I. Rocket

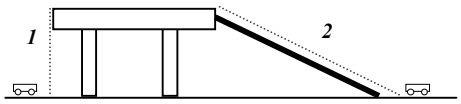
A rocket of mass 6.0 kg takes off from the ground and goes straight up. During the first 100 meters of its ascent, the engine exerts a 80 newton upward force on the rocket.

A. How much work does the engine do on the rocket during those first 100 meters?

B. Assuming kinetic and potential are the only kinds of energy the rocket gains, how much kinetic energy does the rocket have at the moment it's 100 meters above the ground? (Hint: You'll need to use a formula for gravitational potential energy but *not* a formula for kinetic energy. Think about the relationship between work and energy. To keep the math less messy, approximate g as 10 m/s^2.)

C. At height 100 meters, the rocket has 1850 joules of kinetic energy, which is less than your part B answer. Is energy not conserved, or is something else going on? Where are the "missing" joules?

II. Ramp vs. straight up



A lazy professor wants to lift a cart from the floor onto a table. He can either lift it straight up along path 1, or he can push it up the ramp along path 2 (see the dashed lines in the diagram). If he chooses path 2, the cart rolls with negligible friction. Whichever path he chooses, the cart starts at rest on the floor and ends at rest on the table. Here's the issue: Along which path will the professor do less work on the cart?

A. Why might a smart student say the professor does less work lifting the cart along path 1?

B. Why might a smart student say the professor does less work pushing the cart along path 2?

C. Along which path, if either, does the professor do less work? Hint: Think about the connection between work and potential energy (in cases where the object gains no kinetic energy).

D. Reconcile your part C answer with the arguments given in parts A and/or B. In other words, show how elements of the "incorrect" ideas from parts A and/or B can be used to *correctly* explain why your part C answer makes intuitive sense. Continue on back if needed.