

Name: _____

- ___ 1) What Greek philosopher was the first person to propose the idea that matter is made of tiny individual particles called atoms?
- A) Democritus
B) Bohr
C) Dalton
D) Rutherford
- In ancient Greece, it was proposed that matter is composed of earth, air, water, and fire, and that these elements
- A) have similar physical properties
B) have similar chemical properties
C) are in continual motion
D) are stationary
- In the early 1900's, it was proposed that energy may be absorbed or released from atoms in small, indivisible packets named
- A) orbitals
B) nucleons
C) quanta
D) protons
- 4) The development of the cathode ray tube led to the discovery of what subatomic particle?
- A) proton
B) positron
C) electron
D) neutron
- 5) Experimental evidence indicates that the nucleus of an atom
- A) has a negative charge
B) contains most of the mass of the atom
C) has no charge
D) contains a small percentage of the mass of the atom
- 6) When alpha particles are used to bombard gold foil, most of the alpha particles pass through undeflected. This result indicates that most of the volume of a gold atom consists of
- A) unoccupied space
B) neutrons
C) deuterons
D) protons
- 7) Compared to the entire atom, the nucleus of the atom is
- A) larger and contains little of the atom's mass
B) smaller and contains little of the atom's mass
C) smaller and contains most of the atom's mass
D) larger and contains most of the atom's mass
- 8) Which particle has the *least* mass?
- A) a neutron
B) a proton
C) a deuteron
D) an electron
- 9) Which of the following statements *best* describes an electron?
- A) It has a smaller mass than a proton and a positive charge.
B) It has a greater mass than a proton and a positive charge.
C) It has a greater mass than a proton and a negative charge.
D) It has a smaller mass than a proton and a negative charge.
- 10) What particle has a mass of approximately one atomic mass unit and a unit positive charge?
- A) a neutron
B) a beta particle
C) an alpha particle
D) a proton

- 11) What particle is electrically neutral?
 A) neutron
 B) positron
 C) electron
 D) proton
- 12) What particle has approximately the same mass as a proton?
 A) neutron
 B) electron
 C) beta
 D) alpha
- Which two particles have approximately the same mass?
 A) neutron and electron
 B) neutron and deuteron
 C) proton and electron
 D) proton and neutron
- How many protons are in the nucleus of an atom of beryllium?
 A) 9
 B) 2
 C) 5
 D) 4
- 15) What kind of particle, when passed through an electric field, would be attracted to the negative electrode?
 A) a neutron
 B) a beta particle
 C) an alpha particle
 D) an electron
- 16) What kind of radiation will travel through an electric field on a pathway that remains unaffected by the field?
 A) an electron
 B) a gamma ray
 C) an alpha particle
 D) a proton
- What particle will be attracted to the positive electrode in an electric field?
 A) a neutron
 B) a positron
 C) a beta particle
 D) an alpha particle
- 18) Which particle has a negative charge?
 A) alpha particle
 B) neutron
 C) beta particle
 D) proton
- 19) In a sample of pure copper, *all* atoms have
 A) a different atomic number, but the same number of protons
 B) the same atomic number and the same number of protons
 C) a different atomic number and a different number of protons
 D) the same atomic number, but a different number of protons
- 20) A substance that is composed only of atoms having the same atomic number is classified as
 A) a compound
 B) an element
 C) a homogeneous mixture
 D) a heterogeneous mixture
- 21) Which atom has the *greatest* nuclear charge?
 A) Al
 B) Na
 C) Si
 D) Ar
- 22) Which atom has the *greatest* nuclear charge?
 A) ${}^{14}_7\text{N}$
 B) ${}^2_1\text{H}$
 C) ${}^{12}_6\text{C}$
 D) ${}^4_2\text{He}$

- 23) What is the nuclear charge of an atom with a mass of 23 and an atomic number of 11?
 A) 34+ B) 23+ C) 12+ D) 11+
- 24) As an Na atom forms an Na⁺ ion, the number of protons in its nucleus
 A) decreases B) increases C) remains the same
- 25) A particle of matter contains 6 protons, 7 neutrons, and 6 electrons. This particle must be a
 A) neutral carbon atom C) neutral nitrogen atom
 B) positively charged carbon ion D) positively charged nitrogen ion
- 26) What is the symbol for an atom containing 20 protons and 22 neutrons?
 A) ${}_{20}^{40}\text{Ca}$ B) ${}_{22}^{40}\text{Ti}$ C) ${}_{20}^{42}\text{Ca}$ D) ${}_{22}^{42}\text{Ti}$
- 27) Compared to an atom of C-12, an atom of C-14 has
 A) fewer protons C) more protons
 B) more neutrons D) fewer neutrons
- 28) What is the mass number of the atom below?

$${}^3_1\text{H}$$
 A) 1 B) 2 C) 3 D) 4
- 29) What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?
 A) 39 B) 20 C) 19 D) 58
- 30) An atom of carbon-14 contains
 A) 8 protons, 6 neutrons, and 6 electrons
 B) 6 protons, 6 neutrons, and 8 electrons
 C) 6 protons, 8 neutrons, and 6 electrons
 D) 6 protons, 8 neutrons, and 8 electrons
- 31) How many protons and neutrons is the nucleus of the atom below composed of?

$${}^{127}_{53}\text{I}$$
 A) 53 protons and 127 neutrons C) 53 protons and 74 electrons
 B) 53 neutrons and 127 protons D) 53 protons and 74 neutrons
- 32) The atomic mass of an element is defined as the weighted average mass of that element's
 A) least abundant isotope C) naturally occurring isotopes
 B) most abundant isotope D) radioactive isotopes
- 33) A sample of element X contains 90. percent ${}^{35}\text{X}$ atoms, 8.0 percent ${}^{37}\text{X}$ atoms, and 2.0 percent ${}^{38}\text{X}$ atoms. The average isotopic mass is *closest* to
 A) 38 B) 35 C) 37 D) 32

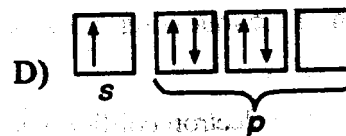
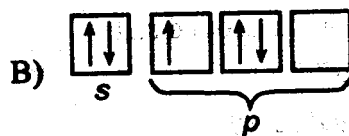
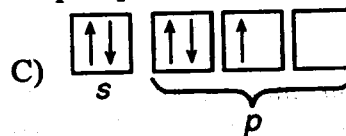
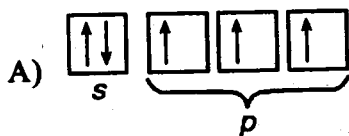
- 34) Isotopes of the same element must also have the same
- A) number of nucleons
B) mass number
C) atomic number
D) number of neutrons
- 35) Which nuclei is an isotope of $\begin{pmatrix} 10p \\ 11n \end{pmatrix}$?
- A) $\begin{pmatrix} 11p \\ 12n \end{pmatrix}$ B) $\begin{pmatrix} 9p \\ 11n \end{pmatrix}$ C) $\begin{pmatrix} 10p \\ 9n \end{pmatrix}$ D) $\begin{pmatrix} 11p \\ 10n \end{pmatrix}$
- 36) Which symbol represents an isotope of carbon?
- A) 1_2X B) ${}^{14}_7X$ C) ${}^{13}_6X$ D) 6_4X
- 37) Usually the term "kernel" includes *all* parts of the atom *except* the
- A) valence electrons
B) orbital electrons
C) neutrons
D) protons
- 38) An atom of chlorine and an atom of bromine have the same
- A) electronegativity
B) London dispersion radius
C) number of valence electrons
D) ionization energy
- 39) What is the atomic number of an atom with six valence electrons?
- A) 12 B) 6 C) 8 D) 10
- 40) What is the atomic number of an atom that forms an ion with 18 electrons and a charge of 2+?
- A) 30 B) 20 C) 18 D) 48
- 41) What is the total number of valence electrons in an atom with a total of 13 protons?
- A) 1 B) 2 C) 3 D) 4
- 42) What is the total number of valence electrons in an atom with the electron configuration 2-8-5?
- A) 15 B) 8 C) 5 D) 2
- 43) A Ca^{2+} ion differs from a Ca^0 atom in that the Ca^{2+} ion has
- A) fewer electrons
B) more protons
C) more electrons
D) fewer protons
- Which of the following is the electron-dot symbol for an atom with an electron configuration of 2-5?
- A) $\cdot\overset{\cdot}{\underset{\cdot}{\text{X}}}\cdot$ B) $\cdot\overset{\cdot}{\text{X}}\cdot$ C) $\cdot\overset{\cdot}{\underset{\cdot}{\text{X}}}\cdot$ D) $\cdot\overset{\cdot}{\text{X}}\cdot$
- An atom has the electron configuration 2-8-7. The electron-dot symbol for this element is
- A) $\text{X}:$ B) $\cdot\overset{\cdot}{\text{X}}:$ C) $:\overset{\cdot}{\underset{\cdot}{\text{X}}}:$ D) $\text{X}:$
- 46) What is the electron-dot symbol for a chlorine atom in the ground state?
- A) $:\overset{\cdot}{\underset{\cdot}{\text{Cl}}}:$ B) $:\overset{\cdot}{\underset{\cdot}{\text{Cl}}}:$ C) $\text{Cl}:$ D) $\cdot\overset{\cdot}{\underset{\cdot}{\text{Cl}}}\cdot$

- 47) The electron-dot symbol $\cdot\cdot\cdot\cdot\text{X}\cdot\cdot\cdot\cdot^-$ represents an ion of atom X. Atom X could be an atom of
- A) H B) I C) S D) K
- 48) What causes the emission of radiant energy that produces characteristic spectral lines?
- A) gamma ray emission from the nucleus
B) movement of electrons to higher energy levels
C) neutron absorption by the nucleus
D) return of electrons to lower energy levels
- 49) The characteristic spectral lines of elements are caused when electrons in an excited atom move from
- A) lower to higher energy levels, releasing energy
B) lower to higher energy levels, absorbing energy
C) higher to lower energy levels, releasing energy
D) higher to lower energy levels, absorbing energy
- 50) The *greatest* absorption of energy occurs as an electron moves from
- A) 1s to 3s C) 4s to 3p
B) 4d to 4s D) 3p to 3s
- 51) Electron X can change to a higher energy level or a lower energy level. Which of the following statements is true of electron X?
- A) Electron X emits energy when it changes to a higher energy level.
B) Electron X absorbs energy when it changes to a higher energy level.
C) Electron X absorbs energy when it changes to a lower energy level.
D) Electron X neither emits nor absorbs energy when it changes energy level.
- 52) An atom of which element in the ground state has a complete outermost shell?
- A) Be B) He C) Hg D) H
- 53) In an atom that has an electron configuration of 2-5, what is the total number of electrons in its *highest* energy level?
- A) 8 B) 5 C) 7 D) 2
- 54) Which of the following is the electron configuration of an atom in the ground state?
- A) 2-7-1-1 B) 1-8-2 C) 2-7-2 D) 2-8-1
- 55) What is the electron configuration of a fluorine atom in the ground state?
- A) 1-8 B) 2-9 C) 2-7 D) 2-8-7
- 56) Which of the following is the electron configuration for Mg²⁺ ions?
- A) 2-8-2 B) 2-8-8 C) 2-2 D) 2-8
- 57) What is the electron configuration of a calcium ion (Ca²⁺) in the ground state?
- A) 2-8-8-1 B) 2-8-8-8 C) 2-8-8 D) 2-8-8-2
- 58) What is the electron configuration of an oxygen ion (O²⁻) in the ground state?
- A) 2-6 B) 2-8 C) 1-7 D) 2-4
- 59) Which electron configuration represents an atom in an excited state?
- A) 2-8-1 B) 2-7-1 C) 2-7 D)

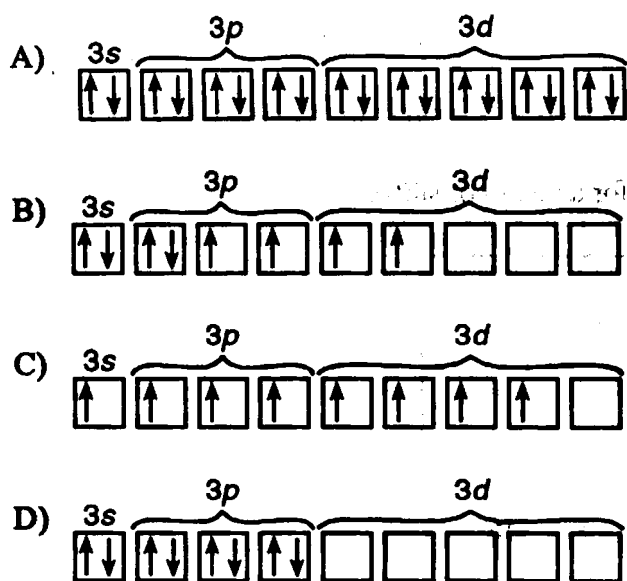
- 60) Which of the following is the electron configuration of a calcium atom in the excited state?
 A) 2-8-8-2 B) 2-8-7-3 C) 2-4 D) 2-3-1
- 61) Which represents the electron configuration of a silver atom in the excited state?
 A) 2-7-7 C) 2-8-18-18
 B) 2-8-18-18-1 D) 2-8-18-17-2
- 62) An atom of an element has the electron configuration $1s^2 2s^2 2p^2$. What is the total number of valence electrons in this atom?
 A) 6 B) 2 C) 5 D) 4

Which electron configuration represents an atom in an excited state?

- A) $1s^2 2s^2 2p^6 3s^2 3p^2$ C) $1s^2 2s^2 2p^6 3p^1$
 B) $1s^2 2s^2 2p^6 3s^2$ D) $1s^2 2s^2 2p^6 3s^2 3p^1$
- 64) In an atom, the s sublevel has
 A) 5 orbitals C) 1 orbital
 B) 7 orbitals D) 3 orbitals
- An atom has 8 electrons in a d sublevel. How many d orbitals in this sublevel are half-filled?
 A) 1 B) 2 C) 3 D) 4
- 66) In which sublevel would an electron have the *highest* energy?
 A) $4f$ B) $4s$ C) $4d$ D) $4p$
- 67) Which electron configuration contains three half-filled orbitals?
 A) $1s^2 2s^2 2p^4$ C) $1s^2 2s^2 2p^6$
 B) $1s^2 2s^2 2p^5$ D) $1s^2 2s^2 2p^3$
- 68) Which electron notation represents the valence electrons of a phosphorus atom in the ground state?



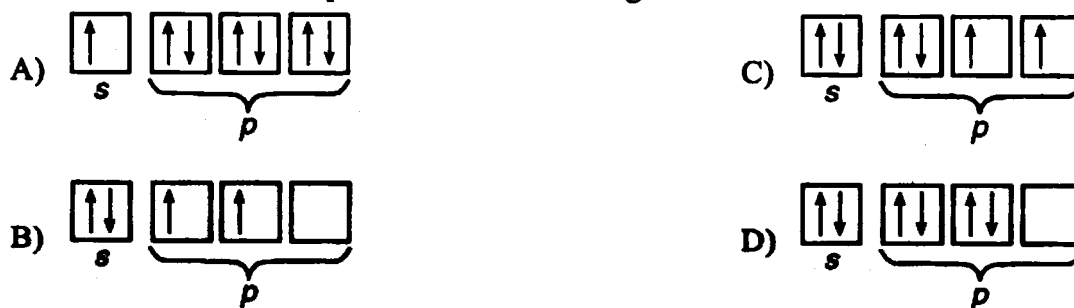
- 69) Which of the following is the orbital notation for the electrons in the third principal energy level of an argon atom in the ground state?



- 70) Which orbital notation represents an atom of beryllium in the ground state?



- 71) Which orbital notation represents an atom in the ground state with 6 valence electrons?

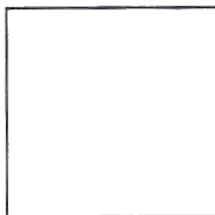


- 72) Which diagram correctly represents an atom of fluorine in an excited state?



73) 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.



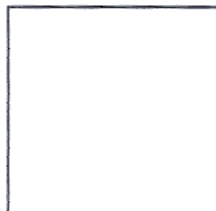
- (d) How does an atom of silicon become a Si^{4-} ion?
- (e) What noble gas has the same electron configuration as Si^{4-} ?

___ 74) 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.

75) The questions below refer to an atom that has 17 protons, 19 neutrons, and 17 electrons.

- (a) What is the atomic number of this atom?
- (b) What is the mass number of this atom?
- (c) Write the electron configuration for this atom.
- (d) Identify the atom.
- (e) Draw a correct Lewis electron-dot diagram for the atom.



76) Given the following Lewis electron-dot diagram: $\cdot \overset{\cdot\cdot}{\underset{\cdot}{X}} \cdot$

Name *three* elements that could be element X.

___ 77) Given the following Lewis electron-dot diagram: $\cdot \overset{\cdot}{\underset{\cdot}{X}} \cdot$

Name *three* elements that could be element X.

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

- 70) B
- 71) C
- 72) D
- 73) (a) 14; (b) 2-8-4 OR 1,2,2,2,2,6,3,2,3,2; (c) $\text{Si}^{\cdot-}$; (d) by gaining 4e⁻; (e) Ar
- 74) (a) fluorine; (b) 9; (c) 7; (d) 2nd; (e) Answers may vary.
- 75) (a) 17; (b) 36; (c) 2-8-7 OR 1,2,2,2,2,6,3,2,3,2; (d) chlorine; (e) $\text{Cl}^{\cdot-}$
- 76) Answers may vary. SAMPLE ANSWERS: N, P, As, Sb, Bi
- 77) Answers may vary. SAMPLE ANSWERS: B, Al, Ga, In, Tl