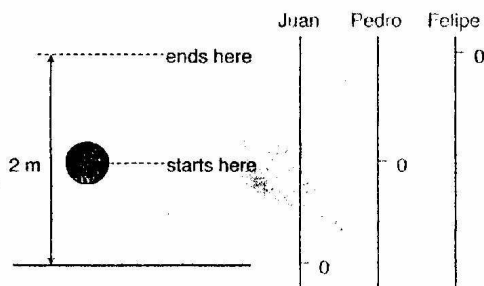


### Gravitational Potential Energy, Conservation of Mechanical Energy

9. In the diagram we see a 1 kg object that is initially 1 m above the ground and rises to a height of 2 m. Juan, Pedro, and Felipe each measure its position, but each of them uses a different coordinate system. Fill in the table to show the initial and final gravitational potential energies and  $\Delta U$  as measured by our three aspiring scientists.



	$U_i$	$U_f$	$\Delta U$
Juan			
Pedro			
Felipe			

10. A roller coaster rolls down a frictionless track, reaching a speed of  $v_f$  at the bottom.
- If you want the car to go twice as fast at the bottom, by what factor must you increase the height of the track?
  - Does your answer to part a depend on whether the track is straight or not? Explain.
11. — 13. Draw an energy bar chart to show the energy transformations for the situation described.
11. A car runs out of gas and coasts up a hill until finally stopping.
12. A pendulum is held out at  $45^\circ$  and released from rest. A short time later it swings through the lowest point on its arc.
13. A ball starts from rest on the top of one hill, rolls without friction through a valley, and just barely makes it to the top of an adjacent hill.

11

$$+ \left| \begin{array}{l} \underline{K_i + U_{gi}} = \underline{K_f + U_{gf}} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ 0 \text{ ---} + \text{---} = \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ - \end{array} \right.$$

12

$$+ \left| \begin{array}{l} \underline{K_i + U_{gi}} = \underline{K_f + U_{gf}} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ 0 \text{ ---} + \text{---} = \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ - \end{array} \right.$$

13

$$+ \left| \begin{array}{l} \underline{K_i + U_{gi}} = \underline{K_f + U_{gf}} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ 0 \text{ ---} + \text{---} = \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ \text{---} \\ - \end{array} \right.$$