Problem 5.1

A weight lifter lifts 350 N 2 meters overhead.

a.) How much work does he do if the motion occurs with constant velocity?

b.) How much work does gravity do during the motion?

c.) What's the total work done?

A weight lifter lifts 350 N 2 meters overhead.

a.) How much work does he do if the motion occurs with constant velocity?

For the velocity to be constant, he has to apply a force equal to the body's weight. That means:

$$
\begin{aligned}
W_{man} &= \vec{F} \bullet \vec{d} \\
&= \left|\vec{F}_{man}\right| \ \left|\vec{d}\right| \cos\theta \\
&= (mg) \ \ d \ \ \cos 0^{o} \\
&= (350 \text{ nt}) \ \ (2 \text{ m}) \ \ \cos 0^{o} \\
&= 700 \text{ nt} \bullet \text{m} \qquad (= 700 \text{ joules})
\end{aligned}
$$

b.) How much work does gravity do during the motion?

Gravity does an equal but opposite amount of work (the displacement is upward while gravity is downward, so the cross product will be negative) as does the man.

If this isn't obvious, the calculation is shown to the right.

$$W_{man} = \vec{F} \bullet \vec{d}$$
$$= \left|\vec{F}_{gravity}\right| \left|\vec{d}\right| \cos\theta$$
$$= (mg)\ \ d\ \ \cos 180^{o}$$
$$= (350\ \text{nt})\ \ (2\ \text{m})\ \ (-1)$$
$$= -700\ \text{J}$$

Big Note: You are practicing doing work calculations here, which is good, but in the future you will use potential energy to determine the work done by gravity!

c.) What's the total work done?

The total work is zero. This may not be evident right now, but the net work ALWAYS EQUALS the body's change of kinetic energy. As kinetic energy is a function of velocity, having a constant velocity situation means the change of kinetic energy is zero and, hence, the net work will be zero.