 5.8×10^{-53}

33) The frequency of electromagnetic radiation required to promote an electron from n = 2 to n = 4 in a Bohr hydrogen atom is _____ Hz.

A) 4.13×10^{-19}
B) 6.17×10^{14}
C) 5.46×10^{-19}
D) 8.22×10^{14}
E) 4.13×10^{19}

34) A spectrum containing only specific wavelengths is called a _____ spectrum.

A) line
B) continuous
C) visible
D) Rydberg
E) invariant

35) When the electron in a hydrogen atom moves from n = 6 to n = 2, light with a wavelength of _____ nm is emitted.

A) 93.8
B) 434
C) 487
D) 657
E) 410

36) When the electron in a hydrogen atom moves from n = 6 to n = 1, light with a wavelength of _____ nm is emitted.

A) 487
B) 411
C) 434
D) 93.8
E) 657

37) When the electron in a hydrogen atom moves from n = 8 to n = 2 light with a wavelength of _____ nm is emitted.

A) 657
B) 93.8
C) 411
D) 487
E) 389

38) The n = 2 to n = 6 transition in the Bohr hydrogen atom corresponds to the _____ of a photon with a wavelength of _____

nm.

A) emission, 410
B) absorption, 410
C) absorption, 660
D) emission, 94
E) emission, 390

39) The n = 5 to n = 3 transition in the Bohr hydrogen atom corresponds to the _____ of a photon with a wavelength of _____ nm.

A) absorption, 657
B) absorption, 1280
C) emission, 657
D) emission, 1280
E) emission, 389

40) The n = 8 to n = 4 transition in the Bohr hydrogen atom occurs in the _____ region of the electromagnetic spectrum.

A) infrared
B) visible
C) ultraviolet
D) microwave
E) X-ray

41) The n = 8 to n = 2 transition in the Bohr hydrogen atom occurs in the _____ region of the electromagnetic spectrum.

A) radio
B) X-ray
C) infrared
D) microwave
E) ultraviolet

42) The deBroglie wavelength of a particle is given by _____.

A) $h + mv$
B) hmv
C) h/mv
D) mv/c
E) mv

43) What is the de Broglie wavelength (m) of a 2.0 kg object moving at a speed of 50 m/s?

A) 6.6×10^{-36}
B) 1.5×10^{35}
C) 5.3×10^{-33}
D) 2.6×10^{-35}
E) 3.8×10^{34}

44) What is the de Broglie wavelength (m) of a 25 g object moving at a speed of 5.0 m/s?

A) 1.9×10^{32}
B) 5.3×10^{-33}
C) 6.6×10^{-36}
D) 3.32×10^{-36}
E) 3.02×10^{45}

45) At what speed (m/s) must a 10.0 mg object be moving to have a de Broglie wavelength of 3.3×10^{-41} m ?

A) 4.1
B) 1.9×10^{-11}
C) 2.0×10^{12}
D) 3.3×10^{-42}
E) 9.1×10^{31}

46) At what speed (m/s) must a 3.0 mg object be moving in order to have a de Broglie wavelength of 5.4×10^{-29} m?

A) 1.6×10^{-28}
B) 3.9×10^{-4}
C) 2.0×10^{12}
D) 4.1
E) 6.3

47) The de Broglie wavelength of an electron is 8.7×10^{-11} m . The mass of an electron is 9.1×10^{-31} kg . The velocity of this electron is _____ m/s.

A) 8.4×10^{3}
B) 1.2×10^{-7}
C) 6.9×10^{-5}
D) 8.4×10^{6}
E) 8.4×10^{-3}

48) The de Broglie wavelength of a bullet (7.5 g) traveling at 700 m/s is _____ m.

A) 7.7×10^{33}
B) 1.3×10^{-34}
C) 6.2×10^{-29}
D) 1.3×10^{-27}
E) 1.3×10^{-23}

49) The de Broglie wavelength of a car $(1.0\times10^{3}\,\text{kg})$ traveling at 75 km/hr is _____ m.

A) 3.2×10^{-38}
B) 8.8×10^{-39}
C) 3.2×10^{-35}
D) 1.4×10^{-35}
E) 1.4×10^{35}

50) The wavelength of an electron whose velocity is $1.7\times10^{4}\,\text{m/s}$ and whose mass is $9.1\times10^{-28}\,\text{g}$ is _____ m.

A) 4.3×10^{-11}
B) 12
C) 4.3×10^{-8}
D) 2.3×10^{7}
E) 2.3×10^{-7}

51) The _____ quantum number defines the shape of an orbital.

A) spin
B) magnetic
C) principal
D) magnetic
E) phi

52) There are _____ orbitals in the third shell.

A) 25
B) 4
C) 9
D) 16
E) 1

53) The _____ subshell contains only one orbital.

A) 5d
B) 6f
C) 4s
D) 3d
E) 1p

54) There are _____ orbitals in the second shell.

A) 1
B) 2
C) 4
D) 8
E) 9

55) The azimuthal quantum number is 3 in _____ orbitals.

A) s
B) p
C) d
D) f
E) a

56) The n = 1 shell contains _____ p orbitals. All the other shells contain _____ p orbitals.

A) 3, 6
B) 0, 3
C) 6, 2
D) 3, 3
E) 0, 6

57) The lowest energy shell that contains f orbitals is the shell with n = _____.

A) 3
B) 2
C) 4
D) 1
E) 5

58) The principal quantum number of the first d subshell is _____.

A) 1
B) 2
C) 3
D) 4
E) 0

59) The total number of orbitals in a shell is given by _____.

A) I^2
B) n^2
C) $2n$
D) $2n+1$
E) $2l+1$

60) In a hydrogen atom, an electron in a _____ orbital can absorb a photon, but cannot emit a photon.

A) 3s
B) 2s
C) 3p
D) 1s
E) 3f

61) _____-orbitals are spherically symmetrical.

A) s
B) p
C) d
D) f
E) g

62) How many p-orbitals are occupied in a Ne atom?

A) 5
B) 6
C) 1
D) 3
E) 2

63) Each p-subshell can accommodate a maximum of _____ electrons.

A) 6
B) 2
C) 10
D) 3
E) 5

64) How many quantum numbers are necessary to designate a particular electron in an atom?

A) 3
B) 4
C) 2
D) 1
E) 5

65) A _____ orbital is degenerate with a $5d_{z^2}$ in a many-electron atom.

A) $5p_z$
B) $4d_{z^2}$
C) 5s
D) $5d_{xy}$
E) $4d_{zz}$

66) The 3p subshell in the ground state of atomic xenon contains _____ electrons.

A) 2
B) 6
C) 8
D) 10
E) 36

67) The second shell in the ground state of atomic argon contains _____ electrons.

A) 2
B) 6
C) 8
D) 18
E) 36

68) The 4d subshell in the ground state of atomic xenon contains _____ electrons.

A) 2
B) 6
C) 8
D) 10
E) 36

69) $[Ar]4s^2 3d^{10} 4p^3$ is the electron configuration of a(n) _____ atom.

A) As
B) V
C) P
D) Sb
E) Sn

70) There are _____ unpaired electrons in a ground state phosphorus atom.

A) 0
B) 1
C) 2
D) 3
E) 4

71) There are _____ unpaired electrons in a ground state fluorine atom.

A) 0
B) 1
C) 2
D) 3
E) 4

72) In a ground-state manganese atoms, the _____ subshell is partially filled.

A) 3s
B) 4s
C) 4p
D) 3d
E) 4d

73) The principal quantum number for the outermost electrons in a Br atom in the ground state is _____.

A) 2
B) 3
C) 4
D) 5
E) 1

74) The azimuthal quantum number for the outermost electrons in a nitrogen atom in the ground state is _____.

A) 0
B) 1
C) 2
D) 3
E) -1

75) The electron configuration of a ground-state Ag atom is _____.

A) $[Ar]4s^2 4d^9$
B) $[Kr]5s^1 4d^{10}$
C) $[Kr]5s^2 3d^9$
D) $[Ar]4s^1 4d^{10}$
E) $[Kr]5s^2 4d^{10}$

76) The ground state electron configuration for Zn is _____.

A) $[Kr]4s^2 3d^{10}$
B) $[Ar]4s^2 3d^{10}$
C) $[Ar]4s^1 3d^{10}$
D) $[Ar]3s^2 3d^{10}$
E) $[Kr]3s^2 3d^{10}$

77) Which is the correct ground-state electron configuration for silver?

A) $[Kr]5s^2 4d^9$
B) $[Kr]5s^1 4d^{10}$
C) $[Kr]5s^2 4d^{10}$
D) $[Xe]5s^2 4d^9$
E) $[Xe]5s^1 4d^{10}$

78) What is the correct ground-state electron configuration for molybdenum?

A) $[Kr]5s^1 4d^{10}$
B) $[Kr]5s^2 4d^4$
C) $[Kr]5s^1 4d^5$
D) $[Kr]5s^2 4d^9$
E) $[Kr]5s^2 4d^9$

79) All of the _____ have a valence shell electron configuration ns^1.

A) noble gases
B) halogens
C) chalcogens
D) alkali metals
E) alkaline earth metals

80) The elements in the _____ period of the periodic table have a core-electron configuration that is the same as the electron configuration of neon.

A) first
B) second
C) third
D) fourth
E) fifth

81) The largest principal quantum number in the ground state electron configuration of iodine is _____.

A) 1
B) 4
C) 5
D) 6
E) 7

82) The largest principal quantum number in the ground state electron configuration of barium is _____.

A) 1
B) 2
C) 4
D) 5
E) 6

83) The largest principal quantum number in the ground state electron configuration of cobalt is _____.

A) 2
B) 3
C) 4
D) 7
E) 9

84) Elements in group _____ have a np^6 electron configuration in the outer shell.

A) 4A
B) 6A
C) 7A
D) 8A
E) 5A

85) Which group in the periodic table contains elements with the valence electron configuration of ns^2np^1?

A) 1A
B) 2A
C) 3A
D) 4A
E) 8A

6.2 Multiple-Choice Questions

Chemistry, 11e (Brown/LeMay/Bursten/Murphy)
Chapter 6: Electronic Structure of Atoms

1) Which one of the following is correct?

A) $\nu + \lambda = c$
B) $\nu \div \lambda = c$
C) $\nu = c\lambda$
D) $\lambda = c\nu$
E) $\nu\lambda = c$

2) The photoelectric effect is _____.

A) the total reflection of light by metals giving them their typical luster
B) the production of current by silicon solar cells when exposed to sunlight
C) the ejection of electrons by a metal when struck with light of sufficient energy
D) the darkening of photographic film when exposed to an electric field
E) a relativistic effect

3) Low-frequency electromagnetic fields with potential biological effects have frequencies of _____ Hz.

A) 10^{-3} - 10^{-5}
B) 10^{-5} - 10^{-9}
C) 100 - 10,000
D) 400 - 700
E) 1 - 1000

4) The wavelength of light emitted from a traffic light having a frequency of 5.75×10^{14} Hz is _____.

A) 702 nm
B) 641 nm
C) 674 nm
D) 521 nm
E) 583 nm

5) A radio station broadcasts at 103.5 MHz . The wavelength of the signal is _____ m.

A) 3.10
B) 2.90
C) 4.71
D) 2.75
E) 3.84

6) In the Bohr model of the atom, _____.

A) electrons travel in circular paths called orbitals
B) electrons can have any energy
C) electron energies are quantized
D) electron paths are controlled by probability
E) both A and C

7) The de Broglie wavelength of a 6.0 gram bullet traveling at the speed of sound is _____. The speed of sound is 331 m/sec.

A) 2.7×10^{-34} m
B) 3.3×10^{-34} m
C) 3.35×10^{-33} m
D) 2.7×10^{-37} m
E) 6.6×10^{-31} m

8) According to the Heisenberg Uncertainty Principle, it is impossible to know precisely both the position and the _____ of an electron.

A) mass
B) color
C) momentum
D) shape
E) charge

9) The de Broglie wavelength of a _____ will have the shortest wavelength when traveling at 30 cm/s.

A) marble
B) car
C) planet
D) uranium atom
E) hydrogen atom

10) The uncertainty principle states that _____.

A) matter and energy are really the same thing

B) it is impossible to know anything with certainty
C) it is impossible to know the exact position and momentum of an electron
D) there can only be one uncertain digit in a reported number
E) it is impossible to know how many electrons there are in an atom

11) All of the orbitals in a given electron shell have the same value of the _____ quantum number.

A) principal
B) azimuthal
C) magnetic
D) spin
E) psi

12) All of the orbitals in a given subshell have the same value of the _____ quantum number.

A) principal
B) azimuthal
C) magnetic
D) A and B
E) B and C

13) Which one of the following is not a valid value for the magnetic quantum number of an electron in a 5d subshell?

A) 2
B) 3
C) 0
D) 1
E) -1

14) Which of the subshells below do not exist due to the constraints upon the azimuthal quantum number?

A) 2d
B) 2s
C) 2p
D) all of the above
E) none of the above

15) Which of the subshells below do not exist due to the constraints upon the azimuthal quantum number?

A) 4f
B) 4d
C) 4p
D) 4s
E) none of the above

16) An electron cannot have the quantum numbers n = _____, l = _____, m_l = _____.

A) 2, 0, 0
B) 2, 1, -1
C) 3, 1, -1
D) 1, 1, 1
E) 3, 2, 1

17) An electron cannot have the quantum numbers n = _____, l = _____, m_l = _____.

A) 6, 1, 0
B) 3, 2, 3
C) 3, 2, -2
D) 1, 0, 0
E) 3, 2, 1

18) Which one of the following is an incorrect subshell notation?

A) 4f
B) 2d
C) 3s
D) 2p
E) 3d

19) Which one of the following is an incorrect orbital notation?

A) 2s
B) $3p_y$

C) 3f
D) $4d_{xy}$
E) 4s

20) Which quantum number determines the energy of an electron in a hydrogen atom?

A) n
B) E
C) m_l
D) l
E) n and l

21) Which one of the quantum numbers does <u>not</u> result from the solution of the Schrodinger equation?

A) principal
B) azimuthal
C) magnetic
D) spin
E) angular momentum

22) Which quantum numbers must be the same for the orbitals that they designate to be degenerate in a one-electron system (such as hydrogen)?

A) n, l, and m_l
B) n and l only
C) l and m_l
D) m_l only
E) n only

23) In a p_x orbital, the subscript x denotes the _____ of the electron.

A) energy
B) spin of the electrons
C) probability of the shell
D) size of the orbital
E) axis along which the orbital is aligned

24) The _____ orbital is degenerate with $5p_y$ in a many-electron atom.

A) 5s
B) $5p_x$
C) $4p_y$
D) $5d_{xy}$
E) $5d^2$

25) Which set of three quantum numbers (n, l, m_l) corresponds to a 3d orbital?

A) 3, 2, 2
B) 3, 3, 2
C) 3, 2, 3
D) 2, 1, 0
E) 2, 3, 3

26) At maximum, an f-subshell can hold _____ electrons, a d-subshell can hold _____ electrons, and a p-subshell can hold _____ electrons.

A) 14, 10, 6
B) 2, 8, 18
C) 14, 8, 2
D) 2, 12, 21
E) 2, 6, 10

27) If an electron has a principal quantum number (n) of 3 and an azimuthal quantum number (l) of 2, the subshell designation is _____.

A) 3p
B) 3d
C) 4s
D) 4p
E) 4d

28) Which one of the following represents an acceptable set of quantum numbers for an electron in an atom? (arranged as n, l, m_l, and m_s)

A) 2, 2, -1, -1/2
B) 1, 0, 0, 1/2
C) 3, 3, 3, 1/2
D) 5, 4,- 5, 1/2

E) 3, 3, 3, -1/2

29) Which one of the following represents an acceptable possible set of quantum numbers (in the order n, l, m_l, and m_s) for an electron in an atom?

A) 2, 1, -1, 1/2
B) 2, 1, 0, 0
C) 2, 2, 0, 1/2
D) 2, 0, 1, -1/2
E) 2, 0, 2, +1/2

30) Which one of the following orbitals can hold two electrons?

A) $2p_x$
B) 3s
C) $4d_{xy}$
D) all of the above
E) none of the above

31) Which quantum numbers must be the same for the orbitals that they designate to be degenerate in a many-electron system?

A) n, l, and m_l
B) n only
C) n, l, m_l, and m_s
D) m_s only
E) n and l only

32) Which one of the following represents an impossible set of quantum numbers for an electron in an atom? (arranged as n, l, m_l, and m_s)

A) 2, 1, -1, -1/2
B) 1, 0, 0, 1/2
C) 3, 3, 3, 1/2
D) 5, 4, - 3, 1/2
E) 5, 4, -3, -1/2

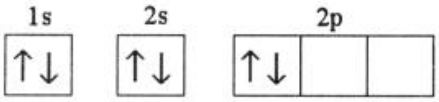
33) Which of the following is <u>not</u> a valid set of four quantum numbers? (n, l, m_l, m_s)

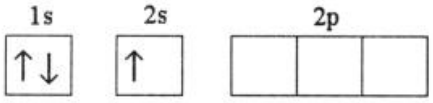
A) 2, 0, 0, +1/2
B) 2, 1, 0, -1/2
C) 3, 1, -1, -1/2
D) 1, 0, 0, +1/2
E) 1, 1, 0, +1/2

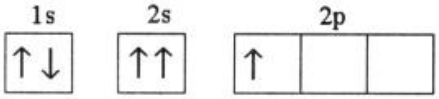
34) Which of the following is a valid set of four quantum numbers?(n, l, m_l, m_s)

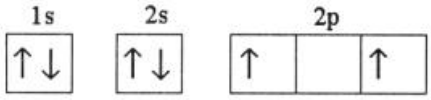
A) 2, 1, 0, +1/2
B) 2, 2, 1, -1/2
C) 1, 0, 1, +1/2
D) 2, 1, +2, +1/2
E) 1, 1, 0, -1/2

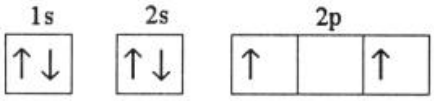
35) Which electron configuration represents a violation of the Pauli exclusion principle?

A) 

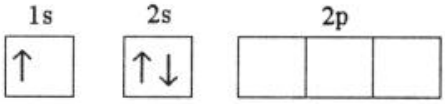
B) 

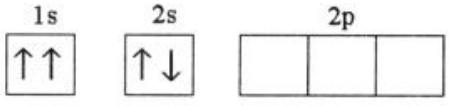
C) 

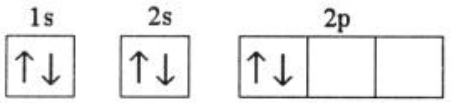
D) 

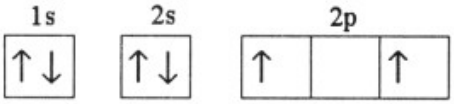
E) 

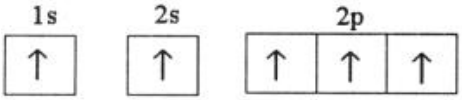
36) Which electron configuration represents a violation of the Pauli exclusion principle?

A) 

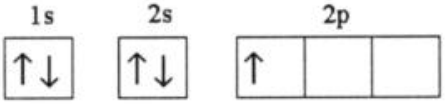
B) 

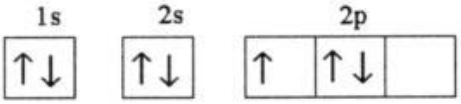
C) 

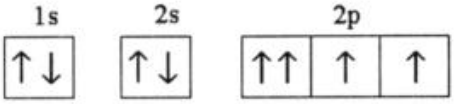
D) 

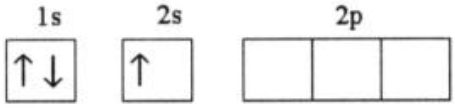
E) 

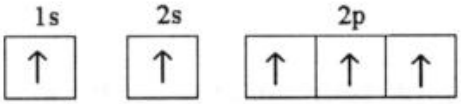
37) Which electron configuration represents a violation of the Pauli exclusion principle?

A) 

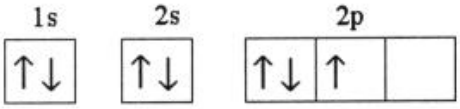
B) 

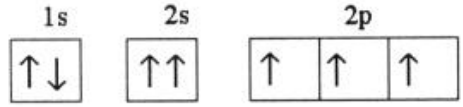
C) 

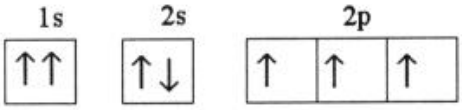
D) 

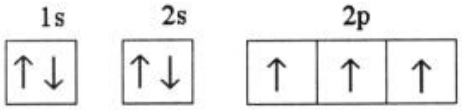
E) 

38) Which one of the following is the correct electron configuration for a ground-state nitrogen atom?

A) 

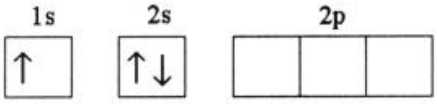
B) 

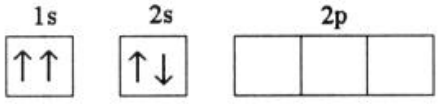
C) 

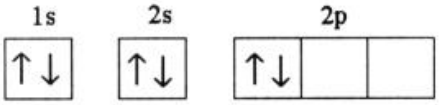
D) 

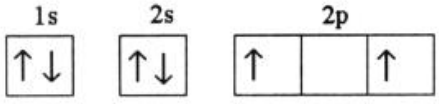
E) None of the above is correct.

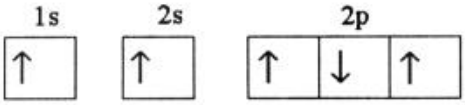
39) Which electron configuration denotes an atom in its ground state?

A) 

B) 

C) 

D) 

E) 

40) The ground state electron configuration of Fe is _____.

A) $1s^2 2s^2 3s^2 3p^6 3d^6$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^6$
E) $1s^2 2s^2 3s^2 3p^{10}$

41) The ground state electron configuration of Ga is _____.

A) $1s^2 2s^2 3s^2 3p^6 3d^{10} 4s^2 4p^1$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^1$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^1$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4d^1$
E) $[Ar] 4s^2 3d^{11}$

42) The ground-state electron configuration of the element _____ is $[kr]5s^1 4d^5$.

A) Nb
B) Mo
C) Cr
D) Mn
E) Tc

43) The ground-state electron configuration of _____ is $[Ar]4s^1 3d^5$

A) V
B) Mn
C) Fe
D) Cr
E) K

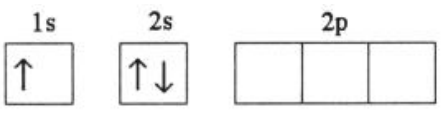
44) Which one of the following configurations depicts an excited oxygen atom?

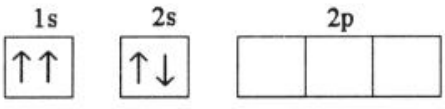
A) $1s^2 2s^2 2p^2$
B) $1s^2 2s^2 2p^2 3s^2$
C) $1s^2 2s^2 2p^1$
D) $1s^2 2s^2 2p^4$
E) $[He]2s^2 2p^4$

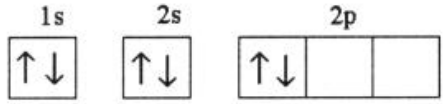
45) Which one of the following configurations depicts an excited carbon atom?

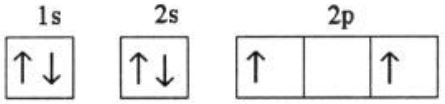
A) $1s^2 2s^2 2p^1 3s^1$
B) $1s^2 2s^2 2p^3$
C) $1s^2 2s^2 2p^1$
D) $1s^2 2s^2 3s^1$
E) $1s^2 2s^2 2p^2$

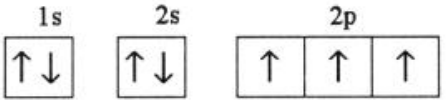
46) Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

A) 

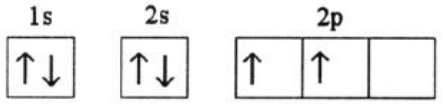
B) 

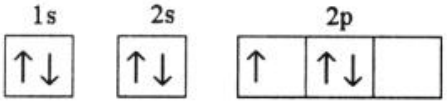
C) 

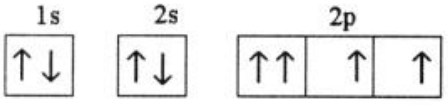
D) 

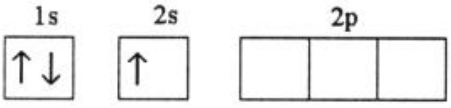
E) 

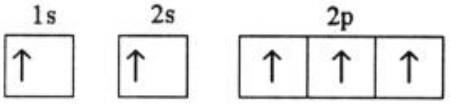
47) Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

A) 

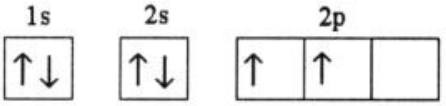
B) 

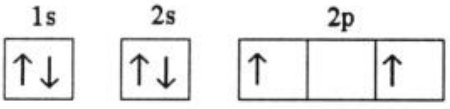
C) 

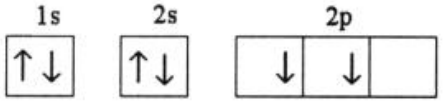
D) 

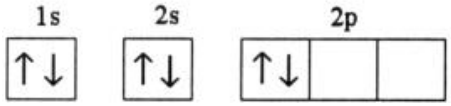
E) 

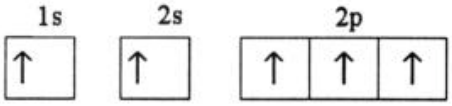
48) Which electron configuration represents a violation of Hund's rule for an atom in its ground state?

A) 

B) 

C) 

D) 

E) 

49) The ground state configuration of fluorine is _____.

A) $[He]2s^22p^2$
B) $[He]2s^22p^3$
C) $[He]2s^22p^4$
D) $[He]2s^22p^5$
E) $[He]2s^22p^6$

50) The ground state configuration of tungsten is _____.

A) $[Ar]4s^23d^3$
B) $[Xe]6s^24f^{14}5d^4$
C) $[Ne]3s^1$
D) $[Xe]6s^24f^7$
E) $[Kr]5s^24d^{10}5p^5$

51) The lowest orbital energy is reached when the number of electrons with the same spin is maximized. This statement describes _____.

A) Pauli Exclusion Principle
B) Planck's constant
C) deBroglie hypothesis
D) Heisenberg Uncertainty Principle
E) Hund's rule

52) The element that has a valence configuration of $4s^1$ is _____.

A) Li
B) Na
C) K
D) Rb
E) Cs

53) Which of the following elements has a ground-state electron configuration different from the predicted one?

A) Cu
B) Ca
C) Xe
D) Cl
E) Ti

54) Which two elements have the same ground-state electron configuration?

A) Pd and Pt
B) Cu and Ag
C) Fe and Cu
D) Cl and Ar
E) No two elements have the same ground-state electron configuration.

55) How many different principal quantum numbers can be found in the ground state electron configuration of nickel?

A) 2
B) 3
C) 4
D) 5
E) 6

56) The valence shell of the element X contains 2 electrons in a 5s subshell. Below that shell, element X has a partially filled 4d subshell. What type of element is X?

A) main group element
B) chalcogen
C) halogen
D) transition metal
E) alkali metal

6.3 Short Answer Questions

1) What wavelengths correspond to the visible region of the electromagnetic spectrum?

2) In the deBroglie formula describing the movement of an electron about the nucleus,

the quantity "mv" is called its _____.

3) A spectrum containing radiation of specific wavelengths is called a _____.

4) The shape of an orbital is defined by the azimuthal quantum number which is represented as letter _____

5) All of the subshells in a given shell have the same energy in the hydrogen atom. In a many-electron atom, the subshells in a given shell do not have the same energy. Why?

6) The largest principal quantum number in the ground state electron configuration of francium is _____.

7) The ground state electron configuration of scandium is _____.

8) The electron configuration of the valence electrons of an atom in its ground state is ns^2np^3. This atom is a group _____ element.

9) Elements in group _____ have a np^5 electron configuration in the outer shell.

10) The ground state electron configuration of copper is _____.

6.4 True/False Questions

1) The wavelength of radio waves can be longer than a football field.

2) Black body radiation is the emission of light from metal surfaces.

3) If a hydrogen atom electron jumps from the n=6 orbit to the n=2 orbit, energy is released.

4) The square of Schrodinger's wave equation is called an orbital.

5) The electron density of the 2s orbital is asymmetric.

6) The larger the principal quantum number of an orbital, the lower is the energy of the electrons in that orbital.

7) When the value of n is greater than or equal to 3, electrons can reside in d orbitals.

8) An NMR spectrum results from photon irradiation in which the nuclear spin alignment is flipped.

6.5 Algorithmic Questions

1) Electromagnetic radiation with a wavelength of 525 nm appears as green light to the human eye. The frequency of this light is _____s^{-1}.

A) 5.71×10^{14}
B) 5.71×10^{5}
C) 1.58×10^{2}
D) 1.58×10^{11}
E) 1.75×10^{-15}

2) An FM radio station broadcasts electromagnetic radiation at a frequency of 100.6 MHz. The wavelength of this radiation is _____ m.

A) 2.982×10^{6}
B) 2.982
C) 3.018×10^{16}
D) 3.018×10^{10}
E) 0.3353

3) Electromagnetic radiation with a wavelength of 525 nm appears as green light to the human eye. The energy of one photon of this light is _____ J.

A) 1.04×10^{-31}
B) 3.79×10^{-28}
C) 3.79×10^{-19}

D) 1.04×10^{-22}
E) 2.64×10^{18}

4) Electromagnetic radiation with a wavelength of 531 nm appears as green light to the human eye. The energy of one photon of this light is 3.74×10^{-19} J Thus, a laser that emits 1.3×10^{-2} J of energy in a pulse of light at this wavelength produces _____ photons in each pulse.

A) 2.9×10^{-17}
B) 9.2×10^{-24}
C) 1.8×10^{19}
D) 3.5×10^{16}
E) 6.5×10^{13}

5) The de Broglie wavelength of an electron with a velocity of 6.00×10^{6} m/s is _____ m. The mass of the electron is 9.11×10^{-28} g

A) 8.25×10^{9}
B) 8.25×10^{12}
C) 1.21×10^{-16}
D) 1.21×10^{-13}
E) 1.21×10^{-10}

6) The element that corresponds to the electron configuration $1s^2 2s^2 2p^6$ is _____.

A) sodium
B) magnesium
C) lithium
D) beryllium
E) neon

7) The complete electron configuration of argon, element 18, is _____.

A) $1s^2 2s^2 2p^6 3s^2 3p^6$
B) $1s^2 2s^2 2p^{10} 3s^2 3p^2$
C) $1s^4 2s^4 2p^6 3s^4$
D) $1s^4 2s^4 2p^{10}$
E) $1s^6 2s^6 2p^2 3s^4$

8) The complete electron configuration of gallium, element 31, is _____.

A) $1s^2 2s^2 2p^{10} 3s^2 3p^{10} 4s^2 3d^3$
B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4P^1$
C) $1s^4 2s^4 2p^6 3s^4 3p^6 4s^4 3d^3$
D) $1s^4 2s^4 2p^{10} 3s^4 3p^9$
E) $1s^4 2s^4 2p^8 3s^4 3p^8 4s^3$

9) The condensed electron configuration of silicon, element 14, is _____.

A) $[He]2s^4 2p^6$
B) $[Ne]2p^{10}$
C) $[Ne]3s^2 3p^2$
D) $[He]2s^4$
E) $[He]2s^6 2p^2$

10) The condensed electron configuration of krypton, element 36, is _____.

A) $[Kr]4s^2 3d^8$
B) $[Ar]4s^4$
C) $[Kr]4s^4 3d^8$
D) $[Ar]3d^{10} 4s^2 4p^6$
E) $[Ar]4s^4 3d^4$