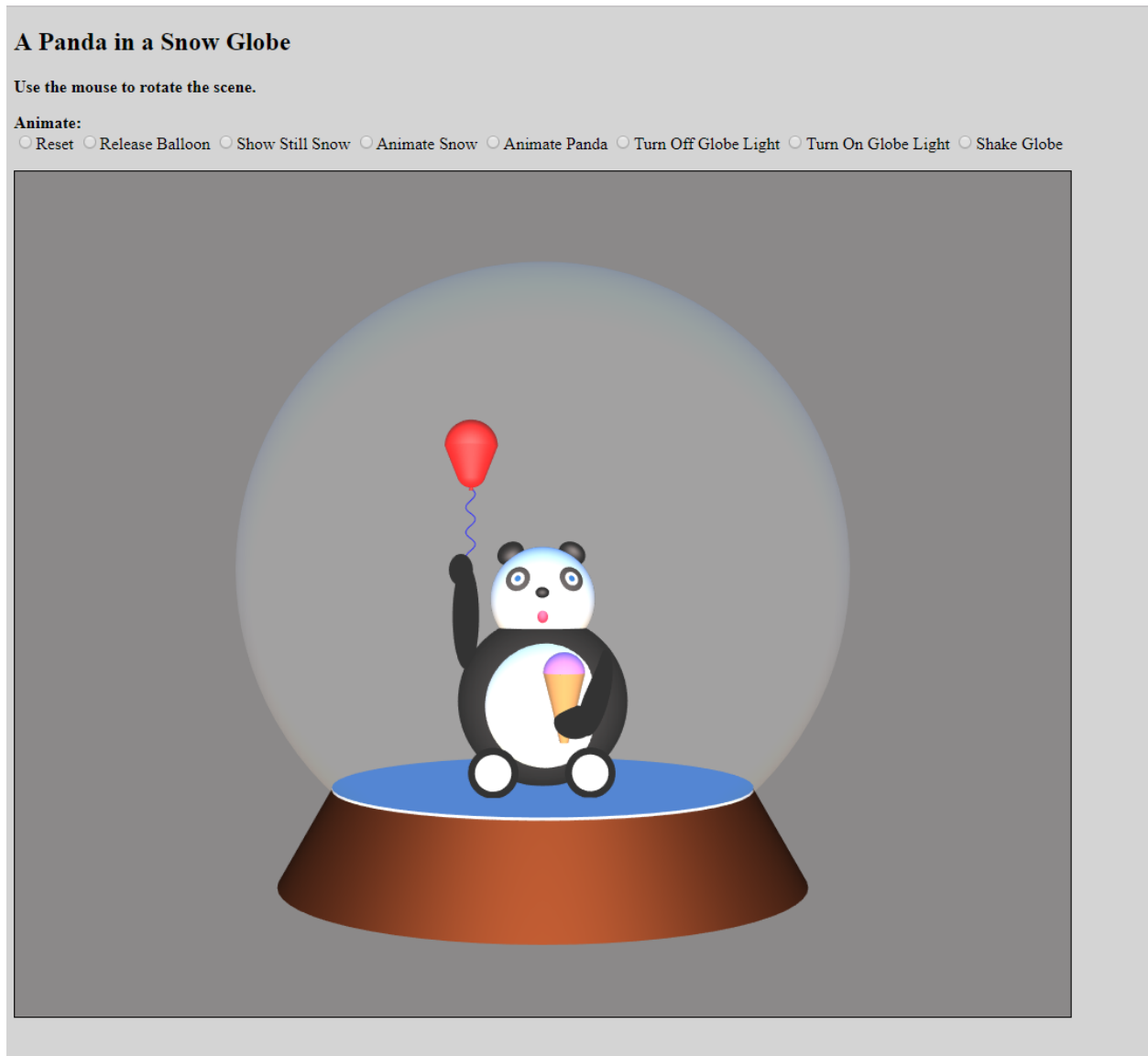


## CMSC 405 Project 3 Three JS

### User Guide:

The purpose of this application is to display a Three js scene that draws 6 shapes and uses multiple lighting effects. To begin the program, select the file named snow\_globe.html.

Once this file is selected this screen will appear:



*Figure 1. Initial screen of snow globe*

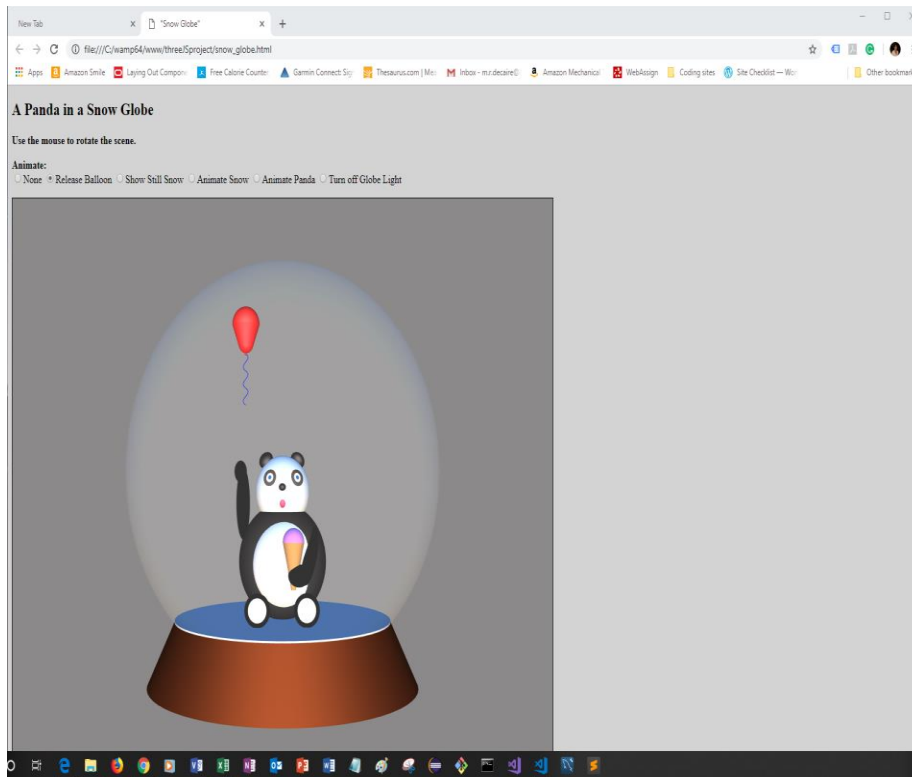
The user has the ability to move around the screen with a mouse trackball. Simply click on the screen and move the mouse.



*Figure 2 Scene rotated with trackball.*

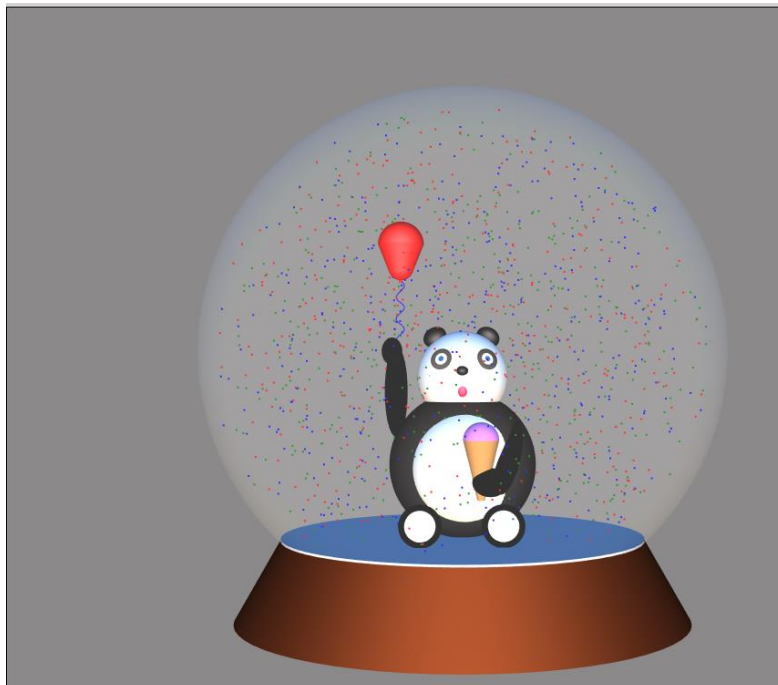
There are several radio buttons at the top which allow you to control different animations within the snow globe.

The release balloon radio button will allow the balloon to continuously ascend and descend into the panda's hand.



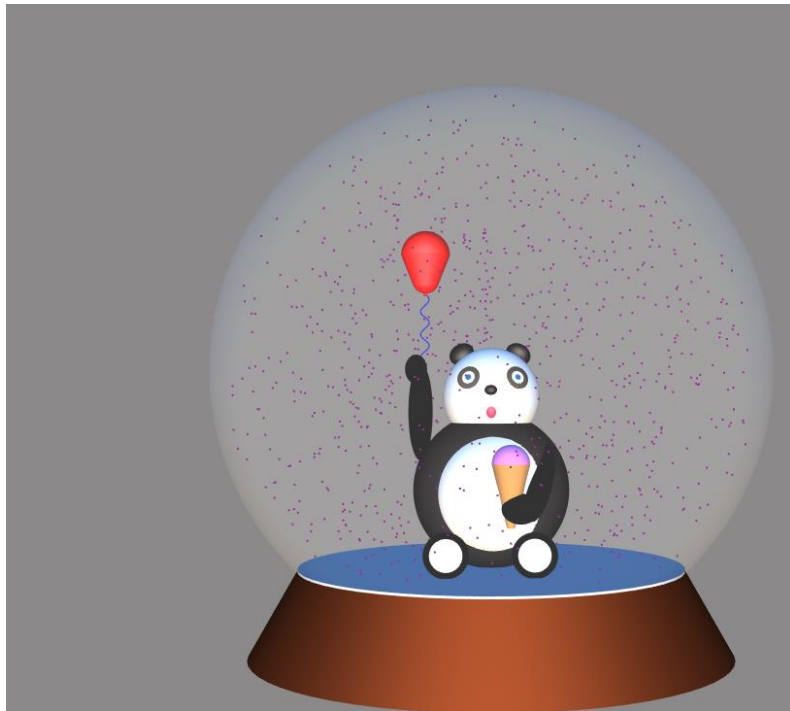
*Figure 3. Animated Balloon*

The show still snow will show multicolored snow in the snow globe.



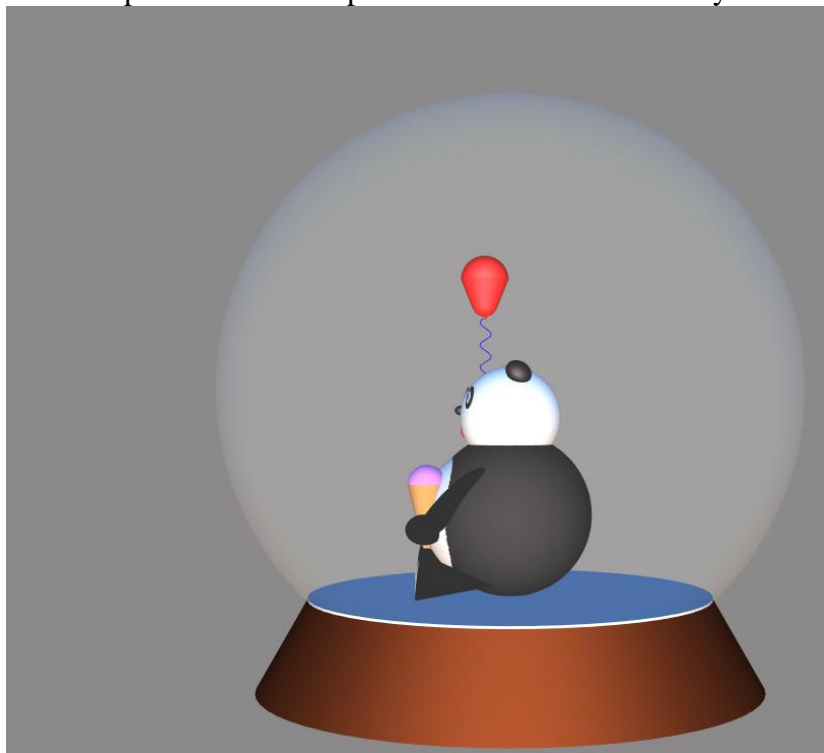
*Figure 4. Multicolored Snow in Globe.*

Animate snow actually produces a different snow which drifts around . The code for this was taken from 5.1 of the textbook (Eck D., 2005).



*Figure 5. Animated purple snow*

Animate panda causes the panda to revolve around the y axis.



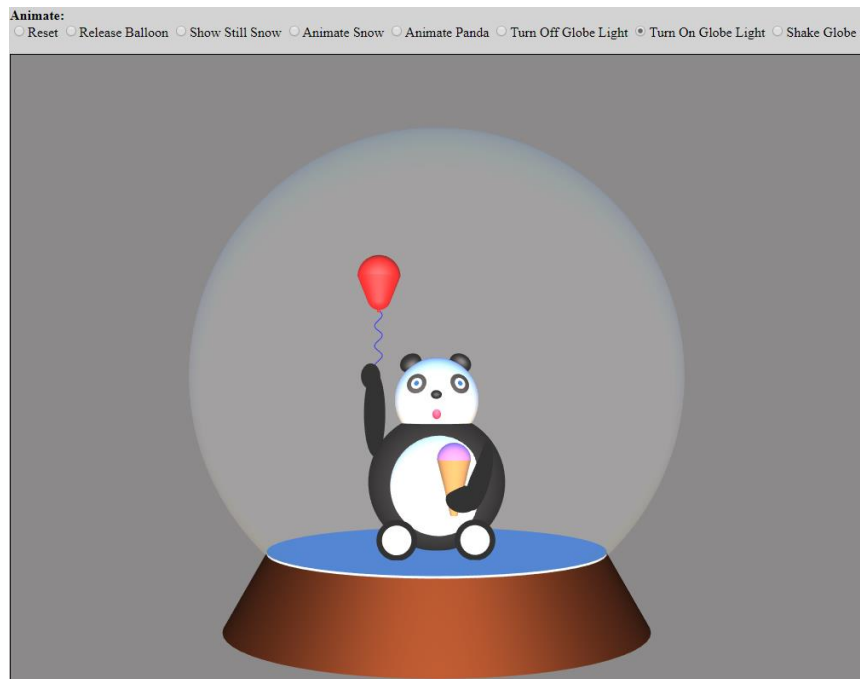
*Figure 6. Revolving panda*

Turn off Globe light will turn off the illumination in the globe.



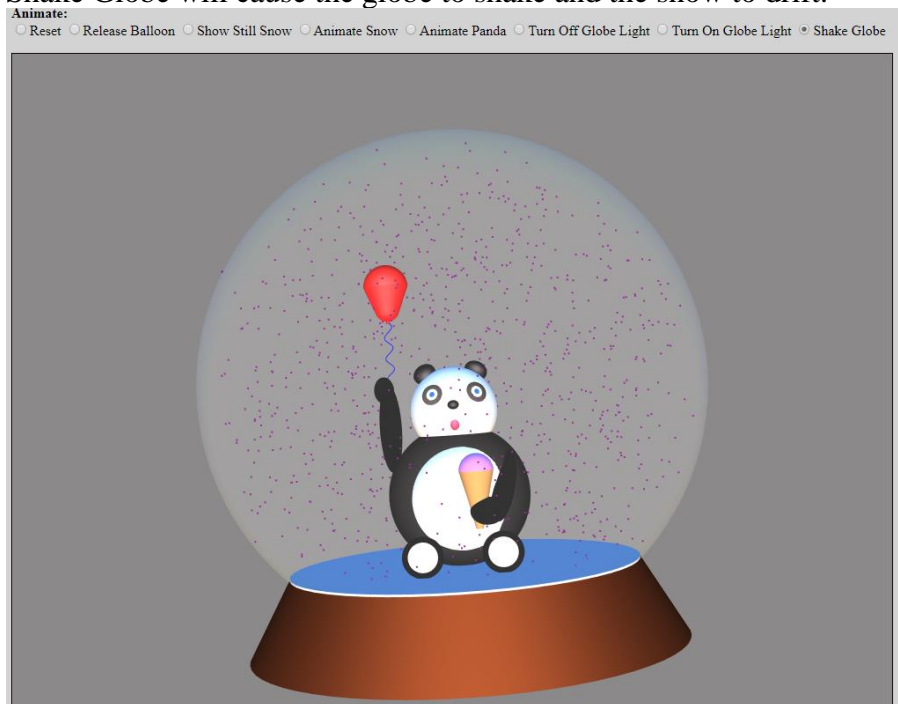
*Figure 7. Globe with light off.*

Turning on the Globe will turn the light back on.



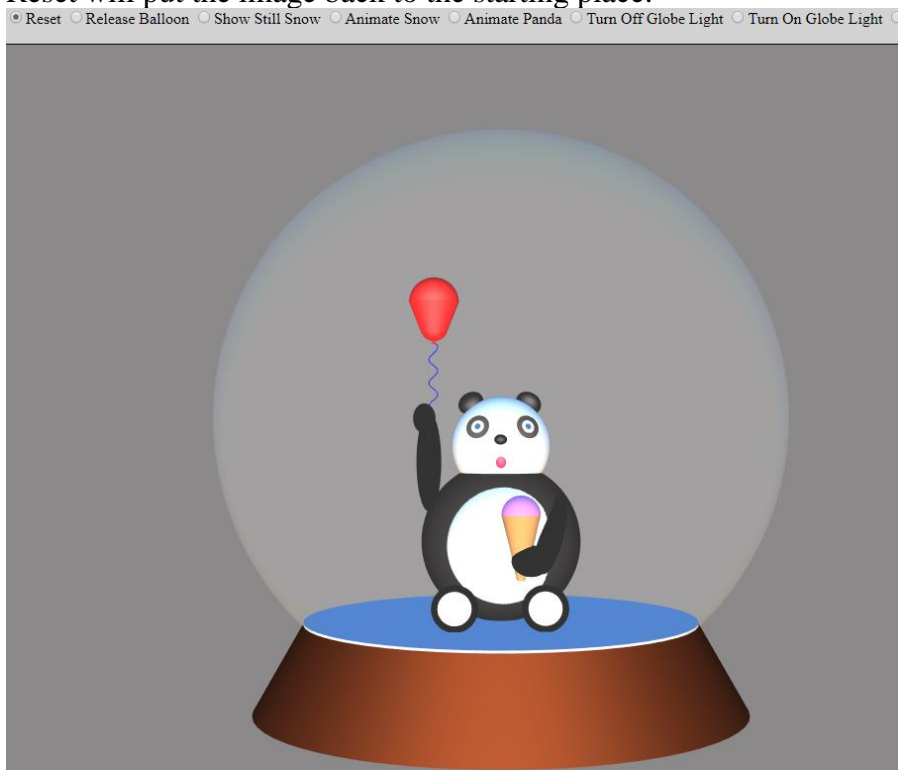
*Figure 8. Globe light back on*

Shake Globe will cause the globe to shake and the snow to drift.



*Figure 9. Globe Shaking*

Reset will put the image back to the starting place.



*Figure 10. Globe reset to the original picture*

## **Project Requirements & Project Design:**

1. Create a 3D scene which is a minimum of 640 x 480 pixels, contains 6 different shapes, and uses multiple lighting effects, and widgets.

### **Assumptions:**

1. There must be 6 different shapes, meaning we can combine shapes to create objects.

Objects developed:

- Base of globe
- Top of globe
- Balloon
- Balloon string
- Head of the bear
  - Eyes
  - Ears
  - Nose
  - Mouth
- Ice cream cone
- Arms and hands of bear
- Legs

2. Multiple Lighting effects:

- Lighting can be either actual light which are:
  - Direct light
  - Hemisphere light in globe
- Or it can be reflectivity of materials:
  - Bear
  - Balloon

- Base of globe
- Snow layer in globe

**Development of these requirements:**

Canvas is set to 1000 x 800.

**File Names:**

- snow\_globe.html.
- bear.js
- globe.js
- snow.js
- TrackBallControls.js (threejs resources Eck D., 2005).
- Three.js – required for THREEjs graphics.
- Demo.css demos Eck D., 2005).

Within each file are several functions that build elements.

1. Bear.js: has no animation and simply calls different geometry methods to build a still life of a panda bear.
2. Globe.js: Builds the outside of the snow globe and contains the effects for the hemisphere lighting but contains no other animations.
3. Snow.js: builds two different types of point clouds. The snow cloud has no animation and contains three colors. I could not line up the velocity and vertexes since there were three arrays. I built another point cloud to actually animate. This one builds a purple cloud assigns drift speeds and velocity to the points and is what is called by shake globe and animate snow radio buttons.
4. Snow\_globe.html is the main file that drives the program. It initializes and creates the world, draws the images, checks the radio buttons and assigns correct animations. It also installs the trackball controls.
5. Three.js, demo.css, and trackballControls.js are auxiliary files that are required for layout



and proper mechanisms of different calls.

### Test Plan:

*Table 1. Test Plan for Three.js*

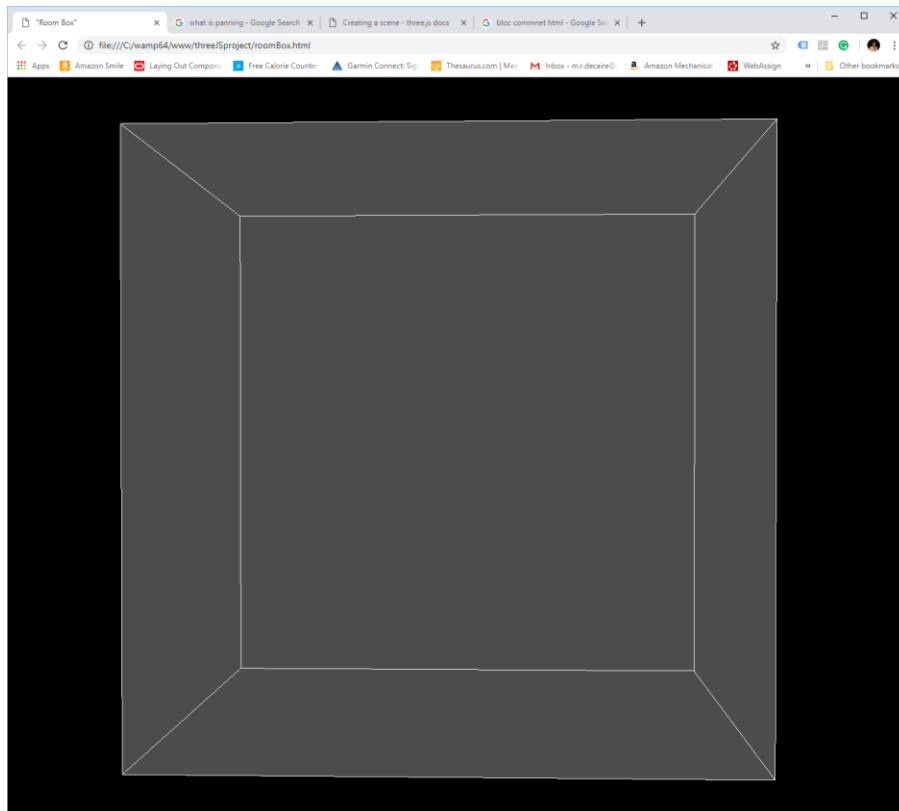
Case	Input	Expected Output	Actual output	Pass/Fail
1	Canvas working with cube.	Canvas shows cube.	A cube is displayed .	Pass
2	Draw a brown base at the bottom of the screen.	Canvas shows the brown base of a snow globe.	The base of the globe is showing.	Pass
3	Set Trackball	Trackball should be able to move objects.	The trackball feature is working.	Pass
4	Set the background to light Gray	light gray background	Background is set to light gray.	Pass
5	Draw a clear dome/globe on top of the base.	Globe positioned on top of base.	Globe is on top of base.	Pass
6	Add hemisphere lighting to the globe.	Globe should glow.	Globe has a blue and yellow aura.	Pass
7	Add white snow layer above base.	A white thin layer should appear above base.	Snow Layer shows up.	Pass
8	Draw base of bear.	A black and white base should appear at the bottom of the globe.	Black and white sphere is present.	Pass
9	Draw two lower legs.	A right leg and left leg should be present.	Both left and right legs look proportional.	Pass
10	Draw head on bear.	A round sphere with a face should appear on the bears body.	Head is correctly placed on body.	Pass
11	Draw Arms	Arms on either side of the bear should appear.	Arms are correctly placed on the bear.	Pass

12	Draw Hands	Hands appear on the arms of the bear.	Hands appear on the bear's arms.	Pass
13	Draw Ice Cream Cone	The bear should hold an ice cream cone in his left (my right) hand.	A cone appears in his left hand.	Pass
14	Draw Balloon	A balloon should appear his right (my left) hand.	The balloon is correctly placed in his hand.	Pass
15	Add Radio Buttons	Radio Buttons should appear at the top of the page.	Radio Buttons are present.	Pass
16	Check release balloon button	Balloon should animate and ascend to the height of the snow globe.	Balloon ascends and goes back to the panda's hand.	Pass
17	Show still snow	A point cloud should appear in globe.	A cloud of snow appears.	Pass
18	Reset animation	Everything should reset once reset is selected.	Globe resets to normal appearance.	Pass
19	Animate Snow	Snow moves around in a drift pattern.	Snow is moving.	Pass
20	Animate Panda	Panda should rotate on its axis	Panda rotates pass	Pass
21	Turn off globe light	Light in globe should be removed.	Light from globe disappears.	Pass
22	Turn on globe light	Light in globe should be added	light in globe turns on	Pass
23	Shake Globe	Globe should shake and snow drift.	Globe shakes and snow drifts.	Pass
24	Animate balloon and snow.	Both balloon and snow should move.	Both balloon and snow move	pass
25	Animate balloon and show still snow.	Balloon should move, and multicolor snow should appear.	Balloon ascends, and snow shows up.	Pass

26	Animate and turn light off	Balloon should ascend, and light should turn off.	Light turns off and balloon moves .	Pass
----	----------------------------	---	-------------------------------------	------

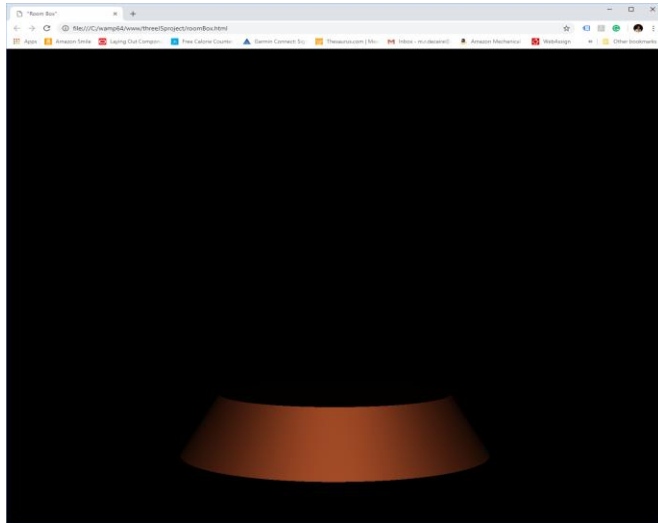
## Screen shots of successful Compiling and Running:

### Test 1. Working canvas



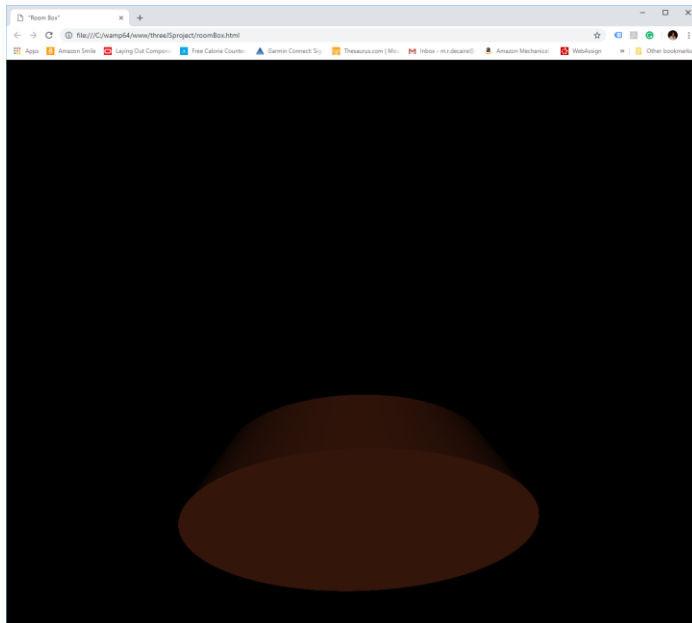
*Figure 11. Successful setup of the canvas*

Test 2. Base of the Globe.



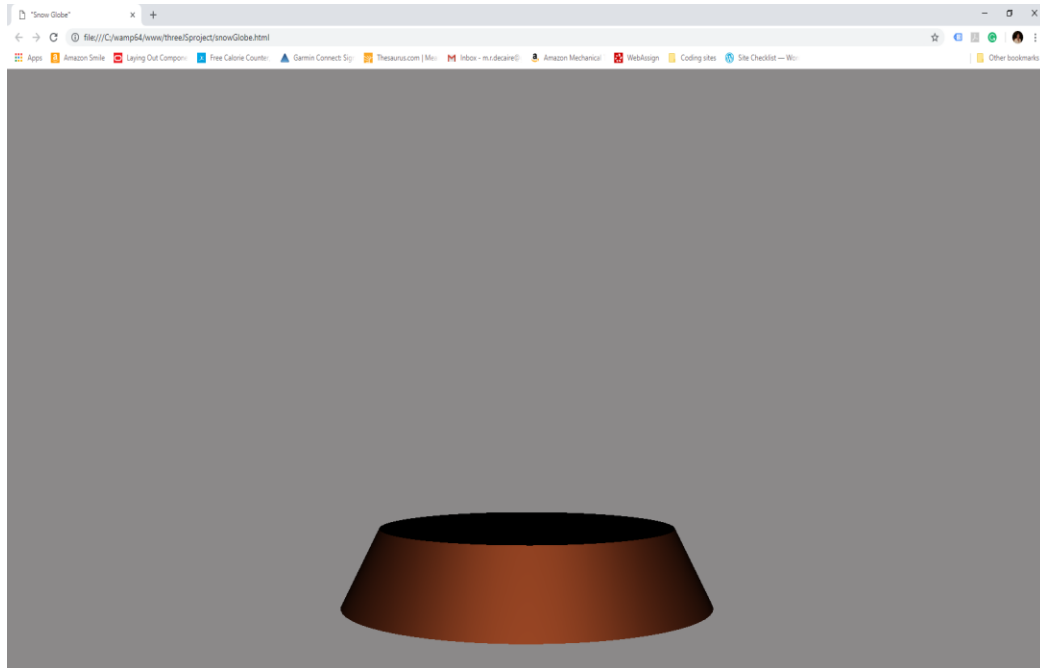
*Figure 12. Base of the snow globe.*

Test 3. Set the trackball—this is largely for building elements, since it is impossible to properly build features without rotation.



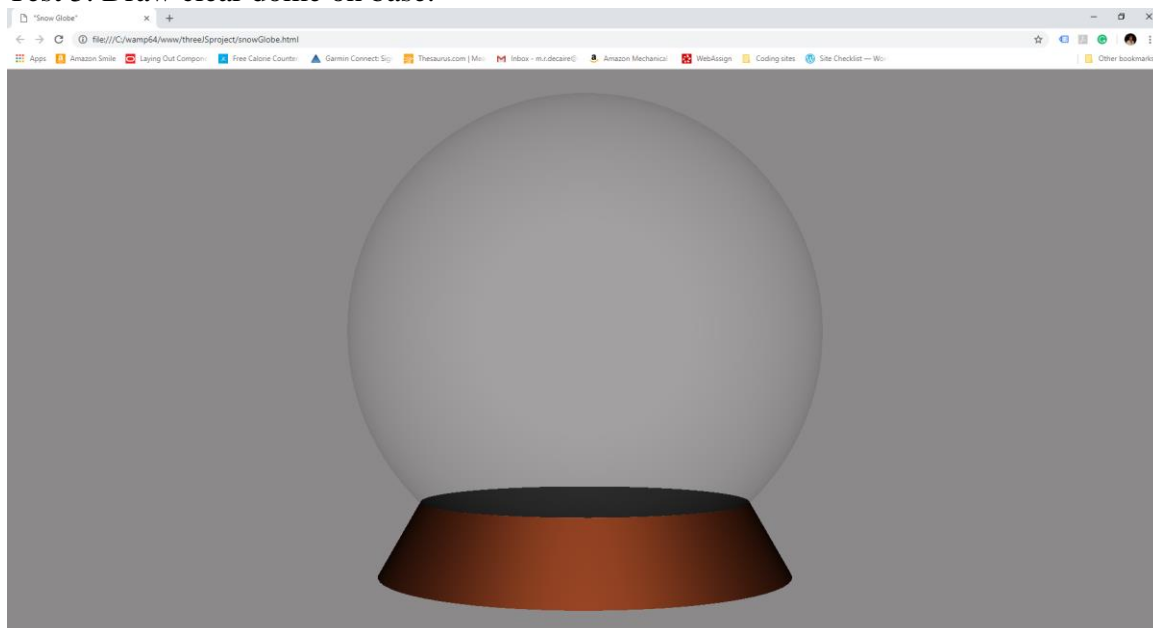
*Figure 13. Trackball successfully working*

Test 4. Set background to gray.



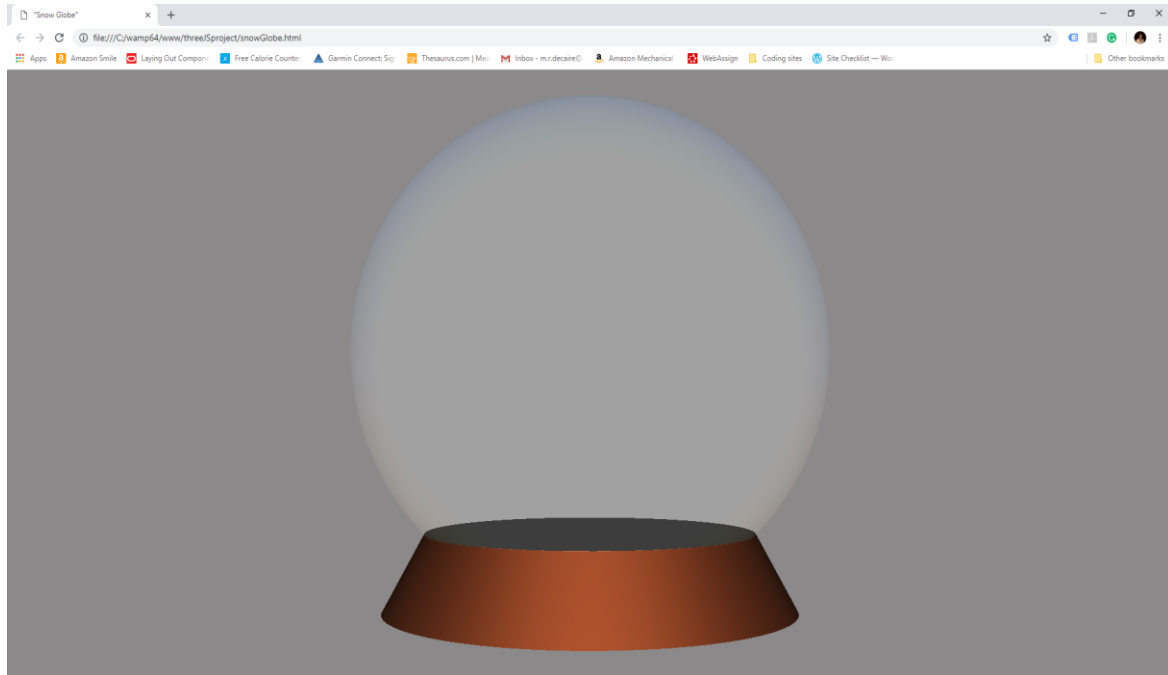
*Figure 14. Gray background.*

Test 5. Draw clear dome on base.



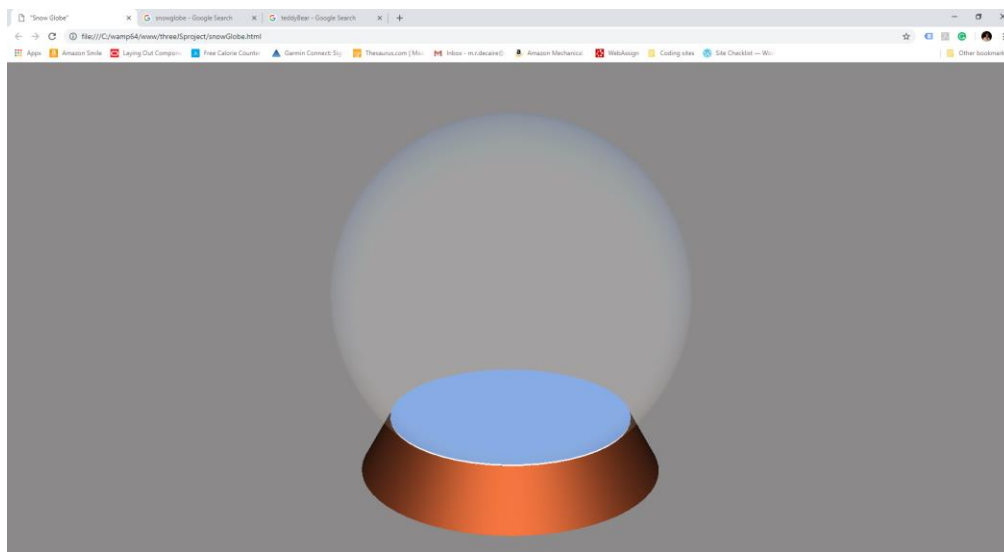
*Figure 15. Dome on base of globe*

Test 6. Hemisphere light added to globe



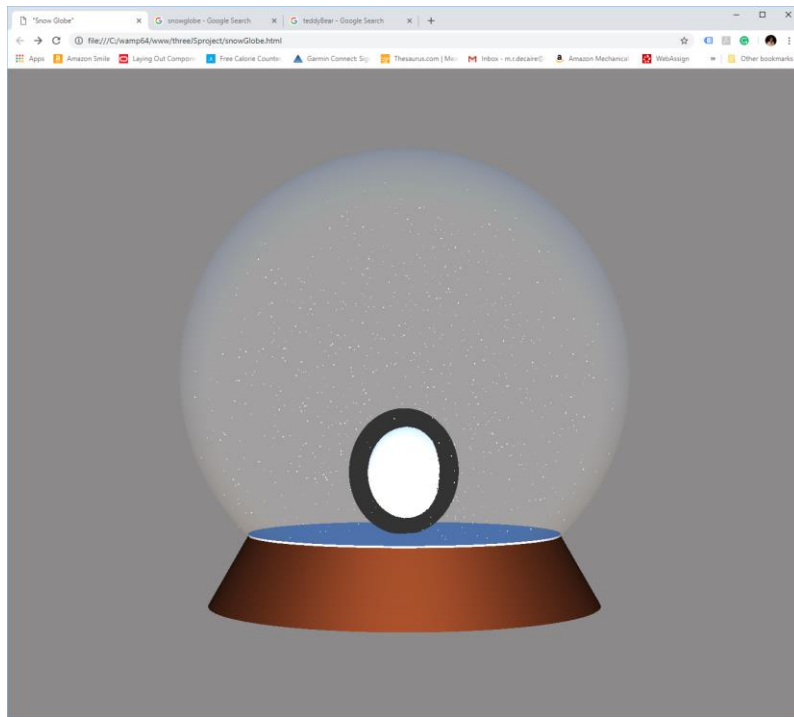
*Figure 16. Light added to globe*

Test 7. Add snow layer to base of globe



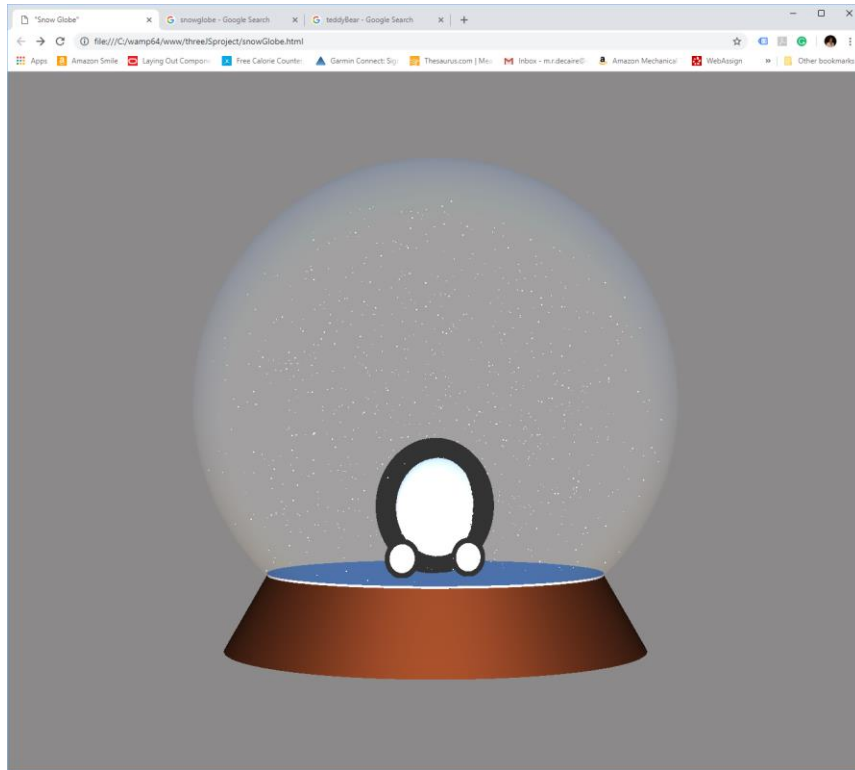
*Figure 17. White layer added to bottom of globe.*

Test 8. Draw base of bear.



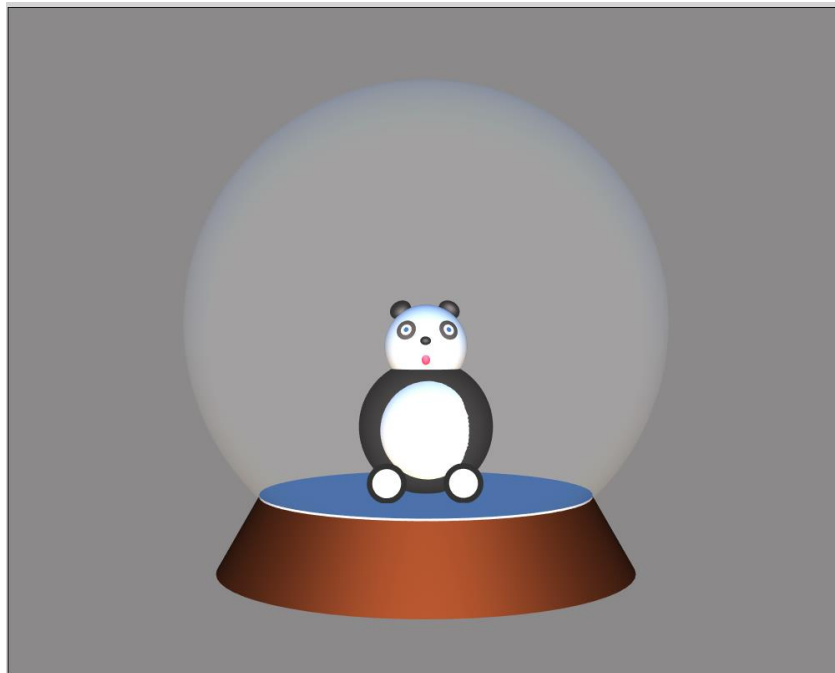
*Figure 18. Bear's torso.*

Test 9. Legs added to torso.



*Figure 19. Legs added to torso.*

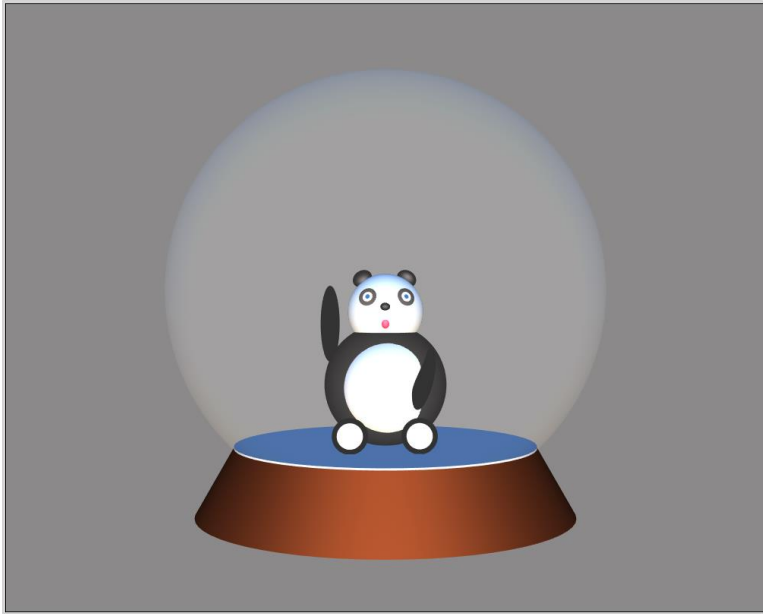
Test 10. Head of bear added.



*Figure 20. Bear with head and feet*

Test 11. Arms are put on the bear.





*Figure 21. Arms show up on the bear*

Test 12. Add the hands.



*Figure 22 Hands appear on the bear.*

Test 13. Add an ice cream cone .



*Figure 23. Bear is holding an ice cream cone.*

Test 14. Draw a balloon in his other hand.



*Figure 24. Bear is holding a balloon.*

Test 15. Add Radio buttons to the layout.

### A Panda in a Snow Globe

Use the mouse to rotate the scene.

☐ Release Balloon ☐ Show Still Snow ☐ Animate Snow ☐ Animate Panda ☐ Turn off Globe Light



Figure 25. Title and Radio Buttons added to the screen.

Test 16. Test balloon button.

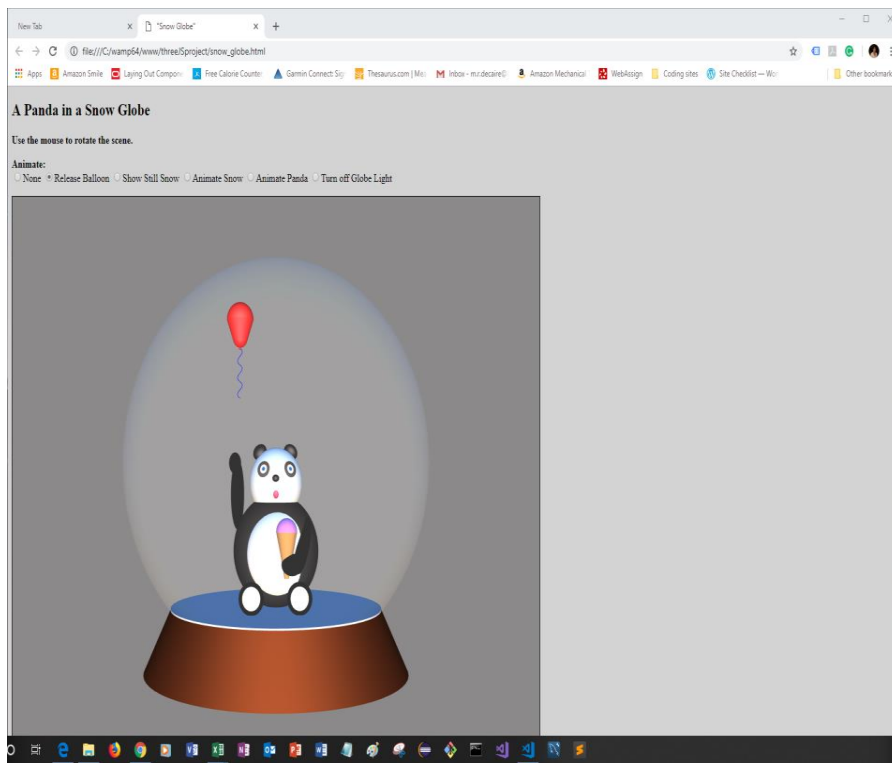
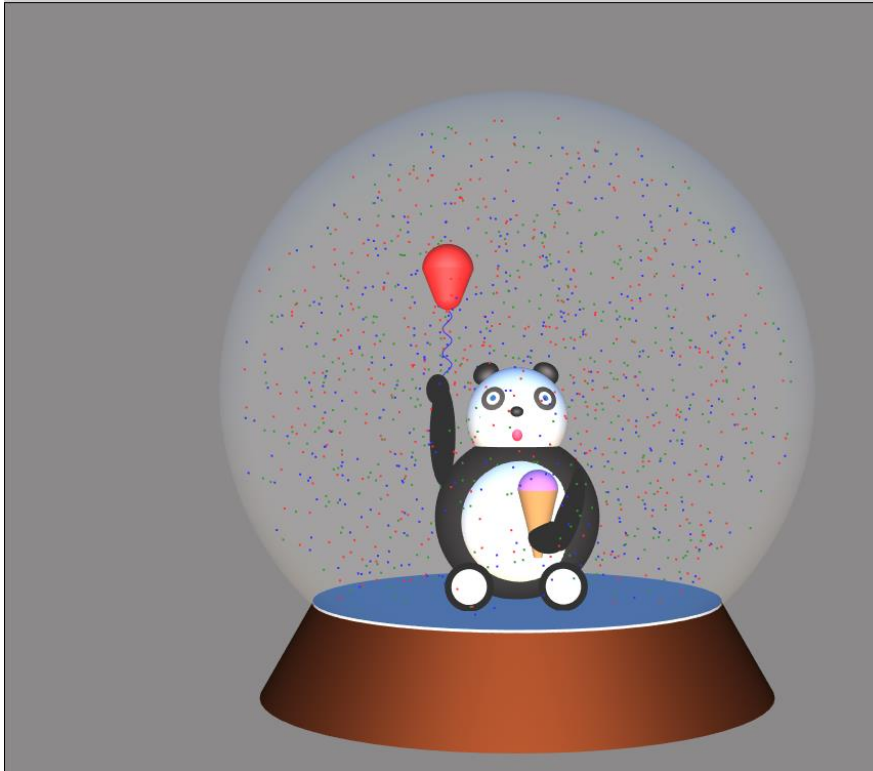


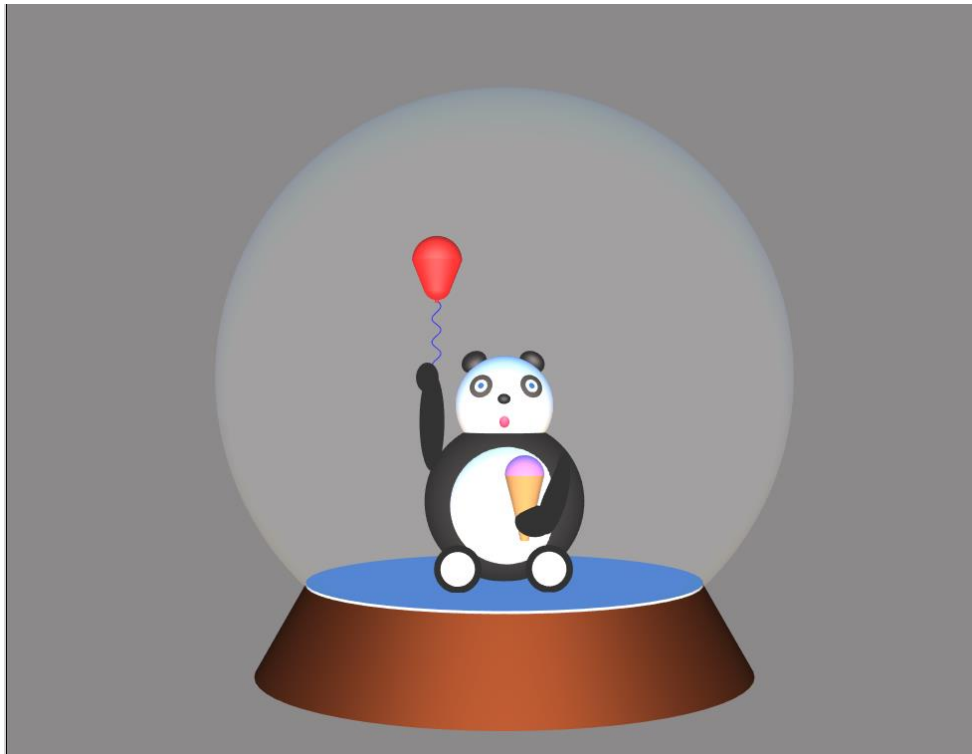
Figure 26. Balloon ascending towards the top of the globe

Test 17. Test still snow button.



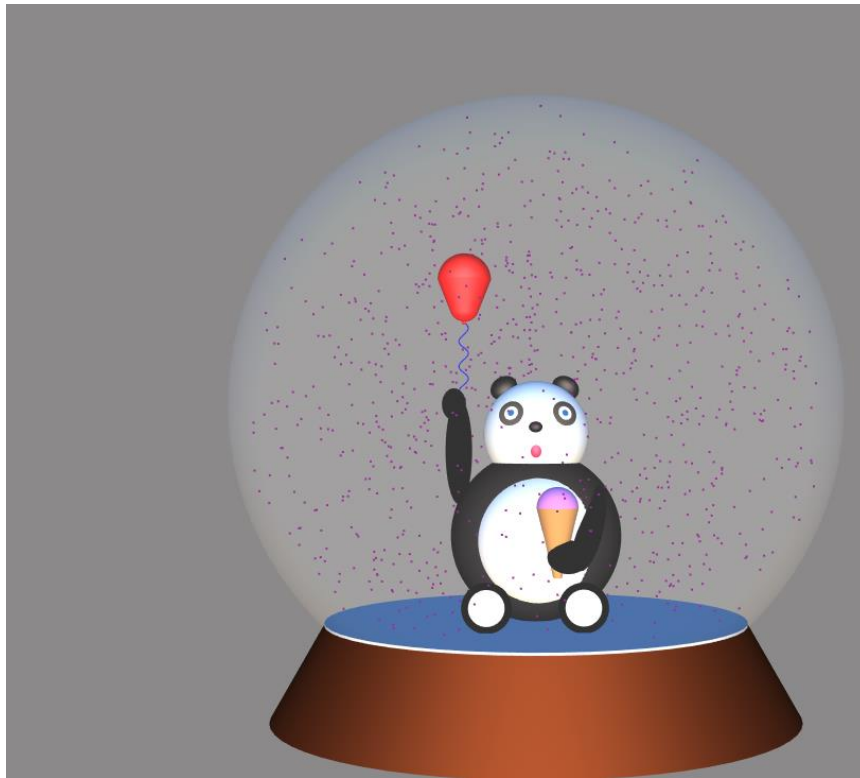
*Figure 27. Still snow appears in globe.*

Test 18. Reset animation.



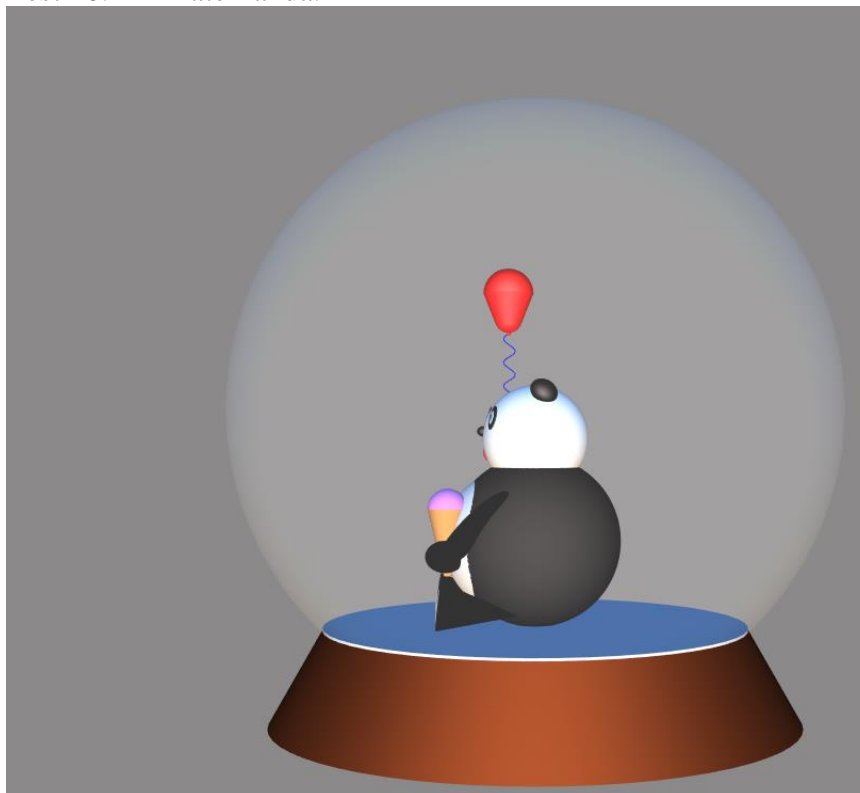
*Figure 28. Picture is restored to start screen.*

Test 19. Animate Snow



*Figure 29. Purple animated snow appears.*

Test 20. Animate Panda.



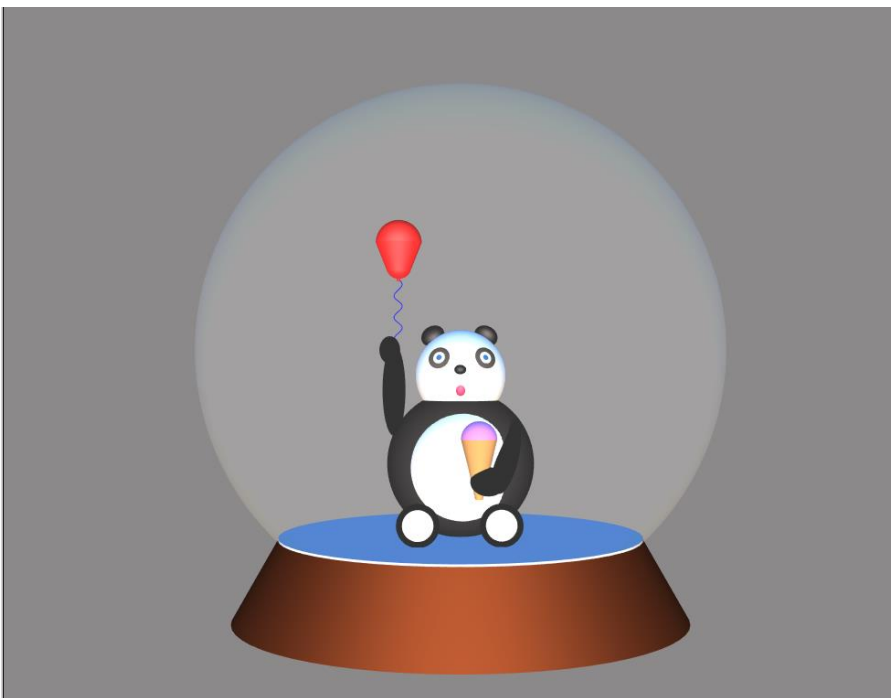
*Figure 30. Panda starts turning.*

Test 21. Turn off globe light.



*Figure 31. Hemisphere light is turned off*

Test 22. Turn light back on



*Figure 32. Light is turned back on.*

Test 23. Shake Globe.

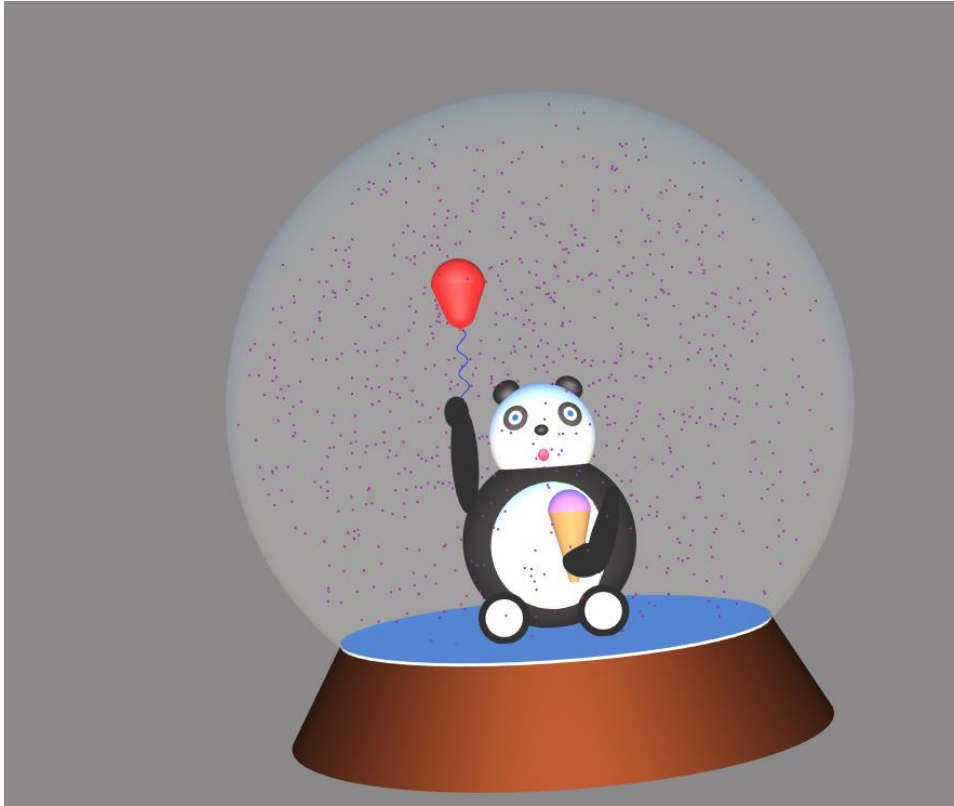


Figure 33. Globe shakes and snow starts drifting around

Test 24. Combined animation of snow and balloon.

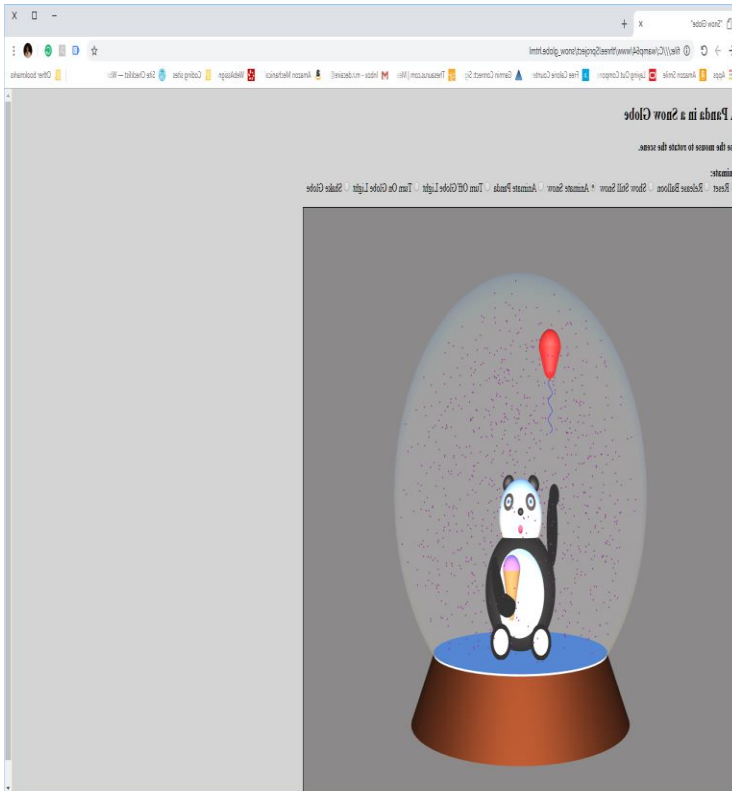


Figure 34. Balloon ascends and snow drifts.

Test 25. Combined balloon and still snow.

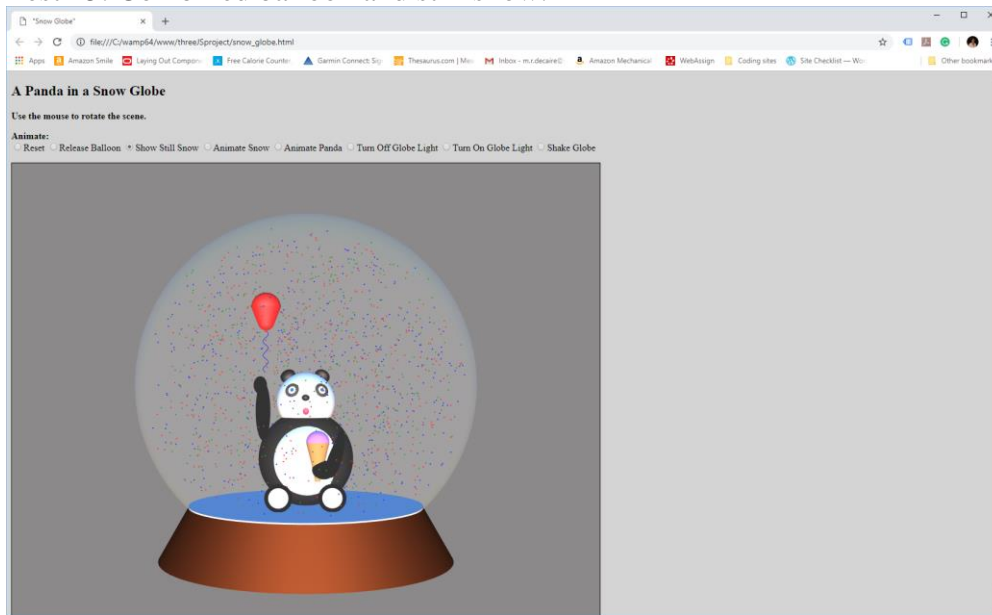


Figure 35 Snow shows up and balloon ascends.

Test 26. Animation keeps going when light is turn off.



Figure 36. Animation works even with lights off.



## **Lessons Learned:**

1. I do not know much about html or java script and the var (instead of strongly typed variables ) really threw me. I could not get my original snow to animate and I know it was because I just didn't know what arrays were storing what values behind the scenes.
2. Never start with a full screen canvas and try to back in controls and a smaller canvas. It took me several hours of trouble shooting to back in a proper sized canvas in order to add controls and such.
3. You can troubleshoot java script by hitting F12 in Google Chrome. I learned this halfway through the project and I wish I had known it sooner. It would have saved me so much time.
4. Store test data and make notes of lessons learned while you are building the project. This saves time and hassle at the end when you are documenting.
5. Some parts of this project were tough because there is not a lot of documentation online for this type of 3D. I built this one mainly on my own, with extensive help from the textbook. There are some geometric elements that I could not get to work properly, so I modified my original design to accommodate my lack of knowledge.

## References

500 Colours. (n.d.). Retrieved September 15, 2018, from

<http://www.cloford.com/resources/colours/500col.htm>

Eck, D. J. (2018). Introduction to Computer Graphics, Chapter 5 -- Three.js A 3D Scene Graph

API. Retrieved September 26, 2018, from

<https://learn.umuc.edu/d2l/le/content/325460/Home?itemIdentifier=D2L.LE.Content.ContentObject.ModuleCO-13071505>

Eck, D. J. (2018). Introduction to Computer Graphics, Appendix D – Source Code for Sample

Programs. Retrieved September 26, 2018, from

<http://polaris.umuc.edu/~jroberts/CMSC405/source/index.html>

Mrdoob. (n.d.). Mrdoob/three.js. Retrieved from

[https://github.com/mrdoob/three.js/blob/master/examples/webgl\\_lights\\_hemisphere.html](https://github.com/mrdoob/three.js/blob/master/examples/webgl_lights_hemisphere.html)

Test Plan Example. (n.d.). Retrieved from <https://learn.umuc.edu/d2l/home/325460>