

HW 9-9 Soln)

a)

$$I = \sum_n m_n r_n^2 = 6(2^2) + 3(1^2) + 5(4^2) = 107 \text{ kg m}^2$$

b)

$$K = \frac{1}{2} I \omega^2 = \frac{1}{2} (107) 6^2 = 1926 \text{ J}$$

c)

For each, $v = r\omega$.

$$v_{6 \text{ kg}} = 2(6) = 12 \text{ m/s}$$

$$v_{3 \text{ kg}} = 1(6) = 6 \text{ m/s}$$

$$v_{5 \text{ kg}} = 4(6) = 24 \text{ m/s}$$

d)

$$K = \sum_n \frac{1}{2} m_n v_n^2 = \frac{1}{2} 6(12^2) + \frac{1}{2} 3(6^2) + \frac{1}{2} 5(24^2) = 1926 \text{ J}$$

e)

They match. The point is that this kinetic energy can be represented as the translational KE of the individual parts, OR as the rotational KE of the whole object. Be sure though not to count it both ways.