- Rotational motion
  All points move in circles about an axis within the body
- Rigid body
  A rigid body is an object with a definite shape that doesn't change
- Torque(moment of a force)
  It is the product of the force and the perpendicular distance between the line of action of the force and the rotational axis
- Newton's first law for rotational motion(rotational equilibrium)
  - An object continues to remain stationary or to move at a constant angular velocity unless an external torque acts on it
  - Condition of equilibrium: net force equals 0, net torque equals 0
- Moment of inertia
  Inertia is a quantity that measures the resistance to change in rotational motion
- Newton's second law for rotational motion
  The net torque acting on a rigid body is the product of the moment of inertia and the angular acceleration
- Center of mass
  The point that moves as though the whole mass were concentrated there
  - An external force applied at the center of mass causes linear but not angular acceleration
  - If not applied at center of mass, there will be linear and rotational motion
- Rolling without slipping
  The point of contact between the wheel and the floor is instantaneously at rest
- Angular momentum
  The angular momentum of an object is the product of the moment of inertia of this object and its angular velocity
  - The net torque of an object is the rate of change of angular momentum of body
- Newton's third law of rotational motion
  When object A applies a torque to object B, then the object will apply an equal and opposite torque to object A
- Conservation of angular momentum
  When the net torque on a system is zero, the total angular momentum of system remains constant

- Kepler's first law of planetary motion
  The path of each planet around the sun is an ellipse with the sun at on focus
- Kepler's second law of planetary motion
  A line joining a planet and the sun sweeps out equal areas in equal time
  - 无普适性，严谨来说只适用于太阳系
- Kepler's third law of planetary motion
  The square of a planet's orbital time period T, is proportional to the cube of its average orbital radius, R

- Newton's universal law of gravitation
  Every single point mass attracts every other point mass with a force that is directly proportional to the product of their masses and inversely proportional to the square of their separation
- Newton's law of gravitation
  1. Masses much smaller than their separation can be regarded as point mass
  2. 球体（密度均匀的）等同于中心的 point mass
- Gravitational field
  A region of space where a mass experiences a force because of its mass
- Gravitational field strength
  Force per unit mass experienced by a test point mass placed in the field
- Gravitational potential energy
  - The work done against field in bringing the mass from infinity to the point
  - Why negative?
    1. Gravitational forces are attractive
    2. Work done against field is negative
- Gravitational potential
  - The work done per unit mass in bringing a small test mass from infinity to the point
  - If test mass move in the direction of field, work is done by the gravitational force, the gravitational potential decreases, and the gravitational potential energy decreases
  - Gravitational field strength is the negative of the rate of change of gravitational potential to the change in distance to the center of the planet
  - $g = -\frac{\Delta V}{\Delta r}$
- Orbital motion: E_k, E_p, E_T

$$E_k = \frac{GMm}{2r}$$

$$E_p = -\frac{GMm}{r}$$

$$E_T = -\frac{GMm}{2r}$$

- Escape speed
  The minimum speed needed to be able to escape completely from the gravitational field of the planet
- Orbit and atmosphere
  In the atmosphere of a planet, as the radius of orbital motion decreases, the speed of the satellite increases