The New Science

Tycho Brahe
The importance of observation.
Nova of 1572
Comet of 1577
Parallax.
The Observatory of Uraniborg
Does the Earth move
The Tychonic model of the cosmos: Why it was important and not just an historical curiosity.
How it differed from that of Copernicus and why.

Johannes Kepler
The first Copernican model: The 'regular' or perfect polyhedra.
Inscribed, superscribed orbits – harmony of the spheres.
Associated with Tycho Brahe: obtained his observations
The first 70 models based on circular motion: A question of errors.
Ovals and Kepler’s 3 Laws.
Quality of the model; does it reproduce the observations better than competing models.
The importance of observation in the sciences.

Galileo
The first great, modern, experimentalist
A new technology: The Telescope
Astronomical contributions: Observations of:
The moon
The sun
The milky way
Jupiter
Venus
The collision with the Aristotelians: What is at rest, what is in motion
The collapse of the Aristotelian universe
The end of Ptolemaic model
BUT does the earth move?

The Physics of Motion
The medieval contribution of 'impetus'
What is constant in falling objects: velocity or acceleration
Experiments with objects rolling down and up inclined planes
Inertial motion; nothing special about $V=0$
Inertial motion: if force=0, the velocity is unchanged, regardless of its magnitude.
How to explain projectile motion

Galileo:
established basic ideas of physics of motion BUT could not reject uniform circular motion
Rejected Kepler and elliptical orbits.

*Isaac Newton*
The Principia Mathematica
The three laws of motion: The relation to Galileo’s experiments: $a = \frac{F}{m}$
Basic notions: Position, length, time, velocity, speed, acceleration, force, inertia, mass

*Gravity*
Why is the tale of the falling apple an interesting analogy even if apocryphal?
Why must there be, and what kind of force acts on the moon?
Conceptual understanding of how Newton derived

$$F = G \frac{Mm}{R^2}$$

How Newton and others showed that this relationship was universal, a 'Law' of nature.
The requirement for calculus
The two definitions of mass.
Newton’s **Law** and Kepler’s **relationships**: differences and insights.
Halley and 'his' comet
The clockwork universe
What is gravity is it an 'occult' quality?
Newton’s Philosophical Rules of Investigation:
    Science and the scientific method