51. (a) We use $\tau = I\alpha$, where τ is the net torque acting on the shell, I is the rotational inertia of the shell, and α is its angular acceleration. Therefore,

$$I = \frac{\tau}{\alpha} = \frac{960\,\mathrm{N\cdot m}}{6.20\,\mathrm{rad/s^2}} = 155\,\mathrm{kg\cdot m^2}\ .$$

(b) The rotational inertia of the shell is given by $I = (2/3)MR^2$ (see Table 11-2 of the text). This implies

$$M = \frac{3I}{2R^2} = \frac{3(155\,\mathrm{kg\cdot m^2})}{2(1.90\,\mathrm{m})^2} = 64.4\,\mathrm{kg}\ .$$