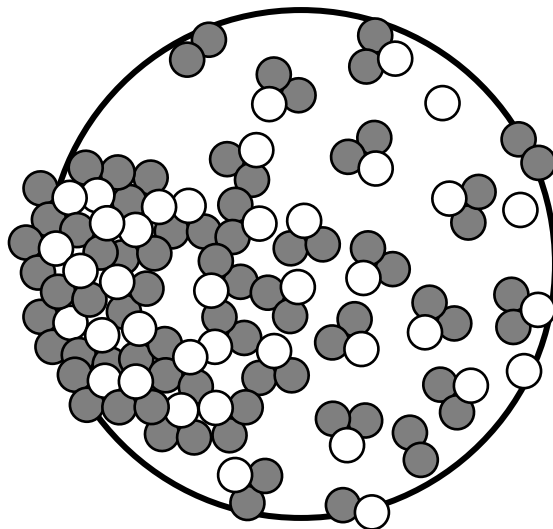


CHECKPOINT: Practice and Review

Categorizing the Organization of Matter

1. The diagram below represents a unique substance.



- a. For each statement in the table below, tell whether it is true or false and explain your reasoning. You might want to draw pictures or label the diagram in the space above to help clarify and support your claims.

Statement	True or False?	How do you know?
<i>This substance is made of elements.</i>		
<i>There are only molecules present in this substance.</i>		
<i>This substance is a liquid.</i>		
<i>This is a pure substance.</i>		

- b. Draw a *single* particle of the substance shown in the diagram above. Explain your reasoning.

- c. What kind of chemical or physical process do you think is being shown in the diagram? Why do you think so?

Chemical Bonding

2. Why do atoms bond together? Why don't they just stay as neutral atoms, all by themselves? (Use the terms *stability, energy, valence electrons* in your answer.)

3. Describe each of the three main types of chemical bonding and how they work. (Use a diagram for each type and make sure you specifically refer to how the electrons are moving and interacting.)

ionic bonding

covalent bonding

metallic bonding

4. Fill in the chart below using what you know about the different elements listed and the type of chemical bonding that will most likely occur between each pair:

Element 1		Element 2		Most likely type of bonding
Calcium	Metal or nonmetal?	Oxygen	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	
Magnesium	Metal or nonmetal?	Cobalt	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	
Chlorine	Metal or nonmetal?	Carbon	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	
Sulfur	Metal or nonmetal?	Lithium	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	
Iron	Metal or nonmetal?	Fluoride	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	
Phosphorus	Metal or nonmetal?	Bromine	Metal or nonmetal?	How do you know?
Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	Number of valence electrons in a neutral atom?	Most likely to give electrons or gain electrons?	

Bonding Diagrams

Draw a diagram that shows how bonding occurs in each of the following compounds. (Hint: Start by identifying which type of bonding will most likely occur in the substance shown and then refer to your "Chemistry Help Guide" for extra help.)

5. MgCl_2

11. Silicon dioxide

6. Iron (III) sulfide

12. Sulfur trioxide

7. Bronze, an alloy of copper (II) and zinc

13. Boron trihydride

8. Pure aluminum metal

14. Ethylene, C_2H_4

9. CF_4

15. Water

10. Phosphorus trichloride

16. $\text{Ca}(\text{OH})_2$

Molecular Geometry and Polarity

17. a. Summarize VSEPR theory in your own words. How does it lead to the common shapes we call “molecular geometries?”

b. Refer back to questions #5-16. In the chart below, in the “Substance” column, list each of the substances from your drawings that are most likely to form covalent bonds. Then, use the diagrams you drew to help you fill in the rest of the chart with the correct molecular geometry for each molecule.

Substance	How many electron domains (“zones”) are there around the central atom?	How many nonbonding domains (sets of “unpaired” electrons) are there around the central atom?	How many bonding domains (sets of “paired” electrons that form a bond) are there around the central atom?	Molecular geometry
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule’s molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule’s molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule’s molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule’s molecular geometry will be?				

b. Chart from question #17b, continued

Substance	How many electron domains ("zones") are there around the central atom?	How many nonbonding domains (sets of "unpaired" electrons) are there around the central atom?	How many bonding domains (sets of "paired" electrons that form a bond) are there around the central atom?	Molecular geometry
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule's molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule's molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule's molecular geometry will be?				
Substance	Electron domains	Nonbonding domains	Bonding domains	Molecular geometry
How do you know what this molecule's molecular geometry will be?				

18. a. Define the term "polarity" and use a diagram to show how it impacts the structure of molecules.

b. In your own words, explain how electronegativity causes polarity in molecules and their bonds.

c. What is difference between bond polarity and molecular polarity? Can a nonpolar molecule contain polar bonds, or a polar molecule contain nonpolar bonds? Use an example (and maybe even a diagram) to explain your answer.

19. a. Calculate the electronegativity difference for each of the following bonds categorize each as **nonpolar**, **polar**, or **ionic**.

H-F	_____	nonpolar	polar covalent	ionic
N-F	_____	nonpolar	polar covalent	ionic
B-Br	_____	nonpolar	polar covalent	ionic
K-F	_____	nonpolar	polar covalent	ionic
Na-Cl	_____	nonpolar	polar covalent	ionic
Li-O	_____	nonpolar	polar covalent	ionic
C-C	_____	nonpolar	polar covalent	ionic
C-H	_____	nonpolar	polar covalent	ionic
C-F	_____	nonpolar	polar covalent	ionic
C-Cl	_____	nonpolar	polar covalent	ionic
C-Br	_____	nonpolar	polar covalent	ionic
C-I	_____	nonpolar	polar covalent	ionic

b. Show the relative polarity of the bonds from question #18d above by adding an "X" and a label to the electronegativity diagram below for each set of elements. Then, color-code your diagram to show where the bonds would be nonpolar, slightly polar, moderately polar, highly polar, and ionic:



c. Categorize each of the compounds listed below according to the polarity and electronegativity difference of their bonds. Then, explain why these values might be misleading for some of the bonds shown:

calcium chloride
carbon tetrachloride
calcium-magnesium alloy

20. a. Again, refer back to questions #5-16 (and your explanation of these molecules' molecular geometries in question #17b). In the chart below, list each of the covalent molecules and then use the diagrams you drew to help you fill in their bond polarity and overall molecular polarity.

Substance	Does this molecule contain polar bonds? Show an example.	Does this molecule contain nonpolar bonds? Show an example.	What is the overall molecular polarity of this molecule?
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			

a. Chart from question #20a, continued

Substance	Does this molecule contain polar bonds? Show an example.	Does this molecule contain nonpolar bonds? Show an example.	What is the overall molecular polarity of this molecule?
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			
Substance	Polar bonds?	Nonpolar bonds?	Molecular polarity
How do you know what this molecule's molecular polarity will be?			

b. Why does the chart above only include the covalent molecules from questions #5-16? Why does it not include substances where other types of bonding are likely to occur?

Man-made molecules and the impacts of Chemical Bonding

19. **Try this verbally with a classmate, friend, or family-member:** Name a man-made molecule and identify the properties that make it useful and valuable to humans. Then, explain how this molecule's bonding structure leads to its properties, including its most important uses. (Using visuals or diagrams that make your communication more effective and clear is a great idea!)