Problem **20-R-WE-DK-17**

In this question, we're asked to compare the potential energy and compare the potential energy between point C and point A of this slider with a spring. So we have to calculate the potential energy. In this case, there's two port two aspects to the potential energy, gravitational potential energy and potential energy stored in the spring. Or assuming both these positions, everything is at rest, so there is no kinetic energy. So we're going to start with a and calculate the potential energy of this system over here. So in the spring is expanded by this much, and a is up here. So we're going to start with a, and in the case of a, we have the potential energy VA being equal to mg ha, plus one half. Okay. That's a squared. Okay. And so that's essays, the structure this rank, so the x minus L knot. So in this case, we're going to set our datum to be the bottom, so h will start from here. So h A will be this, this full height over here. And for C, hc, we'll just be zero, because the data is set there. Okay. And then, and again, for your your datum doesn't have to be at the bottom, it can be anywhere. But when you compare these two, they will have respective to each other, they will have the same energy difference. So that's why it doesn't matter where the datum is, in this case, it's usually nice to pick the lowest one to be zero, so there's no gravitational potential energy for one of the two. And then for the other one, it's going to be a positive value, it's, it's not going to be downwards below the datum. So we have mg H, a, so we can actually solve for this. So this is going to be equal to m g times DC, plus R, okay, because this height here is this DC distance over here, plus this radius over here. So that's going to be h a, hey, so actually draw this into the diagram. So this here is Ha. Okay, and so it's DC plus R. And then we have our second term, which is one half times k, which we have times essay, so as I mentioned, essay is going to be the length, the stretch, so delta x, which is the length of the stretch spring minus the initial unstretched, length L naught and everything squared. Okay, so the stretch length is this distance over here, which we can find with DB and da, it's just the hypotenuse of that triangle. So that's going to be DA squared plus DB squared, square rooted minus l knot, and then everything squared. Okay, so again, stretch length, minus unstretched, length, and then all squared. And if we plug in values, we get the following VA is going to be equal to 0.8 kilograms, times 9.81 meters per second squared times h a, which is 1.3 meters plus 0.2 meters. And this is our first term and then we have our second term which is one half k, which is 600 Newton meters. Newton per meter, sorry. And then we have our da, So square root of 0.6 meters squared, less, and 0.9 meters squared minus 0.12 meters squared. Okay. This Right. And so if we solve for this, we had that VA is equal to 289.2 joules. This is our first part of the answer the energy the potential energy stored in scenario eight. Now we can do B, same process or C sorry, same process, but at a different location. So, BC is going to be equal to m g h c plus one half, okay? c squared. Okay, so in this case, remember hc zero. So this first term cancels, and we're going to get zero plus one half k times this stretch length over here. So let me actually draw those into the diagram. So this length here is FC. This length here is a base, so SC is going to be equal to this x component here, squared plus this x component here, which is the hypotony News. Okay, so that's fine, that was going to be equal to d A plus r squared. So ba plus R is this component here plus DC plus r minus d b squared. Okay. So d c, plus r minus db brings you back to here. And so that is that right over there. Okay, and then we're summing the squares and then taking a square root to get the hypotheses. So a C is hypotony over here, and then we are subtracting l not and squaring everything. Okay. So Vcc is going to be equal to one half times 600 Newtons per meter times the square root of da is 0.6 meters plus r which is 0.2 meters squared plus 1.3 meters plus 0.2 meters minus 0.9 meters squared, taking the square root of that, minus 0.12 meters squared. If we solve for VC, we get that VC is equal to 232.3 joules. So this is the second scenario. And if we can come if we want to compare them, we can see that VA is bigger than DC. So in situation a there is more potential energy and in situation C