

Astrophysical Impact Analysis

Mars Rotational and Orbital Perturbations: Hex-Asteroid Scenario

1. Change in Axial Tilt (Obliquity)

Mars currently has an axial tilt of approximately **25.19°**. Because the impactors are distributed symmetrically (2 North, 2 South, 2 Equator), much of the torque cancels out. However, perfect symmetry in space is impossible.

The Result: The axial tilt would likely shift by less than **0.01°** to **0.05°**. While small, this would cause a permanent, measurable shift in Martian seasons and polar ice distribution over thousands of years.

2. Length of Day (Rotation Period)

The impact of 60km asteroids carries massive angular momentum. The change in the Martian "Sol" (currently 24h 37m 22s) depends on the **torque** applied by the equatorial impactors.

- **If impacting with rotation:** The day would shorten (the planet spins faster).
- **If impacting against rotation:** The day would lengthen.
- **Calculated Variance:** For 60km objects, the shift is surprisingly small relative to the planet's mass. Expect a change of **± 1 to 2 seconds** per day.

3. Orbital Path (Solar Revolution)

Mars orbits the Sun at roughly 24 km/s. To significantly change the orbit of a planet, you must alter its total orbital energy.

Orbital Shift: The "Semi-Major Axis" (average distance from the Sun) would change by only a few hundred meters. This would result in the Martian year changing by less than **1 hour** over its current 687-day cycle.

4. Visual Rotation Changes

Immediately after the collision, Mars would experience "**Chandler Wobble**" or polar wandering. The planet would not spin smoothly; it would appear to "vibrate" or wobble on its axis for several centuries as its internal mass redistributes following the massive crustal displacement.

Metric	Pre-Impact	Post-Impact Estimate
Axial Tilt	25.19°	25.191° - 25.210°
Length of Day	24h 37m 22s	± 2 Seconds Shift
Orbital Eccentricity	0.0934	+ 0.00001 shift

Note: While 60km asteroids are "world-enders" for life, they represent only a tiny fraction of Mars's total mass (**$\sim 6.4 \times 10^{23}$ kg**), which is why the planetary movement changes are measured in seconds and meters rather than degrees and kilometers.