

Solutions

PART B: MULTIPLE CHOICE

- A 1. When a strontium atom loses two electrons to form an Sr^{2+} ion, the electrons are lost from the
 a. 5s orbital b. 5p orbital c. 3d orbital d. 4f orbital
- C 2. The element iodine, I, is a
 a. Period 5 alkali metal b. Period 4 halogen c. period 5 halogen d. period 5 transition metal
- C 3. The subatomic particle that plays the greatest role in determining the physical and chemical properties of an element is the
 a. Proton b. neutron c. electron d. photon
- D 4. For which element would you expect a large jump between the first and second ionization energies?
 a. F b. Ca c. Fe d. Na
- A 5. The category of elements that is characterized by the filling of f orbitals is the
 a. Inner transition metals b. Alkali metals c. alkaline earth metals d. transition metals
- B 6. Of the following atoms, which one has the smallest first ionization energy?
 a. Boron b. aluminum c. nitrogen d. silicon
- B 7. The alkali metals do not include
 a. Li b. Ca c. Na d. Rb
- B 8. The modern periodic table is arranged in order of increasing
 a. Atomic mass b. Atomic number c. atomic size d. atomic radius
- D 9. The elements in Groups 1A through 7A are
 a. Alkali metals b. Alkaline earth metals c. transition metals d. representative elements
- D 10. Which of the following is true concerning the noble gases?
 a. Their highest occupied s and p sublevels are filled
 b. They belong to Group 8A
 c. They are sometimes referred to as the inert gas
 d. All of the above
- A 11. What is the number of electrons in the highest occupied energy level of an element in Group 5A?
 a. 5 b. 3 c. 8 d. 18
- D 12. Among the groups of elements listed below, which have the same number of electrons in their highest occupied energy levels?
 a. Li, B, C, F b. Na, Mg, Al, S c. K, Ca, Rb, Sr d. N, P, As, Sb
- C 13. An element that contains an electron in a d sublevel is
 a. Mg b. O c. Fe d. Ne
- D 14. The elements that contain electrons in an f sublevel near the highest occupied energy level are referred to as
 a. Alkali metals b. Alkaline earth metals c. transition metals d. inner transition metals
- C 15. The electron configuration of the element chlorine ends in
 a. $3s^2$ b. $3p^6$ c. $3p^5$ d. $3p^7$
- D 16. The element with 8 electrons in its 3d sublevel is
 a. O b. Ne c. Ar d. Ni
- A 17. As you move down a group in the periodic table, atomic size generally
 a. Increases b. decreases c. remains the same d. varies randomly
- D 18. The largest atom from among the following is
 a. Li b. Na c. Rb d. Fr
- D 19. The smallest atom from among the following is
 a. Na b. Mg c. Si d. Cl

- B 20. As the number of electrons added to the same principal energy level increases, atomic size generally
a. Increases b. decreases c. remains the same d. varies randomly
- A 21. Removing one electron from an atom results in the formation of an
a. ion with a 1+ charge c. ion with a 7+ charge
b. ion with a 1- charge d. ion with a 7- charge
- D 22. Among the elements listed, which would show the largest increase between the second and third ionization energies?
a. B b. P c. Ca d. Zn
- C 23. Among the following, which element has the lowest ionization energy?
a. Na b. Cl c. Cs d. I
- A 24. Among the following, which element has the highest second ionization energy?
a. Na b. Cl c. Cs d. I
- D 25. Which of the following are always larger than the neutral atoms from which they are formed?
a. Positive ions b. negative ions c. cations d. none of the above
- C 26. The smallest particle from among the following is
a. Li b. Li⁺ c. F d. F⁻
- C 27. The least electronegative element from among the following is
a. Na b. Cl c. Cs d. S

1. Explain the following terms

- Alloy – A mixture composed of two or more elements, at least one of which is a metal
- Chemical Formula – Indicates the number and type of atoms present in the smallest representative amount (ie – Al₂O₃)
- Electron dot diagram – Shows valence electrons as dots around the atomic symbol of the element.
- Structural diagram – Shared electrons are shown by a line between two atoms. Multiple shared electrons between the same two atoms show double and triple bonds.
- Formula Unit – The lowest whole-number ratio of ions in an ionic compound. Aluminum and oxygen (Al₂O₃) would have a ratio of 2 parts aluminum to 3 parts oxygen (or 2:3)
- Ionic Compound – A metal and a non-metal that form an electrically neutral bond.
- Molecular Compound – A group of non-metals that share electrons through covalent bonds.
- Ionic Bond – The attraction between a metal (electron donor) and a non-metal (electron acceptor)
- Octet Rule – The rule that each element (besides 1st energy level) wants to have 8 electrons in its outside shell.
- Valence Electrons – the number of electrons in the outside energy level
- Cation – a positively charged ion
- Anion – a negatively charged ion
- Covalent Bond – a sharing of electrons between two atoms to stabilize their valence shell.
- Coordinate Covalent Bond – When a lone pair is made into a covalent bond to help stabilize a compound. It is shown as a covalent bond with an arrow pointing toward the direction the electrons are being donated.

2. Complete the following table

Group	1A	2A	3A	4A	5A	6A	7A	8A
Dot diagram for element "X" in that group	\cdot X	\cdot X \cdot	\cdot X \cdot \cdot	\cdot X \cdot \cdot \cdot	\cdot X \cdot \cdot \cdot \cdot	\cdot X \cdot \cdot \cdot \cdot \cdot	\cdot X \cdot \cdot \cdot \cdot \cdot \cdot	\cdot X \cdot \cdot \cdot \cdot \cdot \cdot \cdot
Number of Valence Electrons	1	2	3	4	5	6	7	8
Predicted Ion Charge for element "X"	1+	2+	3+	-	3-	2-	1-	-

- What would be the electron configuration for an aluminum *ion*? $1s^2 2s^2 2p^6$
How would you describe the dot structure for an atom of oxygen? *It would have 2 lone pairs and 2 electrons available to make covalent bonds.*
- What are the 7 diatomic molecules? Which one needs a triple bond? *H, N, O, F, Cl, Br, I / N₂ will need a triple bond.*
- What is a lone pair of electrons? Provide an example. *A lone pair are valence electrons that do not get shared between atoms.*
- Complete the information, referring to the central atom for the following molecular shapes:

Sample Formula	Shape	No. Of Bonded/Shared Pairs	No. Of Lone/Unshared Pairs
AX ₂	linear	2	0
AX ₃	trigonal planar	3	0
AX ₄	tetrahedral	4	0
AX ₃ E	trigonal pyramid	3	1
AX ₂ E ₂	V-shape	2	2

- Review VSEPR Theory practice questions and handout sheets.