**Vocabulary:**

*Law of conservation of angular momentum:* when the net external torque acting on a system about a given axis is zero, the total angular momentum of the system about that axis remains constant.

*Law of conservation of energy:* the total energy of an isolated system in a given frame of reference remains constant

*Law of conservation of mass:* mass in an isolated system is neither created nor destroyed by chemical reactions or physical transformations.

*Law of conservation of momentum:* for a collision occurring between object 1 and object 2 in an isolated system, the total momentum of the two objects before the collision is equal to the total momentum of the two objects after the collision.

* Conservation of mass:
  + Ma + Mb = Ma’ + Mb’
  + Assuming no chemical reactions
  + Ma = Ma’
  + Mb = Mb’
* Conservation of momentum:
  + Ma1ra1 + Ma2ra2 + Mb1rb1 + Mb2rb2 = M’a1r’a1 + M’a2r’a2 + M’b1r’b1 + M’b2r’b2
  + Ra2 = -Ra1 -> MaRa + MbRb = MaR’a + MbR’b
  + Homonuclear assumption
    - Ma1 = Ma2 = 1/2 Ma
* Conservation of energy:
  + (1/2 Ma1r2a1 + 1/2 Ma2r2a2 + ɸA) + (1/2 Mb1r2b1 + 1/2 Mb2r2b2 + ɸB) = (1/2 M’a1r’2a1 + 1/2 M’a2r’2a2 + ɸ’A) + (1/2 M’b1r’2b1 + 1/2 M’b2r’2b2 + ɸ’B)
  + ra1 = ra1 + RA1
  + (1/2 Mar2a + ua) + (1/2 Mbr2b + ub) = (1/2 M’ar’2a + u’a) + (1/2 M’br’2b + u’b)
* Conservation of angular momentum