

CENTRIPETAL FORCE FROM GRAVITY

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India Shot Down a Satellite, Modi Says, Shifting Balance of Power in Asia

NEW DELHI — Prime Minister Narendra Modi announced on Wednesday that India had test-fired a rocket that shot down one of its own satellites, escalating the country's rivalry with China and Pakistan, and demonstrating a strategic capability in space that few countries possess. This technological leap, which was confirmed by the Pentagon, puts India in an exclusive club of nations, along with the United States, Russia and China, that have proved their ability to destroy targets in space. But it has potentially ominous repercussions, accelerating the space race with China and destabilizing the uneasy balance of power between India and Pakistan, which are both armed with nuclear weapons. It could allow India essentially to blind an enemy by taking out its space-based communication and surveillance satellites. Shooting down a satellite is no easy feat. In this case, **(((scientists estimate that the satellite that India blasted apart was moving around the Earth at 17,000 miles per hour)))**.

Mr. Modi made the announcement to a rapt nation just weeks before the country heads into a hotly contested election. "India stands tall as a space power!" Mr. Modi tweeted after his announcement. He added that the entire effort had been "indigenous," accomplished entirely by Indians. When China first successfully tested such an antisatellite missile in 2007, it set off global concern over the growing weaponization of space. **Many analysts now worry that the regional rivalry between India and China, the two most populated countries in the world, has moved into space. India's test was a "demonstration against China,"** said Kazuto Suzuki, an international relations professor at Hokkaido University in Japan and an expert on space security. The test "struck the target vehicle" and created 270 pieces of debris that will likely increase as the debris field expands. He added that, "At this point in time, the International Space Station is not at risk." Mr. Modi broke the news in a rare televised address to the nation, and many Indians immediately suspected that his primary objective was more political than technological. The launching of a ballistic missile on Wednesday in Odisha, India.



INTRODUCTION: Gravity supplies required centripetal force to keep Satellites in orbit.

Thus $GM_e m/R^2 = mv^2/R$, becomes $GM_e/R = v^2$. Thus $v = [GM_e/R]^{1/2}$ where v = speed of satellite. G = gravitational constant = $6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$, M_e = mass of earth = $5.972 \times 10^{24} \text{ kg}$, R = distance from center of earth to orbiting satellite = $R_e + h$ = radius of earth + height above earth = 6,356 km. + 186 miles. **Purpose of this application is to verify the article statement that the satellite altitude was at 186 miles and travelling at close to 17,000 mph.**

QUESTIONS: (a) Convert 186 miles height of satellite to meters ?, (b) Find R in meters? (c) Find speed (in units of m./s. & mph) of Indian satellite at 186 mile altitude above earth's surface ?. show your calculations Clearly and neatly. Show clearly how units cancel out properly end up as speed units of m./s.

HINTS: 1.61 km./mi., 2.236 mph/[m./s.]

ANSWERS: (a) 299.46 km., (b) 6655.46 km., (c) $v = 7.736 \times 10^3 \text{ m./s.} \approx 17,298 \text{ mph}$ close to 17,000 mph mentioned in the article .

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The Indian government did not reveal what kind of satellite it had destroyed; the Ministry of External Affairs described it as "one of India's existing satellites operating in a lower orbit." Mr. Modi has revived the notion that he is India's "chowkidar," or watchman, and looking tough in space seemed to fit nicely with that image. "Today's success, in the coming days, will be seen as India's forward march toward a secure nation, a rich nation and a peaceful nation," he said. **The test was conducted within three minutes on Wednesday morning, he said, and (((the satellite was flying about 186 miles above Earth.))) It was low enough, Indian officials said, that its debris will decay and fall back to Earth.**

In 2012, Indian scientists announced they had the capability to shoot down a satellite but that it would take 24 months to prepare for such a test. Some analysts wondered if Mr. Modi, known as a cunning political strategist, planned as early as two years ago to conduct this test right before this year's election, to give him a late-in-the-game boost. "The timing indicates that there is politics around this," said N.K. Singh, a political analyst. "The issues of food, clothing, housing and employment are emerging on the surface in bigger way." He added: "Nobody can say for sure but the perception of politicization is there."