1. Which of the following is an example of a structural formula?

- A. \( \text{C}_2\text{H}_6 \)
- B. \( \text{CH}_3(\text{CH}_2)_n\text{CH}_3 \)
- C. \( \text{CH}_3\text{OH} \)
- D. \( \text{H} \equiv \text{C} \equiv \text{C} \equiv \text{H} \)

2. According to the VSEPR Theory, which of the following molecules will have a linear geometry?

- A. \( \text{O} = \text{N} = \text{O} \)
- B. \( \text{F} \equiv \text{O} \equiv \text{F} \)
- C. \( \text{Br} \equiv \text{S} \equiv \text{Br} \)
- D. \( \text{H} \equiv \text{C} \equiv \text{N} \)

3. Which type of chemical formula best shows how atoms are bonded to one another and arranged in space?

- A. molecular
- B. empirical
- C. structural
- D. IUPAC

4. The model of ammonia (\( \text{NH}_3 \)) shown below is best described as
5. A molecule of carbon dioxide has the following Lewis dot structure.

\[ \text{\textbullet\text{-\textbullet}} :\text{C}::\text{O}::\text{O} \]

What is its molecular geometry?
- A. linear
- B. tetrahedral
- C. bent
- D. trigonal planar

6. Which of the following molecules has a polar character?

W. 

\[ \text{Cl - Be - Cl} \]

X. 

\[ \text{O - O} \]
7. Which of the following molecules has a nonpolar character?

- A. X
- B. Y
- C. W
- D. Z

8. The ability to rotate a model so that it looks 3-dimensional is an advantage of computer modeling. The image below, for example, provides views of the molecule *taxol* from three different angles.

Three Views of the Molecule Taxol

*Model provided courtesy of Andrew Ryzhkov.*
What is the function of the colors in the computer model of taxol shown above?

- **A.** The colors are arbitrary and have no precise meaning when interpreting the model.
- **B.** The colors are added by the programmer to identify different elements in the molecule.
- **C.** The colors are used to show which atoms have a ring shape and which are spheres.
- **D.** The colors are showing the actual colors of different elements in the molecule.

9. If methane (CH₄) has a tetrahedral molecular geometry, which of the following diagrams most likely represents its Lewis dot structure?

   - **W.**
   - **X.**
   - **Y.**
   - **Z.**

- **A.** W
- **B.** X
- **C.** Y
- **D.** Z

10. Which of the molecules shown above have a polar character?

- **A.** III and IV only
- **B.** I and II only
- **C.** I, II and III only
- **D.** II, III, and IV only
11. Which of the following is an example of a skeletal formula?

- W.  
- X.  
- Y.  
- Z.

12. If methane (CH₄) has a tetrahedral molecular geometry, which of the following diagrams most likely represents its Lewis dot structure?

- W.  
- X.  
- Y.  
- Z.

13. Which of the following is a non-polar compound?

- A. water (H₂O)  
- B. hydrochloric acid (HCl)  
- C. carbon dioxide (CO₂)  
- D. ammonia (NH₃)

14. Formaldehyde (CH₂O) is a compound that is commonly used in biology as a preservative for cells and tissue samples. If its Lewis dot structure looks like
what is its molecular geometry?
○ A. bent
○ B. linear
○ C. tetrahedral
○ D. trigonal planar

15. Which statement best explains why HCl is a polar molecule?
○ A. The negative charge is greater on Cl than on H.
○ B. The HCl molecule has an excess of electrons.
○ C. The HCl molecule has a symmetrical shape.
○ D. The HCl molecule is a strong acid.

16. Which of the following molecules has a polar character?

○ A. Z
○ B. X
○ C. Y
○ D. W

17. Which of the following molecules is nonpolar?
○ A. H₂O
○ B. Cl₂
○ C. NH₃
○ D. HCl

18.
How many bonds are present in the model of ammonium nitrite shown above?

- A. six
- B. three
- C. four
- D. seven

19. What is the difference between the Lewis model and the valence-shell electron pair repulsion (VSEPR) model?

- A. Only the VSEPR model can be used to explain intermolecular forces.
- B. Only the Lewis model shows the covalent bonds in a molecule.
- C. Only the Lewis model takes into account unbonded electrons.
- D. Only the VSEPR model shows the geometric shape of a molecule.

20. Different models can be used to model compounds in different ways. A computer model can be used to show

- A. the relative sizes of atoms in a compounds.
- B. the density of electrons in the bonds of a compound.
- C. the relative lengths of bonds in an atom.
- D. all of these

21.

What is one advantage of a physical ball and stick model made with a modeling kit over graphical ball and stick model on paper or a computer screen?

- A. A physical model cannot be modified once it has been put together.
- B. A physical model shows the size of the molecule more accurately than a graphical one.
Only a physical model can be easily transported and shared.

A physical model allows the builder to touch and rotate the model by hand.

22. The Lewis structure for ammonia is shown above. Which of the following will be the geometric shape for ammonia?

- **A.** tetrahedral
- **B.** trigonal pyramidal
- **C.** angular
- **D.** trigonal planar

23. Which of the following molecules has a nonpolar character?

- **A.** Y
- **B.** Z
- **C.** X
- **D.** W

24. **Pentanoic Acid**
What advantage of skeletal formulas explains why they are so commonly used in organic chemistry?
- A. They can only represent small molecules.
- B. They leave out the bonds in the formula.
- C. They can be drawn quickly on paper.
- D. They show the molecule in 3-dimensions.

25. The electron sharing that takes place in a covalent bond is often represented by illustrations such as the one shown below.

\[ \text{H : H} \]

What are these illustrations called?
- A. periodic pictures
- B. Bohr models
- C. electron clouds
- D. electron dot diagrams

26. The Lewis structure for boron trifluoride is pictured below.

\[ \text{\( \overset{\text{+}}{\text{B}}\text{F}_3 \)} \]

Due to valence shell electron pair repulsion theory, what is the molecular geometry of this molecule?
- A. trigonal pyramidal
- B. bent or angular
- C. tetrahedral
- D. trigonal planar

27. How is the solid sphere model of chlorophyll shown above different from a ball and stick model?
- A. The solid sphere model uses small spheres to represent bonds.
B. The solid sphere model does not use a line to represent bonds.
C. The solid sphere model does not show how atoms are arranged in space.
D. The solid sphere model uses spheres that are all the same size.

28. The molecule hydrogen peroxide, is written here in a way that shows how the atoms in the molecule are arranged.

    H-O-O-H

What is the name for this type of model?
A. orbital diagram
B. structural formula
C. molecular formula
D. empirical formula

29. Which of the following molecules has a tetrahedral shape?
A. SiCl₄
B. C₂H₂
C. SiO₂
D. CO₂

Answers
1. D
2. D
3. C
4. B
5. A
6. D
7. C
8. B
9. B
10. A
11. B
12. C
13. C
14. D
15. A
16. C  
17. B  
18. A  
19. D  
20. D  
21. D  
22. B  
23. B  
24. C  
25. D  
26. D  
27. B  
28. B  
29. A