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Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

- An atom of a metallic element, represented by the symbol X, loses 4 electrons when it combines with a non-metallic element, represented by the symbol, Y. The chemical formula for the compound that forms is XY_2 . Which one of the following statements correctly accounts for this chemical formula?
 - An atom of element Y loses 4 electrons.
 - An atom of element Y gains 2 electrons.
 - An atom of element Y loses 2 electrons.
 - An atom of element Y gains 4 electrons.
- In the ionic compound PtS, what is the charge on each platinum ion?
 - 2+
 - 4-
 - 1-
 - 1+
- Atoms of elements represented by symbols Q and P combine to form an ionic compound. Each atom of Q loses 2 electrons and each atom of P gains 2 electrons. What is the chemical formula for the compound?
 - Q_2P
 - QP_2
 - Q_2P_2
 - QP
- When atoms of two elements combine, each atom attains a stable electron configuration. Which chemical formula correctly illustrates that this has occurred?
 - LiO_2
 - Na_2I
 - MgS
 - Zn_2O
- Atoms of nitrogen and hydrogen bond to form the compound NH_3 . When this bonding occurs, which one of the following statements is correct?
 - One atom of nitrogen transfers three electrons to three hydrogen atoms.
 - One hydrogen atom shares three electrons with each nitrogen atom.
 - Each hydrogen atom shares three electron pairs with a nitrogen atom.
 - Each hydrogen atom shares one pair of electrons with nitrogen.
- What is the correct IUPAC name for the compound $Sn(SO_4)_2$?
 - stannous sulfate
 - tin(IV) sulfite
 - tin(IV) sulfate
 - tin sulfate

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7. A researcher reports that ions of Br^{2-} have been detected. Which answer is most consistent with the formation of these ions?
- Each ion must have more than eight electrons in the outer energy level.
 - Each bromine atom gained two electrons.
 - Br^{2-} is not expected to be a stable ion of bromine.
 - All of the above statements are correct.
8. The chemical compounds potassium sulfide, K_2S , and sulfur dioxide, SO_2 , illustrate that atoms of sulfur
- always share electrons
 - always form polar covalent bonds
 - can become stable by either the transfer or sharing of electrons
 - can act as both a metal and a non-metal
9. What element does the diagram on the right represent?
- 28

x

14
- a nickel atom
 - a silicon atom
 - a germanium atom
 - an oxygen ion
10. Which answer below shows, in the correct order, the formulas of the compounds magnesium nitrite, magnesium nitride, and magnesium nitrate?
- Mg_3N_2 , $\text{Mg}(\text{NO}_2)_2$, $\text{Mg}(\text{NO}_3)_2$
 - $\text{Mg}(\text{NO}_2)_2$, Mg_3N_2 , $\text{Mg}(\text{NO}_3)_2$
 - $\text{Mg}(\text{NO}_3)_2$, $\text{Mg}(\text{NO}_2)_2$, Mg_3N_2
 - Mg_3N_2 , $\text{Mg}(\text{NO}_3)_2$, $\text{Mg}(\text{NO}_2)_2$
11. An element has an electronegativity of 2.6. What statement concerning this element is *not* correct?
- It is a metal and will transfer electrons to a non-metal.
 - It will form polar covalent bonds with bromine.
 - It will form ionic bonds with potassium.
 - It will form n covalent bonds with carbon.
12. Which one of the following is a correct electron dot diagram for calcium sulfide?
- $\text{Ca}:\text{S}$
 - $\text{Ca}:\ddot{\text{S}}:$
 - $\text{Ca}::\ddot{\text{S}}:$
 - $\text{Ca}^{2+}[:\ddot{\text{S}}:]^{2-}$
13. The symbols G, H, I, and J represent four consecutive elements in the periodic table. Element I is a Group 18 element. What is the expected formula of a compound formed between elements G and J?
- JG_3
 - J_2G
 - JG
 - J_3G

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14. A newly discovered element, represented by the symbol Z, forms a stable compound with nitrogen having the chemical formula ZN. Using the chemical formula X to represent any halogen, what is the expected chemical formula of the compound that forms between element Z and a halogen?
- ZX
 - ZX₂
 - ZX₃
 - ZX₄
15. If the element titanium (electronegativity = 1.5) is alloyed with the element iridium (electronegativity = 2.2), the bonding in this alloy is best described as
- metallic
 - ionic
 - covalent
 - polar covalent
16. Two elements combine to form a binary compound. What information about two atoms is the most reliable predictor of the chemical formula of the compound?
- total number of electrons in each atom
 - number of valence electrons in each atom
 - electronegativity of each atom
 - knowing if the elements are metals or non-metals
17. Intramolecular bonding between atoms is usually described as one of the following types:

ionic **non-polar covalent** **polar covalent** **metallic**

What will be the correct ordering of the numbered definitions when arranged to match the order of the listed bond types?

1	2	3	4
unequal sharing of electrons between two atoms	the attraction between free electrons and positively charged ions	simultaneous attraction of oppositely charged ions	electrons are equally shared between two atoms

- 3, 4, 1, 2
 - 3, 1, 4, 2
 - 1, 4, 1, 3
 - 2, 4, 3, 1
18. Phosphorus atoms (atomic number 15) can form the phosphide ion, P³⁻. What is the correct electron population in the first four energy levels of this ion?
- 2, 8, 5, 0
 - 2, 8, 5, 3
 - 2, 8, 8, 0
 - 2, 8, 2, 0

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19. Four of the chemicals in the table below are classified as ionic compounds. Which numbers correspond to the ionic compounds?

1. NaCl(s)	4. HgCO ₃ (s)	7. K ₂ SO ₄ (aq)
2. H ₂ O(l)	5. HF(aq)	8. C ₃ H ₈ (g)
3. PF ₅ (g)	6. Sb ₃ N ₅ (s)	9. CaF ₂ (s)

- a) 1, 4, 5, 9
- b) 1, 4, 6, 7
- c) 1, 6, 7, 9
- d) 1, 4, 7, 9

20. What is the electric charge on the ion "X" in the ionic compound XIO₂?

- a) 1+
- b) 2+
- c) 3+
- d) 4+

Written Response Questions

Answer each question in the space provided. Use complete sentences and diagrams where necessary.

21. A student answer on a test about chemical bonding contained the following sentence: "When elements combine, they gain or lose electrons to become a noble gas."

- a) What is incorrect in this statement?

- b) Rewrite this statement to correct the error that has been made.

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22. $C_2H_4Cl_2(g)$ is a molecular compound called 1,2-dichloroethane that is produced in the petrochemical industry.

a) Draw a Lewis structure to represent a molecule of 1,2-dichloroethane.

b) Classify the C—Cl, C—C, and C—H bonds in this molecule as non-polar covalent or polar covalent. Explain the reason for your classification.

c) The C—Cl bond is polar covalent. Which atom would be labelled as δ^+ ? Give a reason for your answer.

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23. Draw structural formulas for each of the following four compounds:



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24. The element tin can bond with carbon, phosphorus, and iodine. Refer to the electronegativities shown in the periodic table and arrange the bonds formed between tin and each of these elements, from least polar to most polar.

25. Some elements form ions with more than one charge. For example, copper forms Cu^+ and Cu^{2+} ions. These ions differ in the size of their ionic radius. Which ion would be expected to be larger? Give an explanation for your answer.

26. Use electron dot diagrams to show how the ionic compound chromium(III) iodide will form from its elements.

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27. For each pair of molecules shown below, either the Lewis structure or the corresponding structural formula is incorrect. Identify the error in each pair and draw a correct form of the molecule.

Lewis structure

Structural formula

Correction

