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SPACE TECH SERIES

Mae C. Jemison

Engineering a Path Beyond Earth

Science, Medicine, and the Physics of Getting to Orbit

Mae C. Jemison built one of the most interdisciplinary resumes in astronaut history. After entering Stanford University at 16, she graduated in 1977 with a B.S. in chemical engineering while also completing a B.A. in African and African-American Studies. She earned her M.D. from Cornell University in 1981 and served as a Peace Corps medical officer in West Africa, managing health care and even supervising the making of medical guidelines.

NASA selected Jemison in 1987, and she was assigned as a Science Mission Specialist on STS-47. The mission's centerpiece was Spacelab-J, a pressurized laboratory built through a collaboration between NASA and Japan's National Space Development Agency (NASDA). It carried more than forty investigations spanning materials science and life sciences, from semiconductor crystal growth to studies of how living organisms adapt to microgravity.

Endeavour lifted off on September 12, 1992, making Jemison the first Black woman to reach space. During the flight she conducted bone-cell research, tested a fluid therapy system that generated sterile saline from onboard water, and participated in experiments on space adaptation and motion sickness. The orbiter circled Earth at an altitude of roughly 300 kilometers, completing 126 orbits over a mission of 7 days, 22 hours, and about 30 minutes.

To reach and hold that orbit, Endeavour first had to accelerate to orbital velocity, near 7.7 kilometers per second. At orbital speed, the spacecraft is continuously falling toward Earth while moving forward fast enough that it keeps missing the planet, producing the free-fall condition often called weightlessness in which Jemison ran her experiments.

After leaving NASA in 1993, Jemison founded a technology company, taught at Dartmouth, and became the head of the 100 Year Starship project, a DARPA-seeded initiative to advance the capabilities needed for human interstellar travel within a century. Her career illustrates how deep engineering and scientific literacy can open doors across research, medicine, exploration, and public leadership.

Part 1 · Comprehension & Analysis

1. Analyze how Jemison's engineering background and her medical background each contributed to her specific role on STS-47.

2. The passage says the shuttle is 'continuously falling toward Earth' yet never hits it. Explain how this describes an orbit.

3. Why was STS-47 significant both scientifically and internationally?

4. Based on the passage, how does Jemison's post-NASA work extend the themes of her earlier career?

Part 2 · Quantitative Challenge

Orbital Velocity and Period at 300 km

Model Endeavour's low Earth orbit as circular. Use Earth's radius R = 6,371 km, an altitude of 307 km (so orbital radius r = 6,678 km = 6.678 x 10^6 m), and Earth's gravitational parameter GM = 3.986 x 10^14 m^3/s^2. Orbital speed is v = sqrt(GM / r).

1. Compute the orbital speed v = sqrt(GM / r). Round to three significant figures.

2. Compute the orbital circumference C = 2(pi)r in kilometers. Round to the nearest 100 km.

3. Find the orbital period T = C / v using the unrounded C (in meters) and v. Convert to minutes and round to the nearest minute.

4. Rounding T down to 90 minutes, how many orbits occur in one 24-hour day? (1,440 min / 90 min)

Part 3 · Discussion & Extension

Jemison's career crosses many fields that are often treated as separate. Drawing on her path from chemical engineering and medicine to spaceflight and the 100 Year Starship project, write an essay evaluating whether an interdisciplinary education is an advantage or a distraction for someone pursuing a demanding technical field. Use specific evidence from her career to support your position.