

63. There is no acceleration, so the lifting force is equal to the weight of the object. We note that the person's pull  $\vec{F}$  is equal (in magnitude) to the tension in the cord.

(a) As indicated in the *hint*, tension contributes twice to the lifting of the canister:  $2T = mg$ . Since  $|\vec{F}| = T$ , we find  $|\vec{F}| = 98 \text{ N}$ .

(b) To rise  $0.020 \text{ m}$ , two segments of the cord (see Fig. 7-48) must shorten by that amount. Thus, the amount of string pulled down at the left end (this is the magnitude of  $\vec{d}$ , the downward displacement of the hand) is  $d = 0.040 \text{ m}$ .

(c) Since (at the left end) both  $\vec{F}$  and  $\vec{d}$  are downward, then Eq. 7-7 leads to

$$W = \vec{F} \cdot \vec{d} = (98)(0.040) = 3.9 \text{ J}.$$

(d) Since the force of gravity  $\vec{F}_g$  (with magnitude  $mg$ ) is opposite to the displacement  $\vec{d}_c = 0.020 \text{ m}$  (up) of the canister, Eq. 7-7 leads to

$$W = \vec{F}_g \cdot \vec{d}_c = - (196)(0.020) = -3.9 \text{ J}.$$

This is consistent with Eq. 7-15 since there is no change in kinetic energy.