Project Deliverable H

Prototype 3 and Final prototype Update

Group 4

Kayla Bigras, Jonah Hamer-Wilson, Donghao Wang, Mariana Rodriguez Munoz, Jackson Zhou

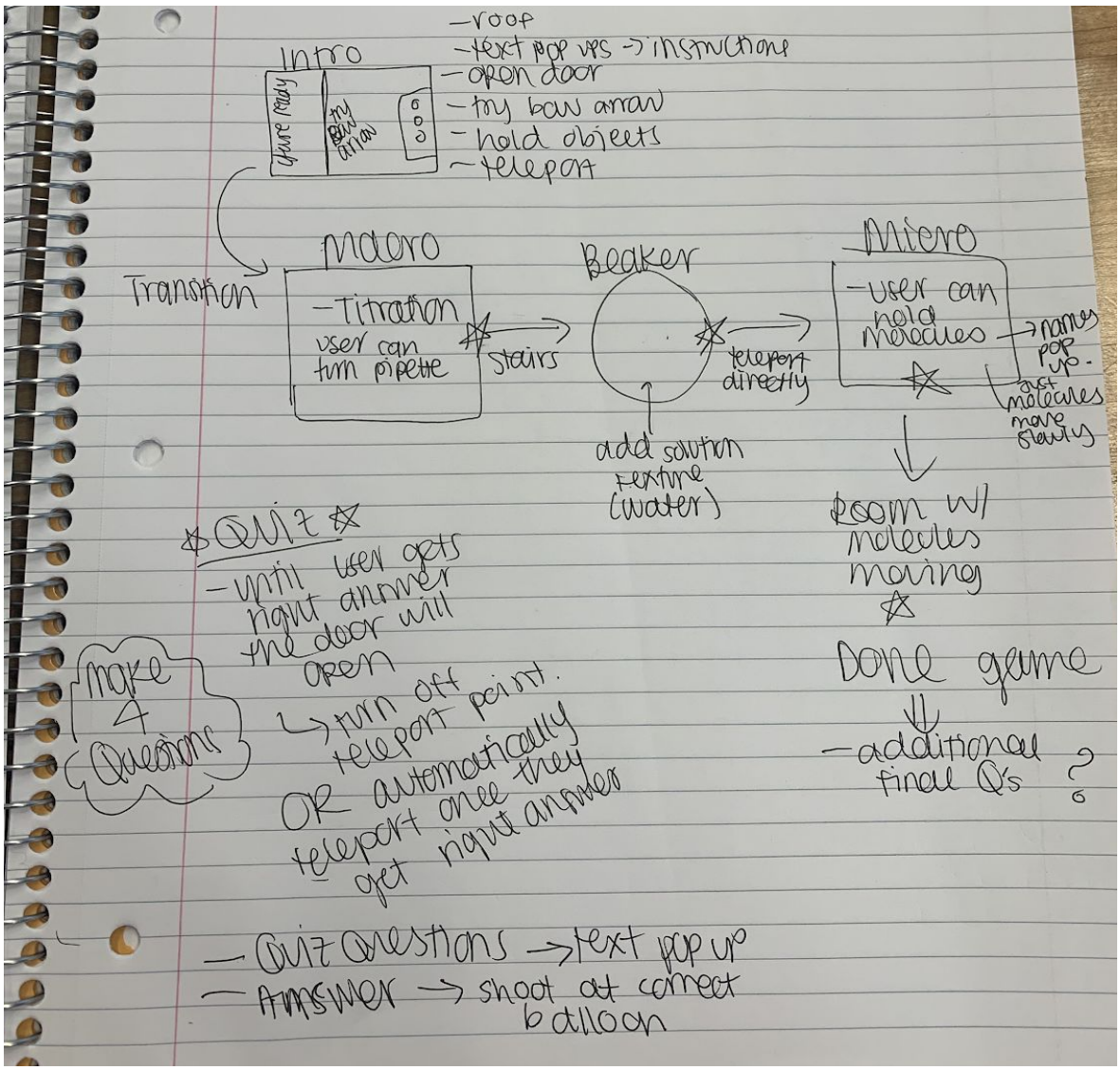
Introduction

In this final stage of prototype development of our educational VR game we had faced some unexpected challenges due to the COVID-19 virus outbreak. The team was forced to work on the game remotely and therefore we were unable to merge seperate parts of our game into one. We were also unable to test the prototype with the VR headsets that were provided to us in makerspace. With all these challenges, our team has completed as much of the game as is possible without testing capabilities, on separate files. In this final deliverable our goal is to showcase our game as effectively as possible using screenshots of our unity files, as well as screenshots that were taken for our last deliverable report. We also will go into detail about the improvements that we would've made to the game under normal circumstances to have a fully functioning and effective VR experience for chemistry students. Although our prototype is not fully completed, our team strives to give the best possible representation of what the game should have been in the rest of the report.

Discussion

1. Documentation of our final prototype

   Our game is structured as a map that the user will explore as they advance throughout the game. Each level of the game is outlined in this sketch and there are stars placed where the game will ask the user quiz questions related to the connection between the macroscopic and microscopic levels of the titration. To choose the correct answer to the quiz question a bow and arrow will be used to shoot the correct answer. The following diagram shows the initial outline of the game.



   If our team had finished the game under normal circumstances, we would have implemented the following quiz questions into the game. The following are the quiz questions that we would have implemented into the game.

   Q1: What change can you observe when performing this titration?

   A. Change in colour
   B. Production of gas
   C. Production of heat

D. Production of a precipitate

Q2: In this NaOH and HCl reaction, which of the following ions has the highest involvement in the reaction?

A. Na+
B. H3O+
C. Cl-

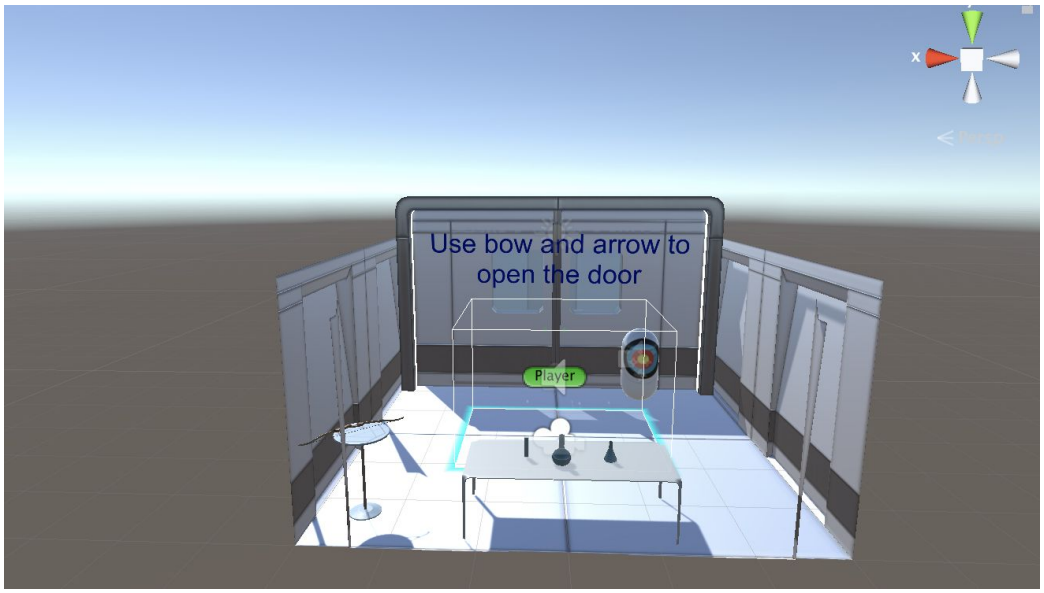
Q3: Identify this molecule:

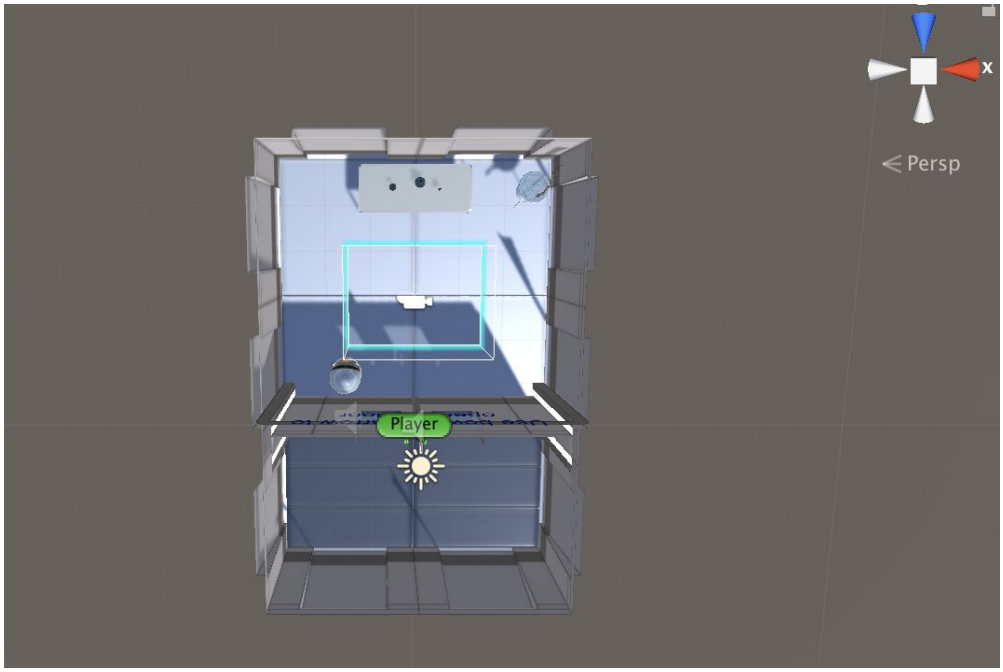
A. Na+
B. H2O
C. OH-
D. H3O+

Q4:What is the ratio of phenolphthalein in comparison to the solute, water?

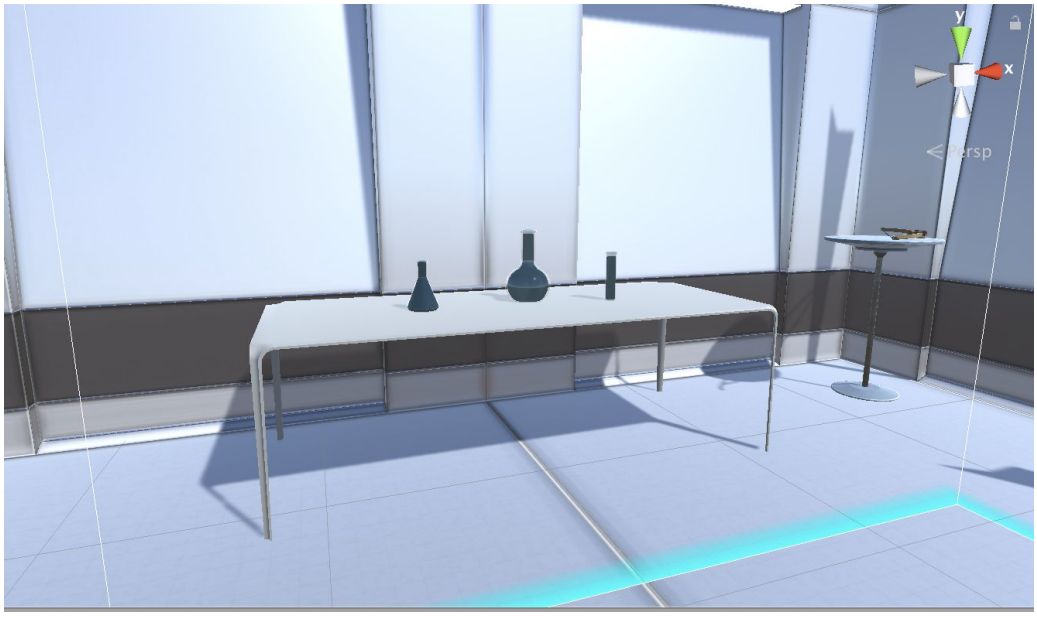
A. A lot more phenolphthalein than water
B. A little more phenolphthalein than water
C. Equal amount of phenolphthalein and water
D. A little less phenolphthalein than water
E. A lot less phenolphthalein than water

The first stage of our game is the introduction room. This room is where the user will be given the instructions to play the game as well as some background information regarding a titration, if the user is unfamiliar with this type of reaction. It will also teach the user about the functionality of the game such as how to teleport, grab objects and answer the questions using the provided bow and arrow. The following screenshots illustrate the final product of this stage.





The chemistry lab instruments present in the table are objects the user is able to hold and drop to become familiar with this function using the controllers. The controller of each side is programmed via a script in Unity so that it detects when it is close to an interactable object and it should allow the user to hold it and drop it, as well as pass it from one hand to the other. In addition, there is a stand present (on the right) with a bow that the user must use to practice shooting arrows as they would in the game to answer questions. Once they do this, the door will open and then they will have completed this introductory stage and move on to the game.



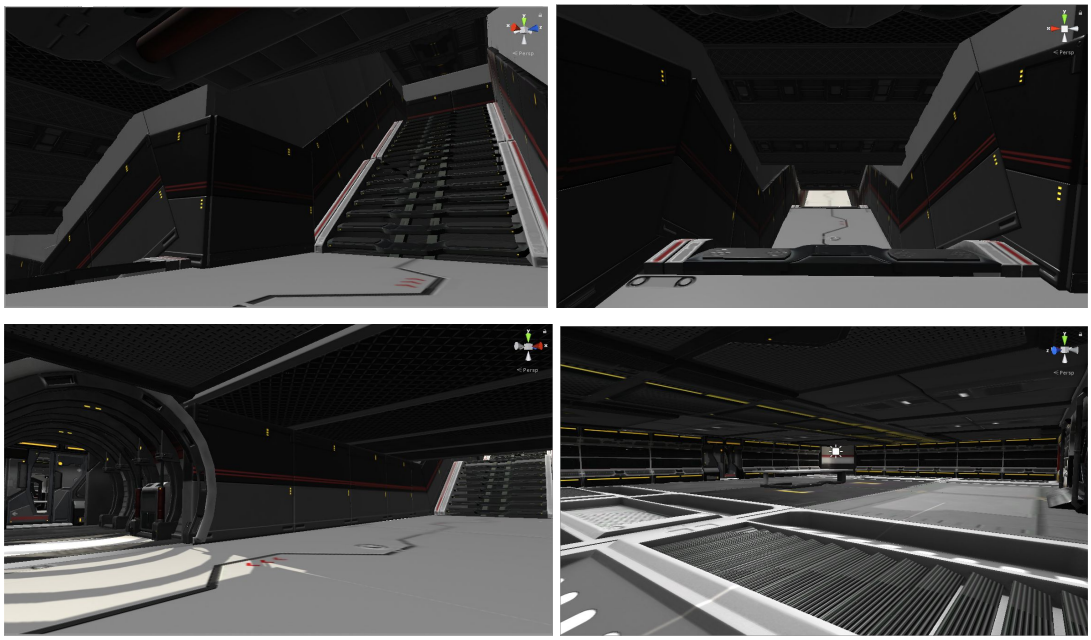
The next screenshot shows the objects present in the actual introductory scene in unity.

If our team had finished the game under normal circumstances, we would have joined this scene to the rest of the game using a transition between the two to complete the game as planned. Then, the user would automatically be transported from the intro to the game after completing all the necessary steps to ensure they are acquainted with how to navigate through the environment and understand the learning outcome. In addition, more text bubbles would be prompted to the user as instructions to guide them through what they must accomplish. These text bubbles would be programmed to appear one after the other, only after the instructions in the first one have been completed by the user.

The second stage of our game is the macroscopic level of the game. In this part of the game the user will have the ability to perform a titration, turning the pipette to observe a colour change in the beaker. After the user successfully performed the titration There will be a question for the user, the user will need to use the bow and arrow to answer the question, by shooting at the right answer. After correctly answering the question, the door will be opened. The user will be able to move to the next stage by walking up the stairs.
The following screenshot(s) illustrate the final product of this stage.

Use the bow and arrow to answer the questions

If our team had finished the game under normal circumstances we would have also included the door opening scene to complete the game as planned.

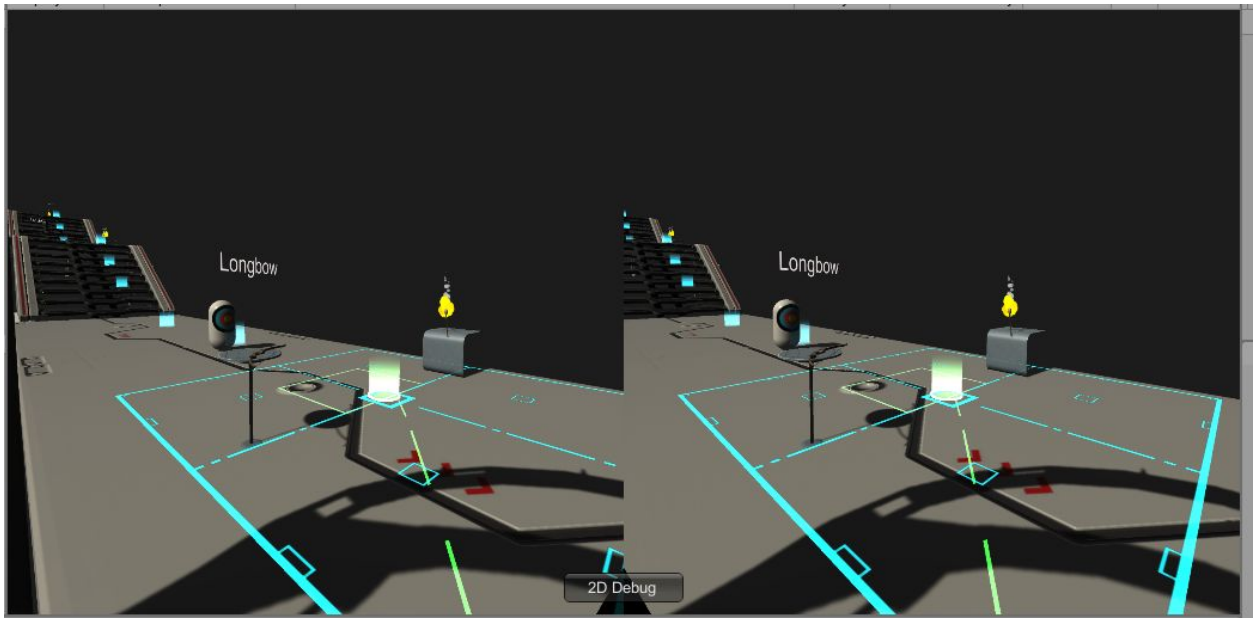


New walls with roof top

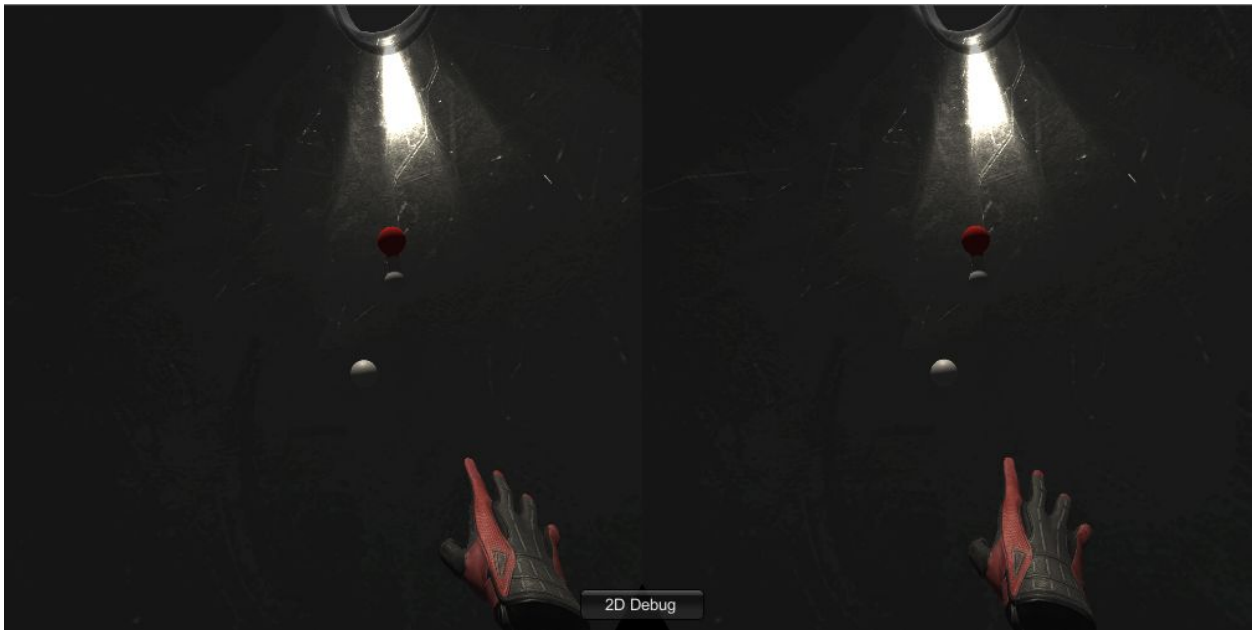
In the third stage of our game, the user walks up the stairs, in between there will also be some questions, after answering all the questions and passing all the doors, The last door for this stage will be the titration beaker. The user will be able to walk down a magic staircase.(The idea is that as the user climbs the stairs they are getting small enough to jump into a beaker.)Once the user jumps into the beaker they are teleported into the medium stage of the vr game(between micro

and Macro), where the user can't see the molecules yet but the user is already in the beaker. At the bottom of the beaker, the user will be able to find a magnifying glass, there are two buttons on the handle of the magnifying glass, One is a + sign the other one is - sign, by pressing the + button the user will teleport into microscopic level of the titration. And - to go back to the midstage.the user is asked quiz questions that they must answer in order to unlock the next level of the game.

The following screenshot(s) illustrate the final product of this stage.



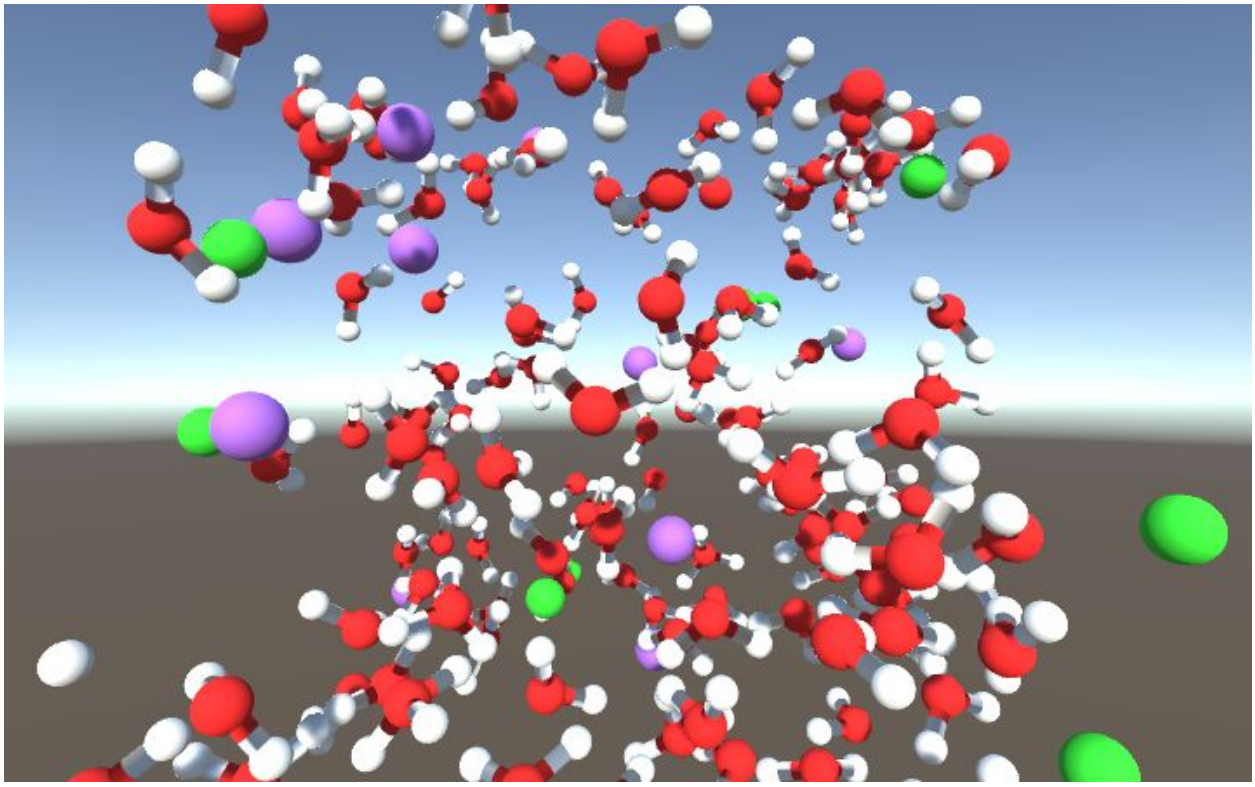
Staircase to the beaker



Inside of the beaker after using the magic staircase

If our team had finished the game under normal circumstances we would have also included teleporting freely after finishing all the quizzes. to complete the game as planned.

In the microscopic level of the game, the user is surrounded with the molecules and ions present in a titration of hydrochloric acid using sodium hydroxide and can watch them interact. They will also be in a room where they can hold and manipulate them. The molecules all move unpredictably and chaotically collide with one another just as they would in the real world.
The following screenshot(s) illustrate the final product of this stage.



If our team had finished the game under normal circumstances we would have also included some molecule interaction with the player and tested it more with the virtual reality itself.

2. What is the purpose and function of our final prototype?
   Students in organic chemistry have trouble visualizing the dynamic nature of molecules. The purpose of our final prototype is to have a VR environment that will help demonstrate the connection between molecular and macroscopic views of molecular chemistry. The final prototype is a fun and interactive educational aid for organic chemistry students.

3. Description of how your client would interact with your final prototype.
   The client would learn how to play the game in the introduction stage. They learn how to teleport on the same plane using the VR controllers as well as teleporting on different planes using the teleportation points placed throughout the game, mostly to climb up the stairs). In the microscopic stage the user is able to interact with the molecules by…….. The learning objectives would be taught throughout the game, and the user is tested on their understanding using the quizzes. Each quiz will allow the user to move to the next stage of the game if answered correctly.

4. In order to carry out final prototype testing, analyzation and evaluate performance compared to the target specifications developed in Project Deliverable B,We compared our final product to other programs that had been ranked in deliverable B based on our design specifications from the client.

Design Benchmarking and Comparing the Target Specifications to Existing Programs:

		ODYSSEY (WAVEFUN)	Molview	Our Team VR game
Description		A VR app produced by an education company which shows molecules and reactions	A website where the user can draw a molecule and see it displayed in 3d	A VR game that shows the connection between the macroscopic and microscopic levels of chemistry through a titration reaction. The user learns through a storyboard where they must unlock each level by answering quiz questions correctly.

Features		- VR
		- Shows reactions and motion
		- Lots of options
		  - Gas sim
		  - Reactions
			- Open source
			- User draws molecules
			- Respects colour standards
			- Can go from name to drawing or vice versa	

Drawbacks		- Really expensive	- No VR - Few representations	
Price	5	$7500	Free (GNU GPL)	Free

Representations	3	4?	2	2
Shows collisions	5	Y	N	Y
Shows dynamic molecules	5	Y	N	Y
Connection between micro and macro	5	N	N	Y
Easy to use	4	?	Y	Y
Audio	2	N	N	N
Relationship between 2d & 3d	2	?	Y	N
Organic molecules	4	Y	Y	Y
Total		77	70	86

Conclusion

During the past couple months of development, our team learnt how to effectively use the design process. The team also learnt how to adapt and learn the skills needed in order to complete the task at hand, for example we learnt how to use unity as well as c# in order to program VR.We also had the opportunity to work on our teamwork and team productivity skills. In conclusion, we were able to create an educational VR chemistry game that is better than competitors software, based on our benchmarking and design criteria.