Methodology

Technique 1 – Researching a Suitable Mask Filter

A filter with electrospinning characteristics was required for this project. Filters produced through electrospinning methods provide highly effective filtration while maintaining breathability and comfort. After thorough research, the Airinum Urban Air Mask Filter was selected due to its combination of performance and affordability. Priced at $20 for a pack of three filters (Airinum, 2024), it offered advanced filtration technology at a low cost, which was a significant factor in the decision. Additionally, the filter included built-in exhalation valve holders, allowing for customization to meet the project's requirements. With the filter selected, the next technique could be implemented.

Technique 2 – Designing Exhalation Valves

Exhalation valves were essential for this project due to their ability to enhance breathability for the user. These valves provide direct access to oxygen while preventing pollutants from entering the respiratory system. The valve utilizes fluid-diode technology, which redirects pollutants towards an internal filter, trapping them until they are expelled back into the atmosphere during exhalation. The exhalation valves were meticulously designed using the OnShape software, with guidance from Mrs. Clark. The design was carefully modeled to ensure compatibility with the Airinum filter. With the valves completed, the mask was ready for the particulate matter detection test.

Technique 3 – The Particulate Matter Detection Test

The particulate matter detection test employed the Airinum Urban Air filter, a Vamoar aroma diffuser, and Vernier's Davis Instruments AirLink Air Quality Monitor. The setup consisted of placing the diffuser below, the mask in the middle, and the air quality monitor above both components. This

arrangement enabled the sensor to capture the number of pollutants passing through the mask, determining its filtration efficiency. All equipment was placed in a controlled environment to ensure accurate measurements. When the diffuser was activated, it released vapor directly into the mask, and the sensor recorded the number of particles that penetrated the filter. This test provided quantitative data on the mask's filtration performance.