Spatial Reasoning

Section 3
17 Questions
1. Do you feel that you have a better understanding of 3-D Shapes of Molecules as a result of completing Chemistry 112?

a) No change  
b) A little  
c) Some  
d) Quite a bit  
e) Significantly
2. How important do you feel it is to have an understanding of 3-D molecular shapes while learning about chemistry?

a) Not important  
b) Somewhat important  
c) Very important  
d) Essential
3. Which of these molecules is polar?

a) CF₄
b) C₂H₆
c) BF₃
d) NF₃
e) None of them
4. Consider the tetrahedral geometry of a molecule of carbon tetrachloride, CCl₄. What is the *maximum* number of atoms that can lie within a symmetry plane?

a) 1       b) 2       c) 3       d) 4       e) 5
5. Does fluoromethane, CH$_3$F, possess a plane of symmetry?

a) yes  b) no  c) not sure
6. When sighting down the carbon chain of a pentane molecule, C$_5$H$_{12}$, how does it look?

a) the molecule is flat with hydrogen’s extending away from the carbon atoms at 90°

b) straight, with all carbons in a line and hydrogen atoms within the same plane

c) zig-zag, with carbon atoms alternating up and down positions and hydrogen atoms in the same plane

d) straight, with all carbons in a line and some hydrogen atoms positioned out of the plane

e) zig-zag, with carbon atoms alternating up and down positions and some hydrogen atoms positioned out of the plane
7. Does methanol, CH$_3$OH, possess a plane of symmetry?

a) yes       b) no       c) not sure
8. VSEPR Theory

Which of these molecules is NOT flat?

a) BH$_3$  

b) PF$_3$  

c) C$_2$H$_2$  

d) O$_3$  

e) none of them
9. Are these molecules the same?

a) yes, the same
b) not the same
c) not sure
10. Consider the molecule $\text{C}_2\text{H}_5\text{NH}_2$, shown on the left. Which image matches what the molecule would look like after a $180^\circ$ rotation about the Y-axis?
11. Consider the molecule PCl$_4$I, shown on the left. Which image matches what the molecule would look like viewed from the position indicated by RED arrow?
12. How many water molecules could hydrogen bond to **one** molecule of methanol (shown below) ?

![Methanol molecule](image)

a) 1    b) 2    c) 3    d) 4    e) 5
13. Are these molecules the same?

![Molecule 1](image1)

![Molecule 2](image2)

a) yes the same
b) not the same
c) not sure
14. Which of these molecules are the same?

a) A and B  
b) A and C  
c) B and C  
d) B and D  
e) None, they are ALL different
15. Which of these molecules are the same?

A)  

B)  

C)  

D)  

a)  A and B  
b)  A and D  
c)  B and C  
d)  B and D  
e)  None, they are ALL different
16. Which of these sketches correctly represents the molecule, NH$_2$F as shown below?

![Molecule Image]

a) \[ \text{H} - \text{N} - \text{F} \]  

b) \[ \text{H} - \text{N} - \text{F} \]  

c) \[ \text{H} - \text{N} - \text{F} \]  

d) \[ \text{H} - \text{N} - \text{F} \]
17. Which of these sketches correctly represents the molecule shown below when viewed down the F to C bond?

![Molecule Diagram]