Spatial Reasoning:

• Chemistry is a very visual science
• Chemists frequently build models and make sketches to help them consider chemical behavior!
• All science, technology and engineering fields require spatial skill.
• Spatial skills are trainable, and we will be working on helping you to acquire these skills.
• Spatial ability has been shown to boost learning achievement
This Pre-test Includes

• First, some general questions from spatial visualization tests
• Second, specific chemistry questions that relate to 3-D understanding
• Last, a few general survey questions
Purdue Spatial Visualization Test

How was the figure rotated?
In which Direction?  AND
By how much?
Purdue Spatial Visualization Test

Warm-up

Select choice A, B, C, D, E shown above
1. IS ROTATED TO

AS IS ROTATED TO

A  B  C  D  E
2.

IS ROTATED TO

AS

IS ROTATED TO

A  B  C  D  E
3.

IS ROTATED TO

AS IS ROTATED TO

A  B  C  D  E
4.

IS ROTATED TO

AS

IS ROTATED TO

A B C D E
5.

IS ROTATED TO

AS

IS ROTATED TO

A  B  C  D  E
6.

IS ROTATED TO

AS

IS ROTATED TO

A  B  C  D  E
7. Fold the paper cut out in your mind and choose the correct representation.

a)  

b)  

c)  

d)
Rotate the Molecule 180° around the Y-axis
8. Rotate the molecule 180° in the clockwise direction around the Y-axis (shown in Yellow). Which image matches what the molecule would look like after the rotation?

A  B  C  D
9. Which atom lies behind the plane of the screen?

A) a
B) b
C) c
D) d
10. How many water molecules could hydrogen bond to one molecule of acetic acid (shown below)?

a) 1    b) 2    c) 3    d) 4    e) 5
11. Does this molecule possess a plane of symmetry?

a) Yes  b) No
Which picture best represents what this molecule would look like after being rotated 180° on the X-axis?
13. Assume *a collection of many* of these CH₃F molecules.

Based on what you know about polarity, predict which region of the molecule, CH₃F, will experience the greatest attraction to fluorine, F on an adjacent molecule.
Select the 3-D shape that best corresponds to the Lewis formula above.

A  
B  
C  
D
15. VSEPR Theory

Which of these molecules, if any, is not flat?

a) BF$_3$  b) PH$_3$  c) HCN

d) O$_3$  e) H$_2$S
16. VSEPR Theory

Imagine a molecule of ammonia, NH₃. If you carefully inspected it, what is the maximum number of atoms that would lie within one plane?

a) 0  b) 1  c) 2  d) 3  e) 4
17. At the molecular level, are you able to imagine how a collection of water molecules, in the liquid state, would interact with each other?

a) Yes, easily
b) Vaguely, but not sure
c) No, I cannot
18. I have a good understanding of how 3-D molecular shape and orientation affect a molecules reactivity.

a) Yes  
b) Some idea  
c) Vague idea  
d) Not sure at all
Survey Questions:

19. Do you feel it is important to be able to imagine molecules in 3-D?
   a) No   b) Sometimes   c) Often   d) Always
Survey Questions (continued):

20. Have you ever built molecules with hand-held molecular models sets?
   a) No       b) Little       c) Some       d) Frequently

21. Have you used computer imaging programs for visualizing 3-D molecules?
   a) No       b) Little       c) Some       d) Frequently