

# **GNG1103**

## **Engineering Design**

### **Deliverable D**

**Date: February 9,2020**

**Team #: F08**

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**Problem Statement:** Interactive, innovative, friendly-user and cost effective VR learning experience that helps students currently enrolled in Organic Chemistry visually understand chemistry molecules in 3D.

**Molecule for display:**

-methane

-acetone

-ammonia

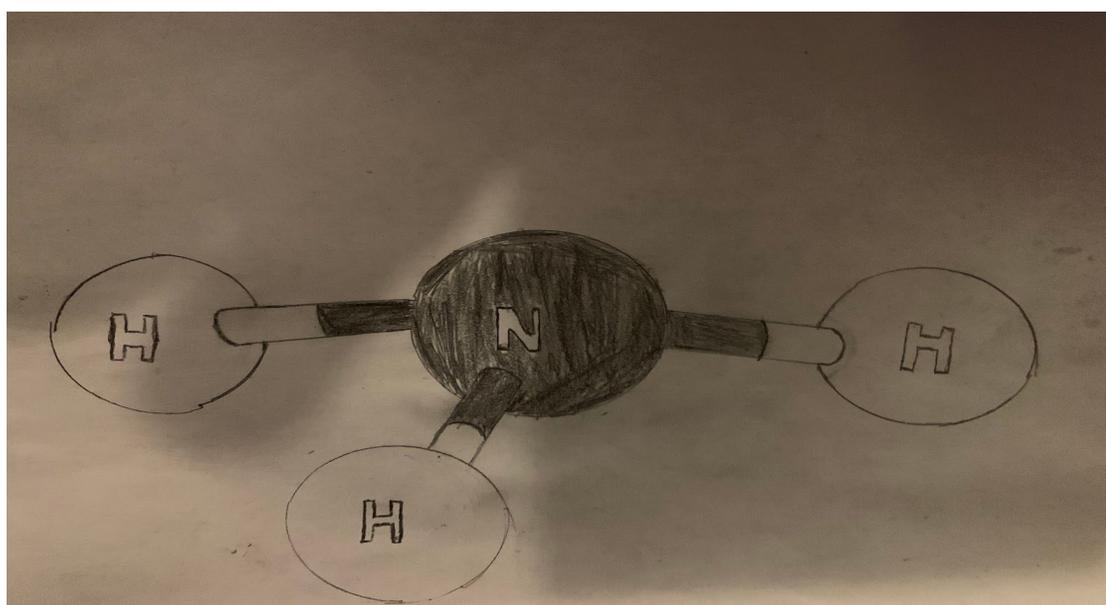
<u>Specifications</u>	<u>VR Name</u>			
	<u>Importance</u>	<u>Ammonia</u>	<u>Acetone</u>	<u>Methane</u>
<u>Designer</u>	<u>N/A</u>	<u>Abdullah</u>	<u>Duncan</u>	<u>Kelly/Sofia</u>
<u>Type of Structure</u>	<u>3</u>	<u>Two Nitrogen atoms either 3 Hydrogens Attached</u> <u>NH<sub>3</sub></u>	<u>Carbonyl with two R" groups</u> <u>C<sub>3</sub>H<sub>6</sub>O</u>	<u>Carbon atom with 4 Hydrogens</u> <u>CH<sub>4</sub></u>

<u>Approximate Cost (CDN)</u>	<u>4</u>	<u>&lt;\$100</u>	<u>&lt;\$100</u>	<u>&lt;\$100</u>
<u>Different type of orbitals</u>	<u>6</u>	<u>1</u>	<u>2</u>	<u>1</u>
<u>Type of Reaction</u>	<u>7</u>	<u>Acid-Base</u>	<u>Addition and Acid Base</u>	<u>Acid-Base</u>
<u>Molecular mass of the molecule</u>	<u>1</u>	<u>17.031 g/mol</u>	<u>58.08 g/mol</u>	<u>16.04 g/mol</u>
<u>Production Difficulty (1 - easy, 10 - very difficult)</u>	<u>8</u>	<u>7</u>	<u>6</u>	<u>10</u>
<u>Vibration</u>	<u>2</u>	<u>Yes</u>	<u>Yes but less than the other molecules</u>	<u>Yes</u>
<u>Rotates</u>	<u>5</u>	<u>Yes</u>	<u>Yes</u>	<u>Yes</u>

<u>Total</u>		<u>89</u>	<u>96</u>	<u>74</u>
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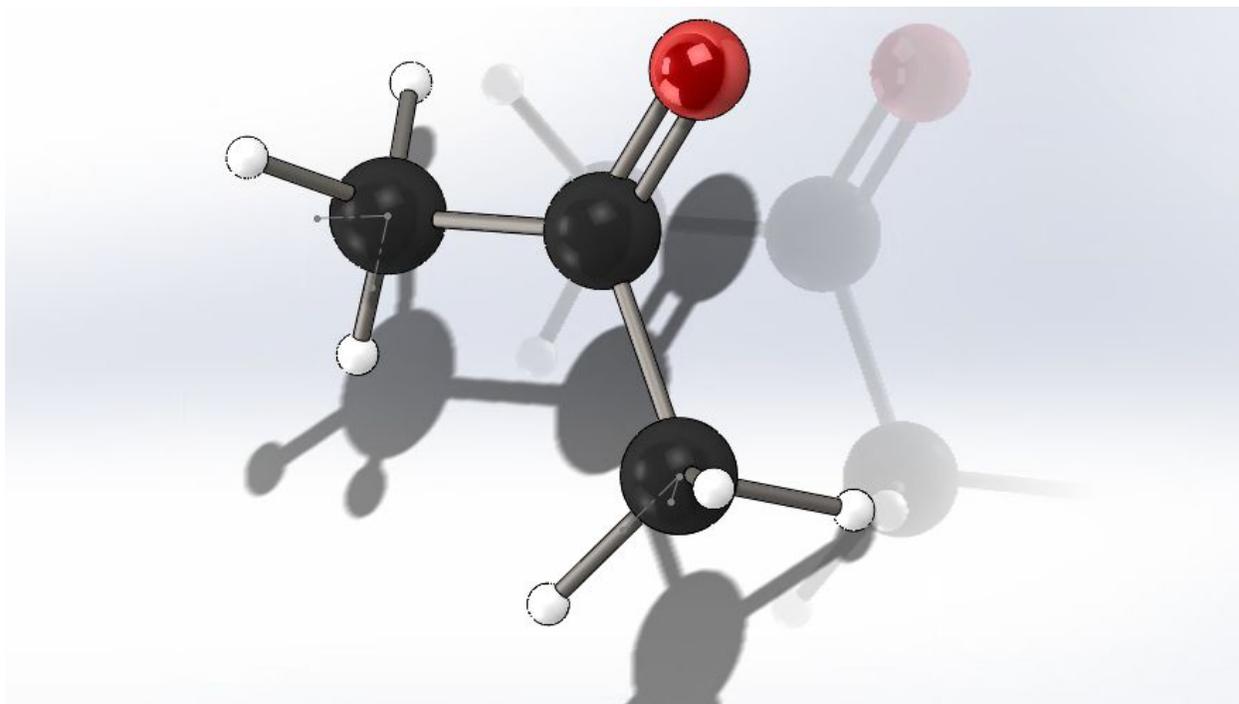
<u>Colour</u>	<b>Red</b>	<b>Yellow</b>	<b>Green</b>
	<u>Worst - 3</u>	<u>Medium - 2</u>	<u>Best - 1</u>

### Concept 1 Ammonia:



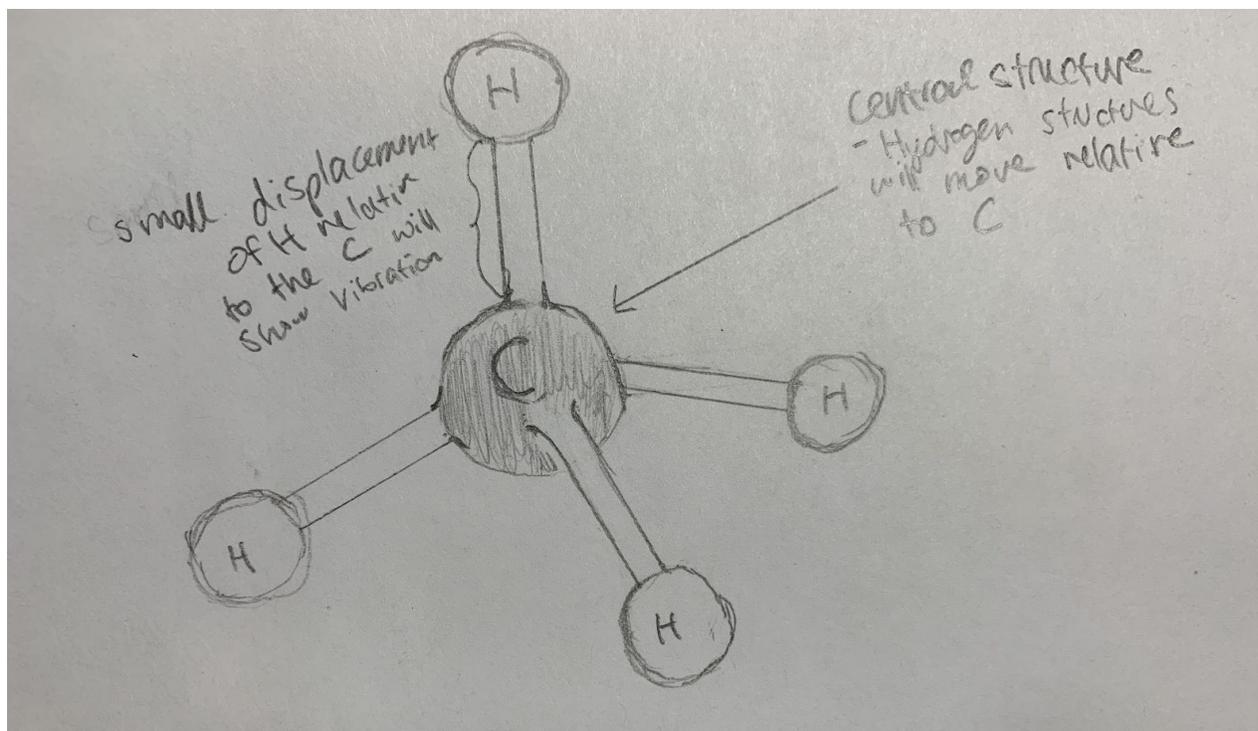
Ammonia is a compound of nitrogen and hydrogen with the formula  $\text{NH}_3$ . A stable binary hydride, and the simplest pnictogen hydride, ammonia is a colourless gas with a characteristic pungent smell. It is a common nitrogenous waste, particularly among aquatic organisms, and it contributes significantly to the nutritional needs of terrestrial organisms by serving as a precursor to food and fertilizers. The axis of the molecule is called a  $C_3$  axis, since the molecule can be rotated about it into 3 equivalent orientations. Small rotation of the Hydrogen atoms around Nitrogen will cause the molecule to vibrate.

### Concept 2 Acetone:



Vibration occurs when the hydrogen atoms are displaced to the carbon atom. This molecule exhibits pi and sigma bonds. An addition reaction can be shown with this molecule to display the Learning objectives and then we could also proceed with an acid-base reaction. Internal rotation of acetone is low but is still a considerable.

### Concept 3 Methane:



Small displacement of the Hydrogen of the relation to the Carbon will show vibration. The central structure, hydrogen will move relative to Carbon. Only exhibits sigma bonds. An acid-base reaction can be shown to interact with this molecule to address the learning objectives.

### **Analysis and Conclusion:**

The molecule that will display in the VR is Acetone because this molecule shows perfectly each property depicted in a 3D ball and stick diagram. Also, this molecule includes double bonds which have pi orbitals and single bonds to show rotation. This molecule has 2 types of orbitals: sigma and pi. It is the easiest molecule to produce but it does display all the characteristics that the customer is looking for. Also the acetone molecule has the highest score when benchmarked.