Work and Energy

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Work Lab – Simulation and Tools

Open the Dynamics Track simulation to do this lab.

IA. Predicted Δh from Conservation of Mechanical Energy

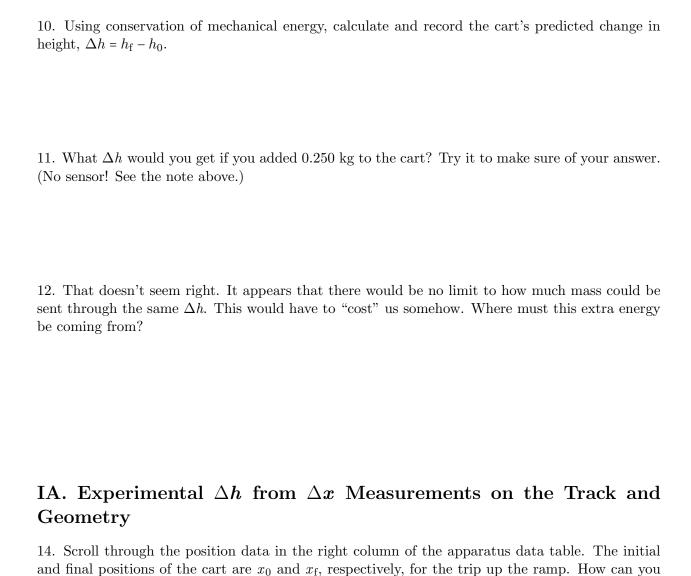
The	cart	mass	=	0.250	kσ
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- 4. By trial and error, find an initial speed that will send the cart to approximately the 170-cm point. Record this as your initial velocity, v_0 .
- 5. Calculate and record KE_0 in joules for the 0.250-kg cart. (Careful with units!)

Note: You'll need data from the lab apparatus data table later, so don't use the sensor again until you complete Part IA.

9. Record the cart's final velocity and kinetic energy, $v_{\rm f}$ and KE_f, respectively, at the top of the cart's travel. (There are no data required for this. Just think about it.)



find x_0 and x_f from this data? Be careful, as the data includes the motion back down the track,

which is not what you're looking for.

15. Record x_0 and x_{f} .
16. Calculate and record Δh .
17. Calculate the percentage error between the experimental and predicted (theoretical) values of Δh .
IB. The Relationship Between Speed and Kinetic Energy $-$ Proportional Reasoning 4. Calculate and record $x_{\rm mid}$.
5. You first need to experimentally determine the proper v_0 to give the cart half of its previous
KE. How about $v_0/2$? Try it and see how it works out.
(a) How'd that work out?
too slowtoo fast
(b) Use trial and error to find your best value for the required initial velocity to just reach $x_{\rm mid}$. Record $v_{0({\rm mid,\ expt})}$.

6. Now let's calculate the *theoretical* initial velocity. Here's the problem and how to think about it.

$$\mathbf{KE}_0 = \frac{1}{2}mv_0^2$$

So KE_o is directly proportional to v_0^2 , not v_0 . So $v_0/2$ won't give the cart KE₀/2. So halving v_0 doesn't halve KE_o, halving v_0^2 does! (If you halve v_0^2 , you will also halve $\frac{1}{2}mv_0^2$, which gives $\frac{1}{2}m(v_0^2/2)$.) So if $v_{0(\text{orig})}$ equals your v_0 from #4 in Part IA, what do $v_{0(\text{orig})}^2$, $v_{0(\text{mid})}^2 = \frac{v_{0(\text{orig})}^2}{2}$, and $v_{0(\text{mid, theo})}$ equal?

II. Work by Friction

8. Record your data.

Note: Sometimes the dT values are a bit iffy. You may find that one of the dT values is negative. Also, dT_2 should be almost twice dT_1 . Please try again if you see any suspicious data. And be sure to note that you're recording dT, not eT.

- 9. Calculate your experimental value for $\mu_{k(expt)}$ using $-\mu_k mg \Delta x = \frac{1}{2} m(v_2^2 v_1^2)$.
- 10. Calculate your percentage error between the two μ 's ($\mu_{k(theo)} = 0.10$).