43. (a) [Yes]. Moment of inertia has a minimum value at the center of mass.

(b) [No]. Mass would have to be negative.

45. The moment of inertia depends on how mass is distributed about an axis. Physically, this means that under a constant torque, the angular acceleration depends on the location of the axis of rotation.

46. The [hard-boiled egg is a rigid body], while the raw egg is not.

47. This is the rotational analog of "pulling the table cloth" in Exercise 4.11. It takes a certain amount of torque to accelerate the paper tower and the paper can only exert a certain amount of force, and therefore torque. When the paper is pulled quickly (a large force is required to accelerate the roll), the force the paper can provide is not great enough to accelerate the paper roll. However, if the paper is pulled slowly, the paper is strong enough to accelerate the roll because the force required is smaller. The amount of paper on the roll affects the results. The more paper the roll has, the greater the moment of inertia, the greater the force required to accelerate the roll, and therefore the easier to tear.

48. (a) The meterstick has a higher center of mass; [larger moment of inertia and smaller angular acceleration].

(b) [Softball wins, others tie] because the softball (a sphere) has a smaller moment of inertia and so a larger angular acceleration.

49. [Yes, it increases]. Since \( I = I_{CM} + Md^2 \) and \( Md^2 \) can never be negative, \( I \) is equal to or greater than \( I_{CM} \).

50. If the net torque is zero, then the angular acceleration is zero (\( \alpha = 0 \)). That means the rigid body remains at rest or rotates with constant \( \alpha \).

51. (a) \[ I = \Sigma (mr^2) = (2.00 \text{ kg})(1.50 \text{ m})^2 + (3.00 \text{ kg})(1.50 \text{ m})^2 + (1.00 \text{ kg})(1.50 \text{ m})^2 + (4.00 \text{ kg})(1.50 \text{ m})^2 \]

\[ = 22.5 \text{ kg m}^2. \]

(b) \[ I = (2.00 \text{ kg})(2.50 \text{ m})^2 + (3.00 \text{ kg})(2.50 \text{ m})^2 + (1.00 \text{ kg})(2.50 \text{ m})^2 + (4.00 \text{ kg})(2.50 \text{ m})^2 = 62.5 \text{ kg m}^2. \]

(c) \[ r^2 = (1.50 \text{ m})^2 + (2.50 \text{ m})^2 = 8.50 \text{ m}^2. \]

\[ I = (2.00 \text{ kg})(8.50 \text{ m}^2) + (3.00 \text{ kg})(8.50 \text{ m}^2) + (1.00 \text{ kg})(8.50 \text{ m}^2) + (4.00 \text{ kg})(8.50 \text{ m}^2) = 85.0 \text{ kg m}^2. \]