#### **Task 1: SceneNode Draw Function Implementation**

In Task 1, I implemented the draw function for the SceneNode class. The main objective was to apply transformations and render nodes recursively. I started by calculating the transformation matrix for the node and applied it to the input matrices (MVP, modelView, normalMatrix, and modelMatrix). This ensured that the node's transformations, including translation, rotation, and scaling, were correctly integrated into the rendering pipeline. Additionally, I implemented a recursive mechanism to render all child nodes by passing the transformed matrices down the hierarchy. This allowed the scene graph structure to be rendered properly with all transformations applied to both parent and child nodes.

#### **Task 2: Diffuse and Specular Lighting Implementation**

For Task 2, I extended the shader to incorporate diffuse and specular lighting. I added calculations for the light direction, the reflection of light, and the view direction in the fragment shader. These calculations allowed the rendering of both diffuse and specular components of lighting. The diffuse lighting was computed using the dot product of the normalized normal and light direction, while the specular component was calculated using the reflection of light and the view direction with a phong exponent. These values were then combined with the ambient lighting to achieve the final color. The shader was modified to account for light sources and non-light source objects, ensuring correct shading based on the object's material properties.

#### **Task 3: Adding Mars Node and Rotation**

In Task 3, I added a Mars node to the scene and made it a child of the Sun node in the solar system. To do this, I initialized the Mars mesh and set its transformation properties, including translation, scaling, and rotation. Specifically, I applied a rotation to the Mars node along the Z-axis with a multiplier of 1.5 times the original zRotation value, as specified in the task. This introduced the desired rotational movement for Mars while maintaining its position relative to the Sun. The Mars node's transformations were correctly set to reflect this dynamic behavior, contributing to a realistic solar system model where Mars orbits the Sun with rotation.