

Semiconductor Cleanroom Operation

LAB ACTIVITY: OBSERVING CLEANROOM PARTICLES

Name	Class/Period	Date

1. Overview

In this lab activity, you will observe the amount of particulate matter present in the air of a standard room environment. You will visualize airborne particles that are normally invisible to the naked eye by using a concentrated light beam in complete darkness. Furthermore, you will compare these everyday environments to the strict cleanroom standards (ISO Class 1 through Class 7) required for semiconductor manufacturing, where such particles can destroy microscopic circuits.

2. Performance Objectives

After completing this lab activity, you will be able to:

- Define cleanroom ISO classifications and particle limits (Class 1 through Class 7).
- Observe and describe the behavior of airborne particulate matter in a standard room.
- Explain why standard room air quality is incompatible with semiconductor manufacturing.

3. Required Materials

The following materials are required to complete this lab activity:

- High-intensity LED flashlight or a strong laser pointer (1 per team)
- A completely dark room (a windowless classroom, large closet, or room with heavy blackout curtains)
- A standard classroom chalkboard eraser or a dusty piece of fabric (1 per team)
- A ruler or measuring tape (1 per team)

4. Preparation Checklist

Before beginning the lab activity, review this checklist and mark off each item as you complete it.

- All hardware components are available for this lab activity.
- The classroom/lab space has been prepared to achieve complete or near-complete darkness.
- You have read through the entirety of this document to familiarize yourself with the requirements.

5. Lab Activity

5.1. Defining Cleanroom Classifications

Before entering the dark room space, define the following cleanroom terms and ISO classifications based on the maximum allowed particles ($\geq 0.5 \mu\text{m}$) per cubic meter:

1. ISO Class 1:

2. ISO Class 6:

3. ISO Class 7:

4. Cleanroom Filter (e.g., HEPA/ULPA):

5.2. Visualizing Airborne Particles

You and your team will now analyze the ambient air quality of your learning environment.

Perform the following:

1. Gather your team's flashlight and ruler and position yourselves in the designated testing area.
2. Have your instructor turn off the room lights to achieve complete darkness. Allow a few moments for your eyes to adjust.
3. Turn on the high-intensity flashlight and hold it parallel to the floor to create a visible beam of light across the room.
4. Closely observe the beam of light. Notice the dust, skin cells, clothing fibers, and other microscopic debris floating in the air.
5. Use the ruler to visually estimate a one-cubic-foot or one-cubic-meter box within the light beam. Discuss with your team how many particles you estimate are floating in that space.
6. Agitation Test: Have one team member stand about three feet away from the light beam and gently clap the chalkboard eraser or shake the fabric once.

- 7. Observe the beam of light again to see how human movement and material agitation drastically increase the particle count in the air.
- 8. Discuss with your team what would happen if a single one of these particles landed on a silicon wafer during the photolithography process.

6. Authentic Skill Assessment

Have your instructor verify that you have met the requirements for the performance objectives and sign below. Keep this lab activity sheet for future reference.

Instructor Signature	Date