6.2. A tow truck pulls a car 5.00 km along a horizontal roadway using a cable having a tension of 850 N. (a) How much work does the cable do on the car if it pulls horizontally? If it pulls at 35.0° above the horizontal? (b) How much work does the cable do on the tow truck in both cases of part (a)? (c) How much work does gravity do on the car in part (a)?

**Identify:** In each case the forces are constant and the displacement is along a straight line, so \( W = F s \cos \phi \).

**Set Up:** In part (a), when the cable pulls horizontally \( \phi = 0^\circ \) and when it pulls at \( 35.0^\circ \) above the horizontal \( \phi = 35.0^\circ \). In part (b), if the cable pulls horizontally \( \phi = 180^\circ \). If the cable pulls on the car at \( 35.0^\circ \) above the horizontal it pulls on the truck at \( 35.0^\circ \) below the horizontal and \( \phi = 145.0^\circ \). For the gravity force \( \phi = 90^\circ \), since the force is vertical and the displacement is horizontal.

**Execute:**

(a) When the cable is horizontal, \( W = (850 \text{ N})(5.00 \times 10^3 \text{ m}) \cos 0^\circ = 4.25 \times 10^6 \text{ J} \). When the cable is \( 35.0^\circ \) above the horizontal, \( W = (850 \text{ N})(5.00 \times 10^3 \text{ m}) \cos 35.0^\circ = 3.48 \times 10^6 \text{ J} \).

(b) \( \cos 180^\circ = -\cos 0^\circ \) and \( \cos 145.0^\circ = -\cos 35.0^\circ \), so the answers are \(-4.26 \times 10^6 \text{ J} \) and \(-3.48 \times 10^6 \text{ J} \).

(c) Since \( \cos \phi = \cos 90^\circ = 0 \), \( W = 0 \) in both cases.

**Evaluate:** If the car and truck are taken together as the system, the tension in the cable does no net work.