

Content core:

Basic Particle Models in Newtonian Mechanics

Kinematical Models

Constant velocity

Constant acceleration

Simple Harmonic Oscillator
(SHO)

Uniform circular motion
(UCM)

Collision $\Delta \mathbf{p} = \mathbf{I}$

Causal Models

Free Particle: $\Sigma \mathbf{F}_i = 0$

Constant force: $\Sigma \mathbf{F}_i = \text{constant}$

Linear binding force: $\Sigma \mathbf{F}_i = -k \mathbf{r}$

Central force (with constant $|\mathbf{r}|$)

Impulsive force

Instructional design: spend two weeks developing each of these models in an instructional cycle that emulates scientific modeling practice!