Teacher Answer Key

Case Study

1. Macrophages in Marcus's lungs engulfed mineral particles they could not digest, died releasing their enzymes, and recruited more immune cells — chronic inflammation. In his case the process formed sarcoid granulomas, inflamed knots that stiffen lung tissue and cut capacity.
2. Because his pre-exposure fitness was exceptional and documented, his decline to the lungs of a fifty-year-old cannot be explained by age, smoking, or prior illness. Like the FDNY baseline data, a known starting point isolates the exposure as the cause.

Multiple Choice

1. D
2. B
3. A

Matching

1-C, 2-A, 3-D, 4-E, 5-B

Fill-in-the-Blank

1) lung, 2) macrophages, 3) forty

Short Answer (Sample Responses)

Q1: A fine particle slips past nose hairs, mucus, and cilia, reaching the alveoli. Macrophages engulf it but cannot digest it, die, and release enzymes that damage tissue while recruiting more immune cells. The resulting chronic inflammation scars and thickens airway walls, permanently reducing capacity.

Q2: Chronic local inflammation dysregulates the wider immune system over time. In 9/11 responders this appeared as elevated autoimmune disease — the immune system attacking joints and organs — plus inflammation-driven rapid cell division that raises cancer risk far beyond the lungs.

Q3: Answers will vary. Strong responses cite latency: lung decline appeared in months, autoimmune disease in years, and asbestos cancers across two to four decades, so a single screening would miss most of the disaster's true health toll.