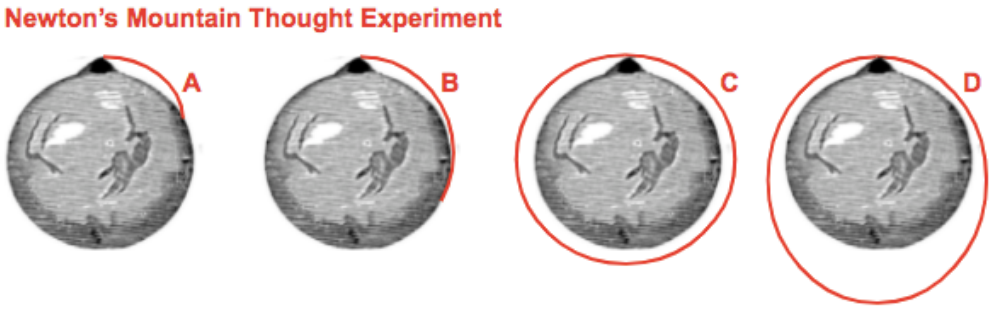
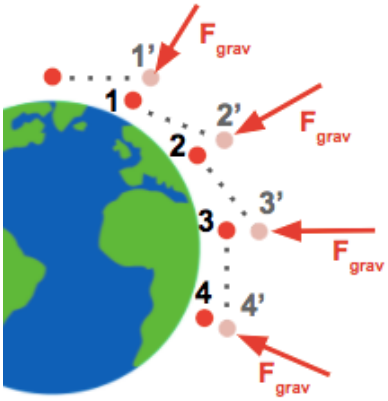
Satellite Motion Principles
Lesson Notes

Learning Outcomes
- What is a satellite?
- How can the velocity, acceleration, and force experienced by a satellite be described?

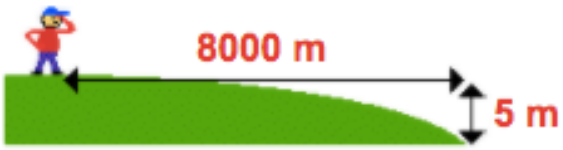
What is a Satellite
- A **satellite** is any object that is orbiting the Earth, the Sun, or other massive body.
- Once launched into orbit, a satellite is a projectile, acted upon by a single force - the force of gravity.



Falling Around the Earth



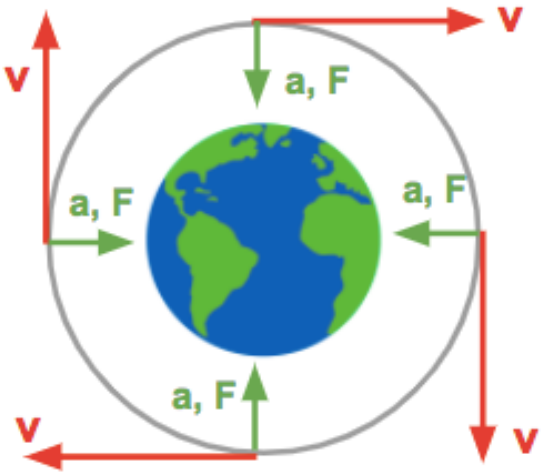
- A satellite is a projectile which falls around the Earth without falling into the Earth.
- For a satellite to have a circular orbit about the Earth, its curvature must match that of Earth.
- An object must be launched at ≥ 8000 m/s for a successful orbit about the Earth.



Velocity, Acceleration, and Net Force

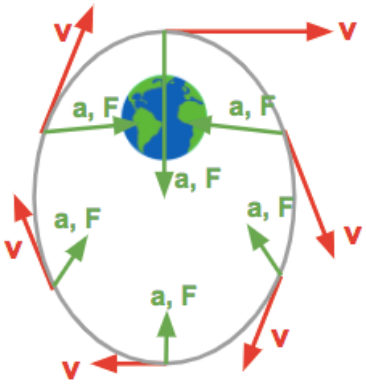
Satellites do not follow any special laws of physics.
The laws associated with any object moving in a circle or along a curved path applies to satellites.

- The velocity (red arrows) is directed tangent to the path.
- The acceleration and net force (green arrows) is directed inwards towards the circle's center.



Elliptical Orbits

An Earth-orbiting satellite will have an elliptical orbit if its launch speed is greater than 8000 m/s and less than 11200 m/s.



- The velocity (red arrows) is tangent to the circle, but varying in magnitude.
- The acceleration and force (green arrows) is directed towards the Earth … and their magnitude also varies with distance from the Earth.

Why Does the Satellite Speed Change?

An elliptically-orbiting satellite changes its speed. As it approaches the central body, it speeds up. As it moves away from the central body, it slows down.