Atomic Structure Review Page

2010

Know the scientist and their contribution to the structure of the atom. Must know everything about Rutherford.

Be able to determine protons neutrons and electrons for atoms and ions.

Know what an isotope is.

Be able to interpret isotopic notation and other forms of writing atoms. i.e Carbon-13

^{13}C $^{13}_{6}C$

Be able to calculate atomic mass from isotopes of an element.

mass • % + mass • % / 100

Be able to determine the most abundant isotope from an atomic mass.

Closest to Atomic mass

Electron configurations-Principle energy levels, sublevels and orbital diagrams,

2-8-1 + s p d f + 7F

Know the definition of valance electron.

Be able to draw a Lewis Dot structure for atoms and ions.

Know how an emission spectrum is produced and how it is used in determining the composition of an unknown mixture.

Know what colors of the visible spectrum have more energy.

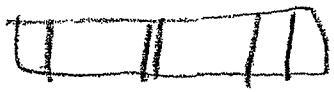
IR Roy G Biv UV

E

Know Pauli
Hund
Aufbau

Also Quantum #s

- Isoelectronic
- Shapes



Wave + Energy equations will be given

$c = \lambda \nu$

speed of light = wavelength × freq.

3×10^8 m/s

$E = h\nu$ or $E = \frac{hc}{\lambda}$

Planck 6.626×10^{-34} J·s

freq

Energy (J)

Page

the atom. Must know

ıs and ions.

ing atoms. i.e Carbon-13

^{13}C $^{13}_{6}C$

% / 100

ıic mass.

Closest to Atomic mass

orbital diagrams,

s p d f + $\boxed{7r}$

in determining the

Know Pauli

Hund

Aufbau

ıso Quantum #s

$E = \frac{hc}{\lambda}$

ıs

Name: _____

1) What Greek philosopher was the first person to propose the idea that matter is made of tiny individual particles called atoms?
   A) Rutherford B) Bohr C) Dalton D) Democritus

2) Which of the following statements is a part of Dalton's atomic theory?
   A) During a chemical reaction, atoms cannot be separated, combined, or rearranged.
   B) Atoms can be created or destroyed.
   C) All atoms of a given element are not identical.
   D) Different atoms combine in simple whole-number ratios to form compounds.

3) The development of the cathode ray tube led to the discovery of what subatomic particle?
   A) positron B) neutron C) electron D) proton

4) Electrons have the properties of
   A) particles only
   B) particles and waves
   C) neither particles nor waves
   D) waves only

5) Experimental evidence indicates that the nucleus of an atom
   A) contains a small percentage of the mass of the atom
   B) has a negative charge
   C) contains most of the mass of the atom
   D) has no charge

6) In an experiment, alpha particles were used to bombard gold foil. As a result of this experiment, the conclusion was made that the nucleus of an atom is
   A) smaller than the atom and negatively charged
   B) larger than the atom and negatively charged
   C) smaller than the atom and positively charged
   D) larger than the atom and positively charged

7) A region of *most* probable electron location in an atom is called
   A) a nucleon B) a nucleus C) a photon D) an orbital

8) Which particle has the *least* mass?
   A) a neutron B) a deuteron C) an electron D) a proton

9) What particle has a mass of approximately one atomic mass unit and a unit positive charge?
   A) an alpha particle B) a beta particle C) a neutron D) a proton

10) What particle is electrically neutral?
   A) neutron B) electron C) proton D) positron

11) Which two particles have approximately the same mass?
   A) proton and electron
   B) neutron and deuteron
   C) proton and neutron
   D) neutron and electron

12) What are the nucleons in an atom?
   A) neutrons and positrons
   B) neutrons and electrons
   C) protons and electrons
   D) protons and neutrons

13) What kind of particle, when passed through an electric field, would be attracted to the negative electrode?
   A) an alpha particle B) an electron C) a neutron D) a beta particle

14) All atoms of an element have the same
   A) atomic number
   B) atomic mass
   C) number of nucleons
   D) number of neutrons

15) A substance that is composed only of atoms having the same atomic number is classified as
   A) a compound
   B) a heterogeneous mixture
   C) an element
   D) a homogeneous mixture

16) As the number of neutrons in the nucleus of an atom increases, the nuclear charge of the atom
   A) remains the same B) decreases C) increases

17) Which atom has the *greatest* nuclear charge?

A) $^{4}_{2}He$ B) $^{2}_{1}H$ C) $^{12}_{6}C$ D) $^{14}_{7}N$

18) As an Na atom forms an Na^{+} ion, the number of protons in its nucleus

A) remains the same B) increases C) decreases

19) What is the total number of protons in an atom of ^{36}Cl?

A) 35 B) 36 C) 17 D) 18

20) An ion with 5 protons, 6 neutrons, and a charge of 3+ has an atomic number of

A) 5 B) 11 C) 8 D) 6

21) What is the symbol for an atom containing 20 protons and 22 neutrons?

A) $^{40}_{22}Ti$ B) $^{42}_{22}Ti$ C) $^{42}_{20}Ca$ D) $^{40}_{20}Ca$

22) Atomic mass is measured in atomic mass units (amu) that are based on an atom of

A) ^{14}N equal to 14.000 amu
B) ^{32}S equal to 32.000 amu
C) ^{12}C equal to 12.000 amu
D) ^{16}O equal to 16.000 amu

23) The mass number of an atom is equal to the number of

A) neutrons plus protons
B) electrons plus protons
C) neutrons, only
D) protons, only

24) In which pair of atoms do *both* nuclei contain the same number of neutrons?

A) $^{14}_{7}N$ and $^{16}_{8}O$ B) $^{40}_{20}Ca$ and $^{38}_{18}Ar$ C) $^{40}_{19}K$ and $^{40}_{17}Cl$ D) $^{7}_{3}Li$ and $^{9}_{4}Be$

25) What is the mass number of the atom below?

$^{3}_{1}H$

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

26) What is the mass number of an atom which contains 21 electrons, 21 protons, and 24 neutrons?

A) 66 B) 45 C) 42 D) 21

27) How many particles are contained in the nucleus of the following atom?

$^{226}_{88}Rn$

A) 88 electrons and 226 protons
B) 88 electrons and 226 neutrons
C) 88 protons and 138 electrons
D) 88 protons and 138 neutrons

28) If 75.0% of the isotopes of an element have a mass of 35.0 amu and 25.0% of the isotopes have a mass of 37.0 amu, what is the atomic mass of the element?

A) 37.0 amu B) 36.0 amu C) 35.5 amu D) 35.0 amu

29) A sample of Nitrogen contains 95% ^{14}N atoms, 3% ^{15}N atoms and 2% ^{16}N atoms. What is the average atomic mass of this sample?

A) 16 amu B) 15 amu C) 14 amu D) 13 amu

30) What is the average atomic mass of element *X* if a sample is composed of 85% ^{127}X, 12% ^{130}X, and 3% ^{128}X?

A) 129.0 amu B) 127.0 amu C) 127.4 amu D) 128.3 amu

31) Isotopes of the same element must also have the same

A) atomic number
B) number of neutrons
C) mass number
D) number of nucleons

32) As the mass number of the isotopes of hydrogen increases, the number of protons

A) increases B) decreases C) remains the same

33) Which pair of nuclei represent isotopes of the same element?

A) (1p 2n) and (2p 1n)

B) (5p 6n) and (7p 6n)

C) (3p 3n) and (3p 4n)

D) (10p 10n) and (11p 11n)

34) If *X* is the symbol of an element, which pair correctly represents isotopes of *X*?

A) $^{158}_{64}X$ and $^{158}_{64}X$

B) $^{158}_{64}X$ and $^{159}_{64}X$

C) $^{158}_{64}X$ and $^{158}_{65}X$

D) $^{64}_{158}X$ and $^{158}_{64}X$

35) Atoms of ^{16}O, ^{17}O, and ^{18}O have the same number of

A) neutrons, but a different number of protons
B) electrons, but a different number of protons
C) protons, but a different number of neutrons
D) protons, but a different number of electrons

36) Usually the term "kernel" includes *all* parts of the atom *except* the

A) orbital electrons B) protons C) neutrons D) valence electrons

37) An atom in the ground state contains 8 valence electrons. This atom is classified as a

A) halogen B) semimetal C) metal D) noble gas

38) What is the atomic number of an atom with six valence electrons?

A) 12 B) 10 C) 8 D) 6

39) What is the total number of valence electrons in an atom of phosphorus in the ground state?

A) 5 B) 2 C) 3 D) 7

40) What is the total number of valence electrons in an atom with the electron configuration 2-8-5?

A) 8 B) 5 C) 15 D) 2

41) A strontium atom differs from a strontium ion in that the atom has a *greater*

A) number of electrons
B) mass number
C) atomic number
D) number of protons

42) A K atom differs from a K^+ ion in that the K atom has one

A) more proton B) more electron C) less proton D) less electron

43) If *X* is the symbol of a noble gas atom in the ground state, its electron-dot symbol could be

A) :X: B) •X• C) X• D) X:

44) Which of the following is the electron-dot symbol for an atom with an electron configuration of 2-5?

A) •X: B) ••X: C) •X• D) •X•

45) Which of the following is the electron-dot symbol for an atom with an electron configuration of $1s^2 2s^2 2p^3$?

A) ••X: B) •X: C) •X• D) •X•

46) What is the correct electron-dot representation of an atom of sulfur in the ground state?

A) S: B) ·S: C) :S: D) ·S:

47) The electron-dot symbol :X:⁻ represents an ion of atom *X*. Atom *X* could be an atom of

A) K B) I C) S D) H

48) When the electrons of an excited atom fall back to lower levels, there is an emission of energy that produces

A) gamma radiation B) alpha particles C) spectral lines D) beta particles

49) The characteristic spectral lines of elements are caused when electrons in an excited atom move from

A) higher to lower energy levels, absorbing energy
B) lower to higher energy levels, absorbing energy
C) higher to lower energy levels, releasing energy
D) lower to higher energy levels, releasing energy

50) The characteristic bright-line spectrum of an atom is produced by its

A) electrons emitting quanta
B) protons emitting quanta
C) electrons absorbing quanta
D) protons absorbing quanta

51) Which electron transition represents the release of energy?

A) 1*s* to 3*p* B) 3*p* to 1*s* C) 2*p* to 3*s* D) 2*s* to 2*p*

52) Which electron transition is accompanied by the emission of energy?

A) 3*p* to 4*p* B) 2*s* to 2*p* C) 3*p* to 3*s* D) 1*s* to 2*s*

53) Which principal energy level change by the electron of a hydrogen atom will cause the *greatest* amount of energy to be absorbed?

A) $n = 2$ to $n = 5$ B) $n = 5$ to $n = 2$ C) $n = 2$ to $n = 4$ D) $n = 4$ to $n = 2$

54) The principal quantum number of the outermost electron of an atom in the ground state is $n = 3$. What is the total number of occupied principal energy levels contained in this atom?

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

55) If n represents the principal energy level, the maximum number of electrons possible in that principal energy level is equal to

A) $2n^2$ B) n^2 C) n D) $2n$

56) An atom of which element in the ground state has a complete outermost shell?

A) Hg B) H C) He D) Be

57) Given the electron configuration of an atom in the ground state: 2-8-6

This element is found in the Periodic Table in

A) Period 3 and Group 14
B) Period 4 and Group 14
C) Period 4 and Group 16
D) Period 3 and Group 16

58) Which represents the electron configuration of a silver atom in the ground state?

A) 2-8-18-17-2 B) 2-8-18-18-1 C) 2-8-6 D) 2-8-4

59) Which of the following is the electron configuration for Mg^{2+} ions?

A) 2-2 B) 2-8-8 C) 2-8 D) 2-8-2

60) When a calcium atom loses its valence electrons, the ion formed has an electron configuration which is the same as an atom of

A) Se B) K C) Ar D) Cl

61) Which electron configuration represents an atom in an excited state?

A) 2-8-2 B) 2-7-1 C) 2-8-1 D) 2-7

62) Which electron configuration represents a potassium atom in the excited state?

A) 2-8-7-2 B) 2-8-8-1 C) 2-8-5 D) 2-8-8

63) Which of the following is the electron configuration of an atom in the ground state?

A) $1s^2 2s^2 2p^5 3s^2$ B) $1s^2 2s^1 2p^2$ C) $1s^2 2s^2 2p^6 3s^1$ D) $1s^2 2s^2 3s^1$

64) What is the total number of valence electrons in an atom with the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^3$?

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

65) Which of the following is the electron configuration of an atom in the ground state that will *most* likely form an ion with a charge of 2+?

A) $1s^2$ B) $1s^2 2s^2$ C) $1s^2 2s^2 2p^6$ D) $1s^2 2s^1$

66) The total number of orbitals in a *d* sublevel is

A) 1 B) 5 C) 3 D) 7

67) The total number of orbitals in the 4*f* sublevel is

A) 1 B) 5 C) 3 D) 7

68) The total number of *d* orbitals in the third principal energy level is

A) 1 B) 5 C) 3 D) 7

69) What is the total number of orbitals in the third principal energy level?

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

70) What is the total number of sublevels in the second principal energy level?

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

71) What is the total number of sublevels in the third principal energy level?

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

72) What is the total number of occupied sublevels in an atom of chlorine in the ground state?

A) 1 B) 5 C) 3 D) 9

73) Which electron configuration contains three half-filled orbitals?

A) $1s^2 2s^2 2p^3$ B) $1s^2 2s^2 2p^4$ C) $1s^2 2s^2 2p^6$ D) $1s^2 2s^2 2p^5$

74) What is the maximum number of electrons in an energy level with a principal quantum number of 3?

A) 3 B) 9 C) 6 D) 18

75) What is the total number of electrons in the 2*p* sublevel of a chlorine atom in the ground state?

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

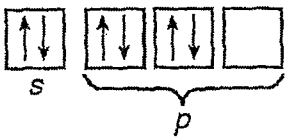
76) The atom of which element in the ground state has 2 unpaired electrons in the 2*p* sublevel?

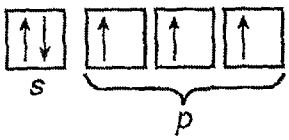
A) fluorine B) nitrogen C) carbon D) beryllium

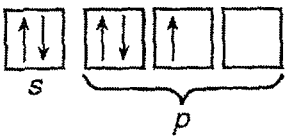
77) A neutral atom in the ground state contains 16 electrons. What is the total number of electrons in the 2*p* sublevel?

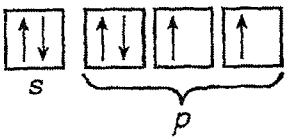
A) 16 B) 8 C) 6 D) 2

78) Which orbital notation correctly represents the outermost principal energy level of a sulfur atom in the ground state?

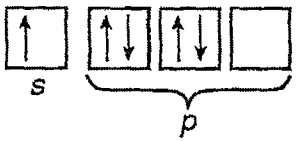
A) 

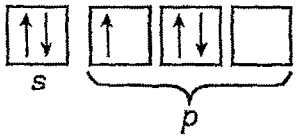
C) 

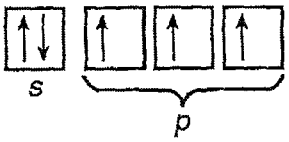
B) 

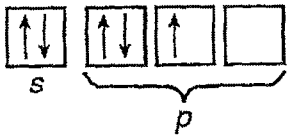
D) 

79) Which electron notation represents the valence electrons of a phosphorus atom in the ground state?

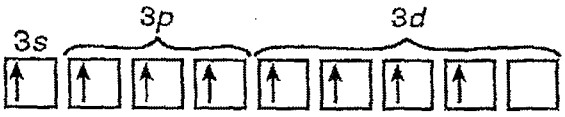
A) 

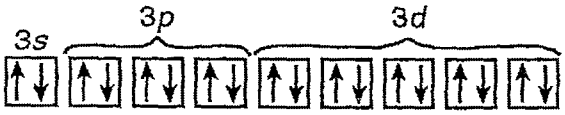
B) 

C) 

D) 

80) Which of the following is the orbital notation for the electrons in the third principal energy level of an argon atom in the ground state?

A) 

B) 

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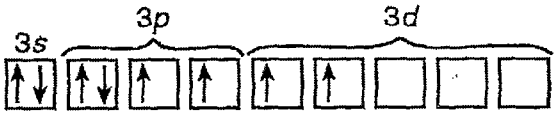
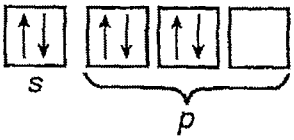
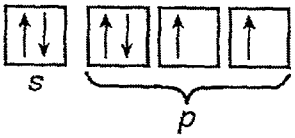
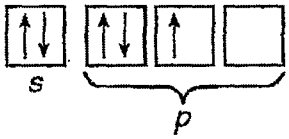
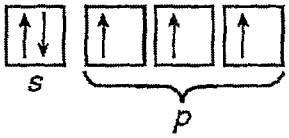
D) 

81) Which orbital notation correctly represents the outermost principal energy level of a nitrogen atom in the ground state?

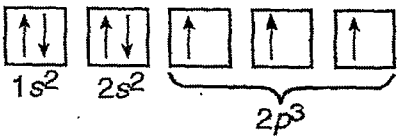
A) 

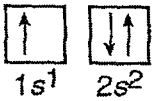
B) 

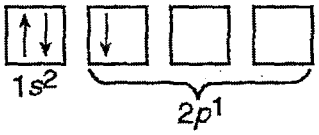
C) 

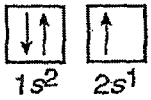
D) 

82) Which of the following is the correct orbital notation of a lithium atom in the ground state?

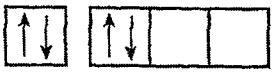
A) 

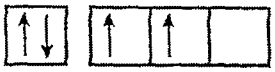
B) 

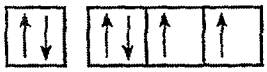
C) 

D) 

83) Which orbital notation represents the second principal energy level of a silicon atom in the ground state?

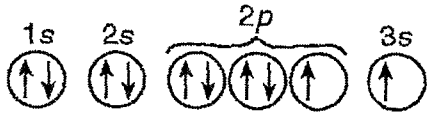
A) 

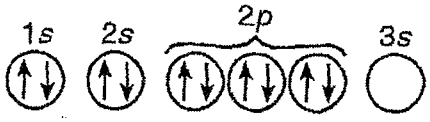
B) 

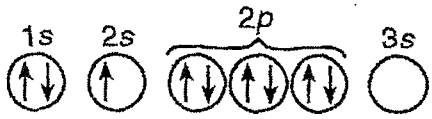
C) 

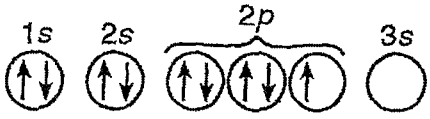
D) 

84) Which diagram correctly represents an atom of fluorine in an excited state?

A) 

B) 

C) 

D) 

85) The questions below refer to an atom of silicon.

(a) How many protons are in the nucleus of a silicon atom?

(b) Write the electron configuration for an atom of silicon in the ground state.

(c) Draw a Lewis electron-dot diagram for an atom of silicon.

(d) How does an atom of silicon become a Si^{4-} ion?

(e) What noble gas has the same electron configuration as Si^{4-}?

86) The questions below refer to a neutral atom in the ground state having the electron configuration 2-7.

(a) Name the element with this electron configuration.

(b) How many protons are contained in the nucleus of this atom?

(c) How many valence electrons does this element contain?

(d) What principal energy level do the valence electrons occupy?

(e) Write a possible electron configuration for this atom in the excited state.

1) D	2) D	3) C	4) B	5) C
6) C	7) D	8) C	9) D	10) A
11) C	12) D	13) A	14) A	15) C
16) A	17) D	18) A	19) C	20) A
21) C	22) C	23) A	24) B	25) C
26) B	27) D	28) C	29) C	30) C
31) A	32) C	33) C	34) B	35) C
36) D	37) D	38) C	39) A	40) B
41) A	42) B	43) D	44) A	45) B
46) B	47) B	48) C	49) C	50) A
51) B	52) C	53) A	54) C	55) A
56) C	57) D	58) B	59) C	60) C
61) B	62) A	63) C	64) A	65) B
66) B	67) D	68) B	69) B	70) B
71) C	72) B	73) A	74) D	75) D
76) C	77) C	78) D	79) C	80) C
81) D	82) D	83) B	84) C	

85) (a) 14; (b) 2-8-4 OR $1s^2 2s^2 2p^6 3s^2 3p^2$; (c) $\cdot\underset{\cdot}{\overset{\cdot}{\mathrm{Si}}}\cdot$; (d) by gaining $4e^-$; (e) Ar

86) (a) fluorine; (b) 9; (c) 7; (d) 2nd;
(e) Answers may vary.
SAMPLE ANSWER: 2-6-1

1. What is the maximum number of electrons that can occupy the second principal energy level? (1) 6 (2) 8 (3) 18 (4) 32

2. Compared to an atom of $^{12}_{6}C$, an atom of $^{14}_{6}C$ has (1) more protons (2) fewer protons (3) more neutrons (4) fewer neutrons

3. The characteristic bright-line spectrum of an element is produced when electrons (1) fall back to lower energy levels (2) are gained by a neutral atom (3) are emitted by the nucleus as beta particles (4) move to higher energy levels

4. How many electrons would be indicated in the electron-dot diagram of an atom with the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$? (1) 2 (2) 4 (3) 6 (4) 16

5. If atom X is represented by $^{12}_{6}X$ and atom Y is represented by $^{14}_{6}Y$, then X and Y are (1) isotopes of the same element (2) isotopes of different elements (3) ions of the same element (4) ions of different elements

6. When an atom goes from the excited state to the ground state, the total energy of the atom (1) decreases (2) increases (3) remains the same

7. Which of the following represents the electron configuration of an atom in the excited state? (1) $1s^1 2s^1$ (2) $1s^2 2s^2 2p^1$ (3) $1s^2 2s^2 2p^5$ (4) $1s^2 2s^2 2p^6 3s^1$

8. A sample of element X contains 90% ^{35}X atoms, 8% ^{37}X atoms, and 2% ^{36}X atoms. The average isotopic mass is closest to (1) 32 (2) 35 (3) 37 (4) 38

9. The atomic number of an atom is always equal to the total number of (1) neutrons in the nucleus (2) protons in the nucleus (3) neutrons plus protons in the atom (4) protons plus electrons in the atom

10. Which principal energy level can hold a maximum of 18 electrons? (1) 5 (2) 2 (3) 3 (4) 4

11. Which is the correct electron-dot representation of an atom of sulfur in the ground state?

(1) S: (2) ·S:

(3) :S: (4) ·S:

12. The total number of *d* orbitals in the third principal energy level is (1) 1 (2) 5 (3) 3 (4) 7

13. The "kernel" usually includes all parts of the atom except the (1) neutrons (2) protons (3) valence electrons (4) orbital electrons

14. The amount of energy required to remove the most loosely bound electron from an atom in the gaseous phase is called (1) kinetic energy (2) potential energy (3) ionization energy (4) electron affinity

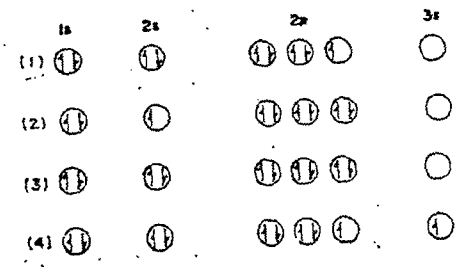
15. What is the total number of electrons in an atom with an atomic number of 13 and a mass number of 27? (1) 13 (2) 14 (3) 27 (4) 40

16. What is the maximum number of sublevels in the third principal energy level? (1) 1 (2) 2 (3) 3 (4) 4

17. The number of valence electrons in an atom with an electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^4$ is (1) 6 (2) 2 (3) 16 (4) 4

18. Which two particles have approximately the same mass? (1) neutron and electron (2) neutron and deuteron (3) proton and neutron (4) proton and electron

19. Which diagram correctly represents an atom of fluorine in an excited state?



20. The mass number of an atom is equal to the number of (1) neutrons, only (2) protons, only (3) neutrons plus protons (4) electrons plus protons

21. In an atom, the *s* sublevel has (1) 1 orbital (2) 5 orbitals (3) 3 orbitals (4) 7 orbitals

22. An atom of $^{226}_{88}Ra$ contains (1) 88 protons and 138 neutrons (2) 88 protons and 138 electrons (3) 88 electrons and 226 neutrons (4) 88 electrons and 226 protons

23. What is the maximum number of electrons that can occupy an orbital? (1) 1 (2) 2 (3) 3 (4) 6

24. Which electron configuration contains three half-filled orbitals? (1) $1s^2 2s^2 2p^6$ (2) $1s^2 2s^2 2p^5$ (3) $1s^2 2s^2 2p^3$ (4) $1s^2 2s^2 2p^4$

1. How many electrons are in a neutral atom of $^{7}_{3}Li$? (1) 7 (2) 10 (3) 3 (4) 4

2. The nucleus of a flourine atom has a charge of (1) 1+ (2) 9+ (3) 19+ (4) 0

1. Which is the electron configuration of a $^{2}_{1}H$ atom in the ground state? (1) $1s^1$ (2) $1s^2$ (3) $1s^2 2s^1$ (4) $1s^2 2s^2$

2. Which is the electron configuration of a noble gas atom in the excited state? (1) $1s^1$ (2) $1s^2 2s^1$ (3) $1s^2 2s^3$ (4) $1s^2 2s^2 2p^2$

3. Which electron configuration represents an atom in an excited state? (1) $1s^2 2s^2$ (2) $1s^2 3p^1$ (3) $1s^2 2s^2 2p^5$ (4) $1s^2 2s^2 2p^6$

4. Which electron configuration represents a neutral atom of nitrogen in an excited state? (1) $1s^2 2s^2 2p^3$ (2) $1s^2 2s^2 2p^4$ (3) $1s^2 2s^1 2p^4$ (4) $1s^2 2s^1 2p^5$

5. The characteristic bright-line spectrum of an element is produced when electrons (1) fall back to lower energy levels (2) are gained by a neutral atom (3) are emitted by the nucleus as beta particles (4) move to higher energy levels

6. When an electron in an atom of hydrogen moves from the second to the first principal energy level, the result is the emission of (1) a beta particle (2) an alpha particle (3) quantized energy (4) gamma rays

1 Which atom has an equal number of protons and neutrons?
(1) $^{1}_{1}H$ (3) $^{19}_{9}F$
(2) $^{12}_{6}C$ (4) $^{39}_{19}K$

2 The atomic mass unit is defined as exactly one-twelfth of the mass of an atom of:
(1) ^{12}C (3) ^{23}Na
(2) ^{11}B (4) ^{24}Mg

3 What is the total number of nucleons (protons and neutrons) in an atom of Se?
(1) 34 (3) 79
(2) 45 (4) 93

4 The atomic number of an atom is always equal to the total number of:
(1) neutrons in the nucleus
(2) protons in the nucleus
(3) neutrons plus protons in the atom
(4) protons plus electrons in the atom

5 Which of the following nuclei is an isotope of (10 p, 11 n)?
(1) (10 p, 9 n) (2) (11 p, 10 n) (3) (9 p, 11 n) (4) (11 p, 12 n)

6 Compared to an atom of $^{14}_{6}C$, an atom of $^{12}_{6}C$ has:
(1) more protons (3) more neutrons
(2) fewer protons (4) fewer neutrons

7 Which of the following atoms has the greatest nuclear charge?
(1) N (3) H
(2) C (4) He

8 Isotopes of the same element must differ in their:
(1) atomic number (3) number of electrons
(2) mass number (4) number of protons

9 An atom of potassium containing 23 neutrons has a mass number of:
(1) 19 (3) 23
(2) 20 (4) 42

10 Which particle has a negative charge?
(1) alpha particle (3) proton
(2) electron (4) neutron

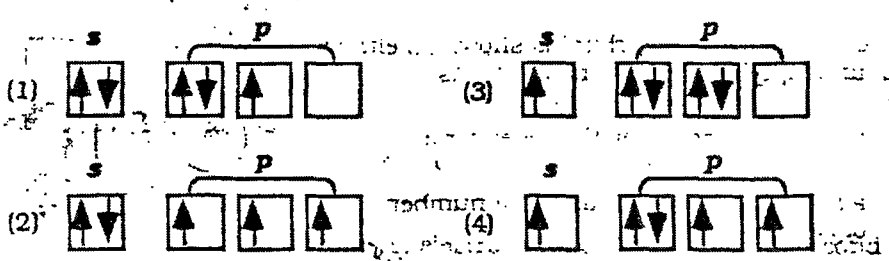
11 Which two particles have approximately the same mass?
(1) neutron and electron (3) proton and neutron
(2) neutron and deuteron (4) proton and electron

1 What is the electron configuration for Be^{2+} ions?
(1) $1s^1$ (3) $1s^2\,2s^1$
(2) $1s^2$ (4) $1s^2\,2s^2$

2 What is the electron configuration of an O^{2-} in the ground state?
(1) 2-4 (2) 2-8 (3) 2-8-4 (4) 2-8-8

3 The number of completely filled orbitals in a fluorine atom in the ground state is:
(1) 5 (2) 6 (3) 9 (4) 4

4 Which orbital notation represents the outermost principal energy level of a phosphorous atom in the ground state?



5 Which 1-mole sample of atoms requires the least energy to form a mole of positive ions?
(1) Ge (2) Ca (3) Ga (4) K

6 Which is the electron configuration of an atom in the excited state?
(1) $1s^2\,2s^1$ (3) $1s^2\,2s^2\,2p^5$
(2) $1s^2\,2s^2\,2p^1$ (4) $1s^2\,2s^2\,2p^5\,3s^1$

12. An atom of which element in the ground state contains electrons with a principal quantum number (n) of 4? (1) Kr (2) Ar (3) Ne (4) He
13. How many sublevels are completely occupied in the second principal energy level of a sodium atom in the ground state? (1) 1 (2) 2 (3) 3 (4) 4
14. How many occupied sublevels are in an atom of carbon in the ground state? (1) 5 (2) 6 (3) 3 (4) 4
15. In which subshell would an electron have the highest energy? (1) $3p$ (2) $2p$ (3) $3s$ (4) $4s$
16. How many electrons occupy the $2p$ sublevel in an atom of boron in the ground state? (1) 1 (2) 2 (3) 3 (4) 5
17. How many orbitals in a sulfur atom in the ground state contain only one electron? (1) 1 (2) 2 (3) 3 (4) 4
18. Which is the correct electron-dot symbol for a boron atom in the ground state? (1) B (2) $\cdot\dot{B}\cdot$ (3) $\dot{B}\cdot$ (4) $\cdot\dot{B}\cdot$
19. If the electron configuration of an atom of element X is $1s^2 2s^2 2p^1$, the electron-dot symbol for the element is
(1) $X:$ (2) $\cdot\dot{X}\cdot$ (3) $:\ddot{X}:$ (4) $\cdot\dot{X}:$
20. Which is the correct electron-dot symbol for the fluoride ion?
(1) $:\ddot{F}:^+$ (2) $:\ddot{F}:^+$ (3) $F:^-$ (4) $:\ddot{F}:^-$

1 When an atom goes from the excited state to the ground state, the total energy of the atom:
(1) decreases (2) increases (3) remains the same

2 What is the maximum number of electrons that can occupy the second principal energy level?
(1) 6 (2) 8 (3) 18 (4) 32

3 A neutral atom of an element has an electron configuration of 2-8-2. What is the total number of P electrons in this atom?
(1) 6 (2) 2 (3) 10 (4) 12

4 Which principal energy level can hold a maximum of 18 electrons?
(1) 5 (2) 2 (3) 3 (4) 4

---

5 Which electron transition is accompanied by the emission of energy?
(1) 1s to 2s (2) 2s to 2p (3) 3p to 3s (4) 3p to 4p

6 The total number of orbitals in the 4f sublevel is
(1) 1 (2) 5 (3) 3 (4) 7

7 The total number of *d* orbitals in the third principal energy level is:
(1) 1 (2) 5 (3) 3 (4) 7

8 What is the total number of electrons in an atom with an atomic number of 13 and a mass number of 27?
(1) 13 (2) 14 (3) 27 (4) 40

9 What is the maximum number of sublevels in the third principal energy level?
(1) 1 (2) 2 (3) 3 (4) 4

2. Electron configurations. Electron configurations of the atoms in order of their atomic numbers starting with hydrogen can be built up by adding one electron at a time according to the following rules:

a. No more than two electrons can be accommodated in any orbital.

b. The added electron is placed in the unfilled orbital of lowest energy.

c. The two electrons in an orbital have opposite spins.

d. In a given sublevel, according to Hund's rule, a 2nd electron is not added to an orbital until each orbital in the sublevel contains one electron.

e. No more than four orbitals are occupied in the outermost principal energy level of any atom except for palladium.

In an electron configuration, the number of electrons in a sublevel is shown by a superscript following the designation of the sublevel. For example:

Calcium is represented as: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ or (Ar) $4s^2$

Sulfur is represented as: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ or (Ne) $3s^2\ 3p^4$

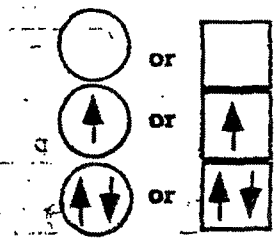
Missing in electron configuration notation is the manner in which the electrons are distributed in the orbitals. This is shown with diagrams called **orbital notation**. The diagrams have been depicted in the New York State Regents in different manners throughout the years.

In each instance, an orbital is shown as either:

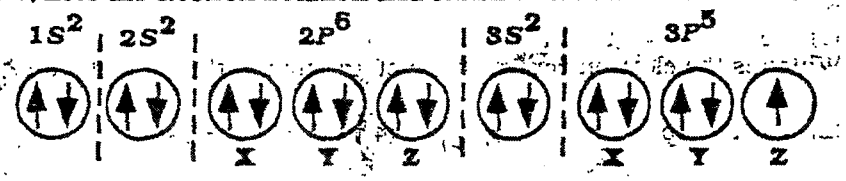
a. an empty orbital with no electrons

b. a half-filled orbital with one electron

c. a full orbital with a maximum number of two electrons



Below, note the electron notation and orbital notation of a chlorine atom:



3. The number of protons in the nucleus of carbon-13 is (1) 19 (2) 13 (3) 7 (4) 6

4. The mass number of an atom is equal to the total number of its (1) electrons; only (2) protons, only (3) electrons and protons (4) protons and neutrons

5. Which pair of atoms are isotopes? (1) $^{14}_{6}C$ and $^{14}_{7}N$ (2) $^{40}_{19}K$ and $^{40}_{18}Ar$ (3) $^{222}_{86}Rn$ and $^{222}_{88}Ra$ (4) $^{40}_{19}K$ and $^{39}_{19}K$

6. Which set of particles is arranged in order of increasing mass? (1) H_2, H, H^+ (2) H^+, H, H_2 (3) H_2, H^+, H (4) H, H^+, H_2

7. The existence of fractional atomic masses is best explained by the (1) mass of electrons (2) existence of isotopes (3) inaccuracies in determining atomic masses (4) varying number of protons in the nucleus of atoms

8. Isotopes of an element have a different (1) number of electrons (2) number of protons (3) atomic number (4) number of neutrons

9. Isotopes of the same element do not have the same (1) number of electrons (2) atomic number (3) mass number (4) electron configuration

10. Which pair of nuclei contain the same number of neutrons? (1) $^{7}_{3}Li$ and $^{9}_{4}Be$ (2) $^{40}_{19}K$ and $^{40}_{18}Ar$ (3) $^{23}_{11}Na$ and $^{23}_{11}Na$ (4) $^{23}_{11}Na$ and $^{24}_{12}Mg$

11. Which atom has an equal number of protons and neutrons? (1) $^{1}_{1}H$ (2) $^{14}_{6}C$ (3) $^{19}_{9}F$ (4) $^{39}_{19}K$

12. An atomic mass unit is equal to (1) the mass of a hydrogen molecule (2) $\frac{1}{1.660}$ the mass of a hydrogen atom (3) the mass of a ^{12}C atom (4) $\frac{1}{12}$ the mass of a ^{12}C atom

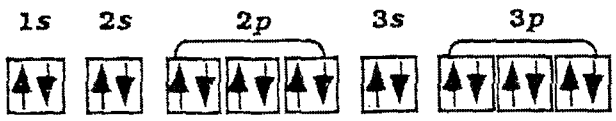
dot symbol could be:

(1) X• (2) X: (3) •X• (4) :X:

8 Usually the term "kernel" includes all parts of the atom except the:
(1) neutrons (3) valence electrons
(2) protons (4) orbital electrons

9 Which electron configuration represents an atom in an excited state?
(1) $1s^2\,2s^2\,2p^6\,3p^1$ (3) $1s^2\,2s^2\,2p^6\,3s^2\,3p^2$
(2) $1s^2\,2s^2\,2p^6\,3s^2\,3p^1$ (4) $1s^2\,2s^2\,2p^6\,3s^2$

10 Which element forms the ion represented in the following orbital notation?



(1) boron (2) bromine (3) magnesium (4) potassium

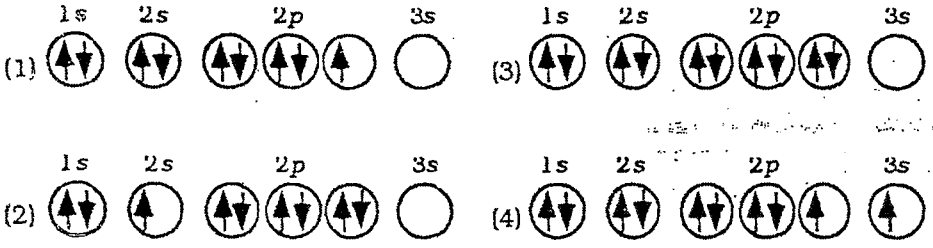
11 Which is the electron configuration of a neutral atom in the ground state with a total of six valence electrons?
(1) $1s^2\,2s^2\,2p^2$ (3) $1s^2\,2s^2\,2\,p^6$
(2) $1s^2\,2s^2\,2p^4$ (4) $1s^2\,2s^2\,2p^6\,3s^2\,3p^6$

12 The amount of energy required to remove the most loosely bound electron from an atom in the gaseous phase is called:
(1) kinetic energy (3) ionization energy
(2) potential energy (4) electron affinity

13 Which electron dot symbol could represent a metalloid?
(1) X• (2) X: (3) :X: (4) •X•

14 The number of valence electrons in an atom with an electron configuration of $1s^2\,2s^2\,2p^6\,3s^2\,3p^4$ is:
(1) 6 (2) 2 (3) 16 (4) 4

15 Which diagram correctly represents a fluorine atom in an excited state?



16 A Ca^{2+} ion differs from a Ca atom in that the Ca^{2+} ion has:
(1) more protons (3) more electron
(2) fewer protons (4) fewer electrons

17 What is the total number of valence electrons in an atom of phosphorus in the ground state?
(1) 5 (2) 2 (3) 3 (4) 7

---

18 What is the total number of principal energy levels that are completely filled in an atom of magnesium in the ground state?
(1) 1 (2) 2 (3) 3 (4) 4

19 What is the total number of occupied principal energy levels in a sodium atom in the ground state?
(1) 1 (2) 2 (3) 3 (4) 4

20 Which atom in the ground state has three unpaired electrons in its outermost principal energy level?
(1) Li (2) B (3) N (4) Ne

21 Which atom in the ground state contains only one orbital that is partially occupied?
(1) Si (2) Ne (3) Ca (4) Na

22 The element with atomic number 10 has an electron configuration that is the same as:
(1) Na (2) Na^+ (3) Cl (4) Cl^-

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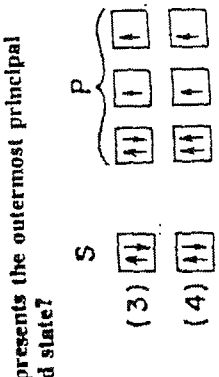
21. Which orbital notation correctly represents the outermost principal energy level of oxygen in the ground state?



22. What is the name given to the amount of energy required to remove the most loosely bound electron from an atom in the gaseous phase?
(1) ionization energy (2) electron affinity (3) electronegativity (4) valence energy

7. What is the maximum number of electrons that can be contained in the 4th principal energy level? (1) 8 (2) 18 (3) 32 (4) 50

8. What is the total number of electrons in the second principal energy level of a calcium atom in the ground state? (1) 6 (2) 2 (3) 18 (4) 8

9. An atom with the electron configuration $1s^2 2s^2 3s^1 3p^6 4s^2$ has an incomplete (1) 3rd principal energy level (2) 2s sublevel (3) 2nd principal energy level (4) 3s sublevel

10. What is the total number of electrons in the second principal energy level of a chlorine atom in the ground state? (1) 5 (2) 7 (3) 8 (4) 17

11. Which sublevels are occupied in the outermost principal energy level of argon atom in the ground state? (1) 3s and 3d (2) 3s and 3p

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12 3	20 3		
13 4	21 4		
14 1	22 2		

Atomic Review 2011

1. Ernest Rutherford concluded from experiments that they indicated nuclei of atoms are relatively

A) far apart and positively charged
B) far apart and negatively charged
C) close together and positively charged
D) close together and negatively charged
E) close together and neutral

2. The nucleus of an atom

A) is electrically neutral
B) is the densest portion of the atom
C) occupies most of the atom's volume
D) is a low fraction of the atom's mass
E) is large compared to the size of the atom

3. According to the Bohr model of the atom, atoms can only absorb energy at certain wavelengths because

A) Atoms of different elements contain different numbers of protons
B) Electrons can only exist in certain energy levels
C) Most of the atom contains empty space
D) Atoms of different elements contain different numbers of electrons
E) None of the above

4. The maximum numbers of electrons in the K, L, M, and N shells of any element are respectively

A) 1, 2, 8, 16 B) 1, 4, 9, 16
C) 2, 8, 16, 24 D) 2, 8, 18, 32
E) 2, 6, 10, 14

5. In the orbital notation $1s^2$ the *coefficient* 1 indicates that

A) helium has 1 electron
B) helium has an atomic number of 1
C) helium has an atomic mass of 1
D) helium has an energy level of 1
E) helium has 1 neutron

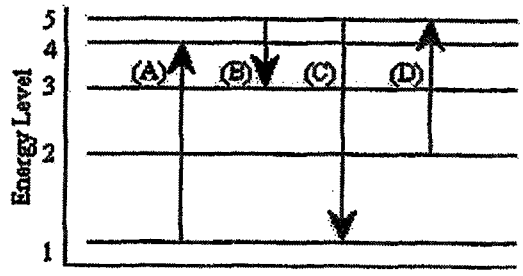
6. What is the electron shell configuration for calcium ions, Ca^{2+}?

A) 2–8–8–2 B) 2–8–8
C) 2–8–8–4 D) 2–8–6
E) 2–8–6-2

7. What is the shell configuration of electrons for neutral atoms of nickel, $_{28}Ni$, in the ground state?

A) 2–8–16–2 B) 2–8–10–8
C) 2–8–8–10 D) 2–18–8–0
E) 2–8–16–28

8. Which electron transition *absorbs* the most energy?



A) A
B) B
C) C
D) D
E) This diagram does not give enough information to tell.

9. Which supports the conclusion that electrons in atoms are quantized; i.e. that they exist at definite energy levels?

A) Mass spectrometer beam distribution
B) Emission spectra of gaseous elements
C) Cathode ray deflection by a magnetic field
D) Scattering of alpha particles by metal foil
E) Oil-drops suspended in air by an electric field

10. What is the mass number of a potassium ion, K^+, consisting of 18 electrons, 19 protons and 20 neutrons?

A) 36 B) 37 C) 38 D) 39 E) 57

11. A single burst of visible light is released by an atom. Which is an explanation of what happened in the atom? An electron

A) removed a proton from the nucleus
B) was changed from a particle to a wave
C) moved from a higher to a lower energy level
D) moved from a lower to a higher energy level
E) was released from the nucleus

12. Movement of an electron from the 4th to the 8th energy level in an atom is

A) exothermic and absorbs energy
B) exothermic and evolves energy
C) endothermic and absorbs energy
D) endothermic and evolves energy
E) neither endothermic nor exothermic

13. When an electron moves from the level where $n = 3$ to the level where $n = 1$, the change in energy is

Bohr Equation

$$E = \frac{-1312\ \text{kJ} \cdot \text{mol}^{-1}}{n^2}$$

A) $-874.\text{kJ} \cdot \text{mol}^{-1}$
B) $+874.\text{kJ} \cdot \text{mol}^{-1}$
C) $-1166.\text{kJ} \cdot \text{mol}^{-1}$
D) $+1166.\text{kJ} \cdot \text{mol}^{-1}$
E) $+656.\text{kJ} \cdot \text{mol}^{-1}$

14. How many energy levels are shown in the electron configuration below?

$1s^2\,2s^2 2p^6\,3s^2 3p^6 3d^7 4s^2$

A) 3 B) 4 C) 7 D) 15 E) 27

15. Which is the shape of a p–orbital?

A) spherical B) propeller
C) clover leaf D) dumbbell
E) pointed

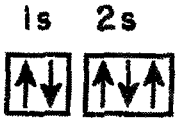
16. What is the shape of an s–orbital?

A) spherical B) propeller
C) clover leaf D) dumbbell
E) elliptical

17. Which of the following scientists proposed the theory that it is impossible to simultaneously determine the exact momentum and position of particle

A) Niels Bohr B) Dmitri Mendeleev
C) Werner Heisenberg D) Wolfgang Pauli
E) Josiah Gibbs

18. Which of the following explains why the electron configuration below cannot exist?



A) Hund's rule
B) Pauli exclusion principle
C) Heisenberg uncertainty principle
D) Bohr's model of the atom
E) it can exist

19. Which of the following explains why the electron configuration below cannot exist?

A) Hund's Rule
B) Pauli exclusion principle
C) Heisenberg uncertainty principle
D) Rutherford's empty space model
E) It can exist

20. Which of the following could not represent the electron configuration of a neutral atom in the ground state?

A) $1s^2\,2s^2\,2p^6\,3s^2 3p^4$ B) $1s^2\,2s^2\,2p^2$
C) $1s^2\,2s^2\,2p^6\,3s^3 3p^4$ D) $1s^2\,2s^2\,2p^6\,3s^2$
E) $1s^2\,2s^2\,2p^6\,3s^1$

21. Base your answer to the following question on the choices below.

(A) Pauli exclusion principle
(B) Heisenberg uncertainty principle
(C) Hund's rule
(D) Wave nature of matter
(E) Photoelectric effect

Which states that electrons half fill an orbital with parallel spin, before completely filling it?

A) A B) B C) C D) D E) E

22. How many electrons are usually left out of the condensed electron dot diagrams of elements with atomic numbers 11 to 18?

A) 8 B) 2 C) 10 D) 12 E) 18

23. The species having the same number of electrons as Mg^{2+} is

A) Na B) O^{2-} C) N^- D) Ar E) Ne^{1+}

24. The electronic configuration of the S^{2-} ion is

A) $1s^22s^22p^63s^23p^2$ B) $1s^22s^22p^63s^23p^4$
C) $1s^22s^22p^63s^23p^5$ D) $1s^22s^22p^63s^23p^6$
E) $1s^22s^22p^63s^43p^4$

25. Potassium ion, K^+ has the same electronic structure as a neutral atom of

A) argon B) calcium
C) sulfur D) xenon
E) neon

26. The electron configuration $1s^22s^22p^63s^13p^1$ could represent a

A) sodium ion
B) manganese atom
C) calcium atom in the ground state
D) sodium ion in an excited state
E) magnesium atom in an excited state

27. How many *unpaired electrons* are in this atom?

$1s^22s^22p^63s^23p^63d^74s^2$

A) 0 B) 2 C) 3 D) 7 E) 9

28. How many *orbitals* are in neutral atoms of this element?

$1s^22s^22p^63s^23p^63d^74s^2$

A) 4 B) 7 C) 12 D) 15 E) 27

29. How many *subshells* are shown in this configuration?

$1s^22s^22p^63s^23p^63d^74s^2$

A) 4 B) 7 C) 12 D) 15 E) 27

30. How many *unpaired* electrons are in this atom?
$1s^2\ 2s^22p^6\ 3s^23p^63d^{10}\ 4s^24p^3$

A) 1 B) 2 C) 3 D) 5 E) 0

31. How many *orbitals* are in neutral atoms of this element?

$1s^22s^22p^63s^23p^63d^{10}4s^24p^3$

A) 4 B) 8 C) 15 D) 18 E) 33

32. How many *subshells* are shown in the electron configuration?

$1s^22s^22p^63s^23p^63d^{10}4s^24p^3$

A) 4 B) 8 C) 15 D) 18 E) 33

33. Which is *isoelectronic* with a scandium ion, (Sc^{3+})?

A) $1s^22s^22p^63s^23p^6$
B) $1s^22s^22p^63s^23p^63d^{10}4s^04p^1$
C) $1s^22s^22p^93s^23p^63d^{10}4s^24p^2$
D) $1s^22s^22p^63s^23p^63d^{10}4s^24p^3$
E) $1s^22s^22p^63s^23p^3$

34. Which is an 'impossible' configuration?

A) $1s^22s^22p^63s^23p^6$
B) $1s^22s^22p^63s^23p^63d^{10}4s^04p^1$
C) $1s^22s^22p^93s^23p^63d^{10}4s^24p^2$
D) $1s^22s^22p^63s^23p^63d^{10}4s^24p^3$
E) $1s^22s^22p^63s^23p^4$

35. Which is an *excited* atom?

A) $1s^22s^22p^63s^23p^6$
B) $1s^22s^22p^63s^33p^63d^{10}$
C) $1s^22s^22p^63s^23p^63d^54s^2$
D) $1s^22s^22p^63s^23p^63d^{10}4s^25s^2$
E) $1s^22s^22p^63s^23p^63d^{10}4s^24p^2$

36. Which general expression is used to find the maximum number of electrons which exist in a given shell?

A) n B) n^2 C) 2n D) $2n^2$ E) 2n – 2

37. What general expression can be used to find the maximum number of subshells which exist in a shell?

A) n B) n^2 C) 2n D) $2n^2$ E) 2n – 2

38. Which group is arranged correctly in order of *increasing* energy for electrons in an element?

A) 2s, 4p, 3d B) 3s, 3d, 3p
C) 3p, 4s, 3d D) 2p, 2s, 1s
E) 3p, 4s, 4d

39. What is the maximum number of subshells in the 3rd energy level of an atom?

A) 2 B) 3 C) 8 D) 9 E) 18

40. How many electrons are in a completed M–shell?

A) 2 B) 8 C) 14 D) 18 E) 32

41. What is the maximum number of electrons allowed in an orbital?

A) 1 B) 2 C) 4 D) 6 E) 10

42. An electron orbital is best described as

A) a spherical shell containing electrons
B) a cloud which is always perfectly circular
C) a cloud with hundreds of electrons in it
D) the figure formed by the extremely rapid motion of electrons
E) a probability function

43. Which element is most likely to form a 2^- ion?

A) Element - W
Shell Electron Configuration - 2, 8, 2
B) Element - X
Shell Electron Configuration - 2, 8, 1
C) Element - Y
Shell Electron Configuration - 2, 8, 5
D) Element - Z
Shell Electron Configuration - 2, 8, 4
E) Element - Z
Shell Electron Configuration - 2, 8, 6

44. The number of valence shell electrons in a calcium atom, $_{20}Ca$, is

A) 8 B) 14 C) 10 D) 18 E) 2

45. Which is the symbol for an atom with six valence electrons?

A) C B) N C) F D) Kr E) S

46. How many valence electrons are in a sodium ion, Na^+

A) 0 B) 1 C) 6 D) 8 E) 11

47. How many valence electrons are in an arsenic atom with the electron structure

[Ar] $3d^{10}4s^24p^3$

A) 2 B) 3 C) 5 D) 10 E) 15

48. The Lewis Dot diagram for a chloride ion, Cl^-, is

A) 
B) 
C) 
D) 
E) 

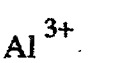
49. What is the Lewis electron–dot diagram for a rubidium ion (element 37)?

A) Rb•
B) 
C) 
D) 
E) Rb•$^+$

50. What is the Lewis electron–dot diagram for neutral atoms of element 12?

A) 
B) 
C) Mg
D) Mg^{+2}
E) 

51. What is the Lewis electron–dot diagram for aluminum, Al, in the ground state?

A) 
B) 
C) 
D) 
E) 

52. An electron cannot exist in the energy state described by which of the following sets of quantum numbers?

A) $1,1,0,\frac{1}{2}$
B) $2,1,-1,-\frac{1}{2}$
C) $2,0,0,\frac{1}{2}$
D) $3,1,-1,-\frac{1}{2}$
E) $3,2,2,\frac{1}{2}$

53. An azimuthal quantum number of 2 corresponds to which subshell?

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

54. How many protons, neutrons, and electrons are there in potassium ions, $^{39}_{19}K^+$?

A) 19 protons, 20 neutrons, 20 electrons
B) 19 protons, 20 neutrons, 18 electrons
C) 20 protons, 19 neutrons, 19 electrons
D) 39 protons, 39 neutrons, 39 electrons
E) 19 protons, 39 neutrons, 18 electrons

55. Naturally occurring gallium is 60% ^{69}Ga and 40% ^{71}Ga by mass. Based on this data the atomic mass of this element is

A) 39.0 B) 69.0 C) 69.8 D) 70.0 E) 71.0

56. A new element has two isotopes ^{300}X and ^{310}X with relative abundance of 75% and 25% respectively. The relative atomic mass of X is

A) 300.0 B) 302.5 C) 305.0 D) 307.5 E) 309.0

57. The standard for atomic masses is based on

A) a kilogram of oxygen
B) standard temperature and pressure
C) the atom of the most common isotope of carbon
D) hydrogen, the lightest element in the periodic table
E) the average of the masses of carbon isotopes

58. Relative atomic masses are

A) averages of allotropic masses
B) fixed in comparison to oxygen
C) always expressed in whole numbers
D) weighted averages of isotopic masses
E) dependent on the number of electrons

59. Beryllium atoms having 4 protons and 5 neutrons in the nucleus, two electrons in the first energy level, and two electrons in the second energy level have an atomic number of

A) 2 B) 4 C) 7 D) 9 E) 13

50. The total number of protons found in the hydronium ion, H_3O^+, is

A) 3 B) 8 C) 10 D) 11 E) 19

51. Which particle consists of 13 protons, 14 neutrons, and 10 electrons?

A) Cobalt atom B) Silicon atom
C) Aluminum ion D) Phosphide ion
E) Nitrogen isotope

52. The atom $^{30}_{15}X$ is an isotope of

A) $^{27}_{15}P$ B) $^{30}_{14}Si$ C) $^{27}_{16}S$ D) $^{65}_{30}Zn$ E) $_{45}Rh$

53. Isotopes have the same

A) mass number but different atomic numbers
B) number of protons but different mass numbers
C) number of protons but different atomic numbers
D) number of electrons but different numbers of protons
E) number of neutrons and mass numbers

64. Which set represents isotopes of the same element?

A) $^{28}_{14}X$, $^{28}_{15}X$, $^{28}_{16}X$ B) $^{1}_{1}X$, $^{2}_{1}X$, $^{3}_{1}X$
C) $^{12}_{6}X$, $^{16}_{8}X$, $^{20}_{10}X$ D) $^{38}_{18}X$, $^{39}_{19}X$, $^{40}_{20}X$
E) $^{12}_{8}X$, $^{16}_{4}X$, $^{20}_{0}X$

65. The symbol representing tritium is

A) $^{2}_{1}H$ B) $^{1}_{2}H$ C) $^{3}_{1}H$ D) $^{1}_{3}H$ E) $^{3}_{1}Tm$

66. Electrically neutral atoms of the three isotopes of hydrogen have

A) the same atomic mass
B) the same atomic number
C) different numbers of electrons
D) different numbers of protons
E) the same number of neutrons

67. The symbol, $^{65}_{30}Zn$, indicates that the nucleus of this isotope consists of

A) 30 protons and 35 neutrons
B) 35 protons and 30 neutrons
C) 65 protons and 30 neutrons
D) 30 protons and 65 neutrons
E) 35 protons and 65 neutrons

68. A neutral atom of magnesium, $^{24}_{12}Mg$, has

A) 12 protons, 12 neutrons, 12 electrons
B) 12 protons, 12 neutrons, 27 electrons
C) 24 protons, 12 neutrons, 24 electrons
D) 24 protons, 24 neutrons, 12 electrons
E) 12 protons, 24 neutrons, 12 electrons

69. Subtracting the atomic number from the mass number of a given atom gives the number of

A) electrons B) neutrons
C) protons D) energy levels
E) nucleons

70. When an aluminum atom forms an Al^{3+} ion, the atom

A) loses three electrons
B) gains three electrons
C) loses three protons
D) gains three protons
E) gains two electrons and loses one proton

71. An ion with 12 protons, 10 neutrons, and 11 electrons has a charge of

A) 1+ B) 2+ C) 1– D) 2– E) 0

72. The charged particles located outside the nucleus of an atom are

A) electrons
B) isotopes
C) neutrons
D) protons
E) positrons

73. In which of the following sets do all the atoms and ions have the same number of electrons?

A) F^-, Ne, Na^+
B) F^-, Cl^-, Br^-
C) He, Ne, Ar
D) Li^+, Na^+, K^+
E) N^{+3}, O^{2-}, F^-

74. The mass number and electrical charge of an electron are, respectively,

A) 0 and +1
B) 1 and 0
C) 1 and +1
D) 0 and –1
E) –1 and 0

75. Which is not isoelectronic with the others?

A) S^{2-} B) K^+ C) Ar^0 D) Si^{4+} E) Ca^{2+}

76. When the element with an atomic number of 17 becomes an ion it will have a charge of

A) 1+
B) 1–
C) 5+
D) 5–
E) This element does not form an ion.

77. An element has a mass number of 32 and an atomic number of 16. The most common ion of this element is represented by

A) X^+ B) X^{2-} C) X^- D) X^{2+} E) X^0

78. A neutral atom contains 12 neutrons and 11 electrons. The number of protons in this atom is

A) 1
B) 11
C) 12
D) 23
E) It is impossible to tell

79. An electron has a charge of

A) –1 and the same mass as a proton
B) +1 and the same mass as a proton
C) 0 and the same mass as a proton
D) –1 and a smaller mass than a proton
E) +1 and a smaller mass than a proton

80. The atomic mass unit is defined as exactly 1/12 the mass of an atom of

A) $^{12}{}_{6}C$
B) $^{14}{}_{6}C$
C) $^{12}{}_{5}B$
D) $^{24}{}_{12}Mg$
E) $^{26}{}_{12}Mg$

81. What is the charge and mass of a proton?

A) charge of +1 and mass of 1 amu
B) charge of +1 and mass of $\frac{1}{1836}$ amu
C) charge of –1 and mass of 1 amu
D) charge of –1 and mass of $\frac{1}{1836}$ amu
E) neutral charge and mass of 1 amu

82. Experimental evidence indicates that the nucleus of an atom

A) contains most of the mass of the atom
B) contains a small percentage of the mass of the atom
C) has no charge
D) has a negative charge
E) contains most of the volume of the atom

83. How many protons does the $^{11}{}_{5}B$ atom contain?

A) 6
B) 10
C) 11
D) 16
E) none of the above

84. How many nucleons does $^{25}{}_{12}Mg$ contain?

A) 12 B) 13 C) 25 D) 37 E) 49

85. Which of the following represents the most common isotope of carbon?

A) $^{6}{}_{12}C$ B) $^{12}{}_{6}C$ C) $^{14}{}_{6}C$ D) $^{6}{}_{14}C$ E) $^{8}{}_{6}C$

Answer Key
Atomic Review

1.	A	37.	A	73.	A
2.	B	38.	C	74.	D
3.	B	39.	B	75.	D
4.	D	40.	D	76.	B
5.	D	41.	B	77.	B
6.	B	42.	E	78.	B
7.	A	43.	E	79.	D
8.	A	44.	E	80.	A
9.	B	45.	E	81.	A
10.	D	46.	A	82.	A
11.	C	47.	C	83.	E
12.	C	48.	D	84.	C
13.	C	49.	C	85.	B
14.	B	50.	B		
15.	D	51.	C		
16.	A	52.	A		
17.	C	53.	C		
18.	B	54.	B		
19.	A	55.	C		
20.	C	56.	B		
21.	C	57.	C		
22.	C	58.	D		
23.	B	59.	B		
24.	D	60.	D		
25.	A	61.	C		
26.	E	62.	A		
27.	C	63.	B		
28.	D	64.	B		
29.	B	65.	C		
30.	C	66.	B		
31.	D	67.	A		
32.	B	68.	A		
33.	A	69.	B		
34.	C	70.	A		
35.	D	71.	A		
36.	D	72.	A		