Problem **20-R-WE-DK-2**

In this question, we have a crate that is being lifted by a constant force height of five meters. And we are asked to determine the work done by both the crate and gravity and the crates final velocity if it starts from rest. So first, we're going to start with our freebody diagram. And we're going to add all our forces. Okay, so at the center of gravity, we're going to add our force due to gravity F of G. And then we have our force pulling up, which we're going to call F. And these are all of our forces. So we're asked to find the work done by gravity first. So the work done by gravity, we're going to call it u g, is just going to be the difference of the force due to gravity times it's the distance that is traveled. And since the distance traveled and the force due to gravity are in opposite directions, it's going to have a negative sign. Okay, so I'm going to draw it over here, we're going to pretend that this blog travels a distance h. And it's actually, I'm going to draw it as a one way arrow. So h goes that way. So since H is that way, and gravity points, the force due to gravity points downwards, the force and the distance traveled or an opposite direction, so we get a negative sign, negative, the force of G is going to be mg times h, which is the distance which is also going to need force at negative m g, h. Okay. And so if we plug in some numbers, we get negative 30 kilograms. That's the mass times G, which is 9.81 meters per second squared, times h, which is five meters, we get that ug is going to be equal to negative 147 1.5. joules. Okay, so this is the work done by gravity, the gravitational force, then we have the work due to the crane. So this we're going to call on work due to the crane seat. And this is going to be equal again to the force times the distance, but in this case, the force and the distance are in the same direction, because f points up in this case, so f is up this way, h is that way, and then have G was downwards. So since they're in the same direction, we're going to have a positive sign here. And the force is just going to be f times h, which is again, the distance traveled. If we plug in some numbers, we get 400 Newtons times a height of five meters. This is going to be equal to 2000. joules. Okay? So we can write out our answer. The answer is u g, equals to negative 147 1.5 joules, and you have the crane is going to be equal to 2000 joules, and we box it in, this is our first answer. All right, next up, we're asked to find the the final velocity of this crate assuming that it starting from zero, so as you can see these two forces here, the force due to gravity and F on they're not balanced. So we have a resulting acceleration. It's a dynamic system. It's it's not static, obviously. Um, so since we have a difference in force, we're going to have an acceleration. And so we can calculate the final velocity after five meters have traveled. So the formula we're going to use is the kinetic from kinetics, which is v final squared is equal to V initial squared plus two, a acceleration times D, which is the distance traveled. Now in this case, we know D which is five. We don't know acceleration, we're not given this. And we know that this initial velocity is zero. And we're solving for b. So we need to find the acceleration. Yeah. So to find, so I can already cross this out B not squared is going to be zero, we're going to find a. So how do we find a well, we can just simply do a force balance. Okay, so we know that f is going to be bigger than f g. So we're going to assume that there's an acceleration in the positive y direction, and we're going to call this a and this is a one D problem. So this we're going to call y. Okay? So we're going to do a sum of force in the y direction. And we're going to equate it to an A, okay, and a y, which is I mean, because there's no acceleration in the x direction. So if we do that, we get that f minus f g is equal to m a, g, y is equal to a, okay? So we have F and we have f g, because f g is simply m g, and we have both. And we can directly solve for A g, y, or a. So A is going to be equal to 400 Newtons minus 30 kilograms, times 9.81 meters per second squared divided by 30 kilograms. And this is going to be equal to 3.53233 meters per second squared. So now we have an acceleration, we have a distance, and we can find the final velocity. So the final velocity is going to be equal to b equals to the square root of two times 3.5233 meters per second squared times the distance which is five meters and we square root that leads us to an answer of 5.9 meters per second. So the final velocity, the f is equal 5.9 meters per second. That is our final answer.