

## Conservation of Energy (no friction)

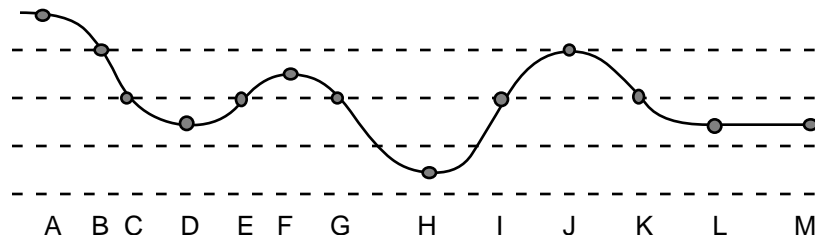
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1. A highdiver ( $m = 75 \text{ kg}$ ) is standing atop a 60 meter tall tower and then jumps to a pool below.
  - a. How much potential energy does the diver have at the top of the tower?
  - b. How much potential energy does the diver have when they hit the water?
  - c. How much kinetic energy does the diver have at the top of the tower?
  - d. How much kinetic energy does the diver have when they hit the water?
  - e. How much total energy did the diver have as they fell?
  - f. When the diver was halfway down, how much potential and kinetic energy did the diver have?
  - g. How fast was the diver going just as they hit the water?
  
2. Charlene is jumping on a trampoline. The trampoline gives her an initial velocity of 12 m/s straight up.
  - a. How much kinetic energy does she have as she leaves the trampoline?
  - b. How much kinetic energy does she have at her highest point?
  - c. How much potential energy does she have as she leaves the trampoline?
  - d. How much potential energy does she have at her highest point?
  - e. How high up does she go?
  - f. When she is one meter off the trampoline, what is her total energy?
  
3. You toss your 7 kg backpack straight up in the air, giving it a kinetic energy of 120 J.
  - a. How fast did you throw it?
  - b. How high does it go?
  
4. A 72 kg skier is at the top a frictionless hill with a vertical drop of 95 meters.
  - a. How much potential energy does the skier have at the top of the hill?
  - b. How fast is the skier going at the bottom of the hill?

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- c. How much work did gravity do on the skier?
5. A 1500 kg car is stopped on a hill when the brakes fail (i.e. no friction) and it rolls down the hill. The car rolls until it has speed of 3 m/s.
- How much kinetic energy does the car have at the bottom?
  - What was the vertical drop of the car on the hill?
  - If the base angle of the hill was  $17^\circ$ , how far down the hill did the car roll? (This is just a trig question.)
  - How much work would it take to stop the car?
  - If the car were to crash into a tree at the bottom of the hill, and the hood is pushed in .25 meters, what was the average force of the tree on the car?
6. A frustrated painter throws his brush ( $m = 0.04$  kg) straight up in the air with an initial velocity of 23 m/s. How high does the brush go?
7. A 32 kg child is having fun at the playground on a Super Slide. It is 4.5 meters high and absolutely frictionless. How fast is the child going at the bottom of the slide?
8. A 1300 kg roller coaster car is 45 meters high in the air. It rolls down a frictionless hill, and "falls" a vertical distance of 25 meters to the bottom of the first hill. How fast is the roller coaster car traveling at the bottom of the first hill?

9. The drawing below represents a frictionless hill, with lines of equal height shown. A ball is given an initial kinetic energy at point A, and then the position of the ball is shown at several positions later.



For each of the questions below, rank the position from greatest to least

- Where is the ball going the fastest?
- Where does the ball have the most potential energy?
- Where does the ball have the most total energy?