Chapter 8 Problem 41

$m = 0.25\,kg \quad v_0 = 40\ m/s \quad v_f = 30\ m/s$

$\Delta y = h = 20\,m$

How much work was done by air resistance?

From The Work-Energy Theorem

$$W_{net} = \Delta K$$

There is work done by gravity, which is conservative. Split the work into That which is done by gravity and That which is done by air resistance.

$$W_{net} = W_f + W_g = W_f - \Delta U_g = \Delta K$$

$$W_f = \Delta K + \Delta U_g$$

[potential energy change due to gravity.

$$W_f = \tfrac{1}{2} m v_f^2 - \tfrac{1}{2} m v_0^2 + mg\Delta y$$

Now substitute in The given values.

$$W_f = \tfrac{1}{2}(0.25\,kg)(30\,m/s)^2 - \tfrac{1}{2}(0.25\,kg)(40\,m/s)^2 + (0.25\,kg)(9.8\,m/s^2)(20\,m)$$

$$W_f = 112.5\,J - 200.0\,J + 49.0\,J$$

$$\boxed{W_f = -38.5\,J}$$

The negative work is because friction is always opposing The motion of The ball.

[I Think There is an error in The textbook solution. The initial kinetic energy goes into changing The altitude of The ball and overcome friction. what is not used up, is left over as remaining kinetic energy. The textbook answer subtracted The potential energy rather than add it.