

Displacement, Velocity and Acceleration



Displacement–time graphs



Acceleration – a change in velocity

Velocity changes when there is a change in its **magnitude** (i.e. a change in speed), a change in its **direction**, or both.

So acceleration can include:

- speeding up
- slowing down (**deceleration**)
- changing direction (e.g. **centripetal acceleration**)



So even though a geostationary satellite is traveling in a circle at a steady speed, it is actually **accelerating** as it constantly changes direction!



Velocity–time graphs



Four “*suvat*” equations

Motion under constant acceleration can be described using the following four equations:

1. $v = u + at$

2. $s = ut + \frac{1}{2}at^2$

3. $v^2 = u^2 + 2as$

4. $s = \frac{1}{2}(u + v)t$



These are known as the “*suvat*” or **constant acceleration equations**, where u is the initial velocity, a is the acceleration, and s and v are the displacement and velocity at time t . How can these equations be derived?



Using the *suvat* equations



Analyzing a velocity–time graph

