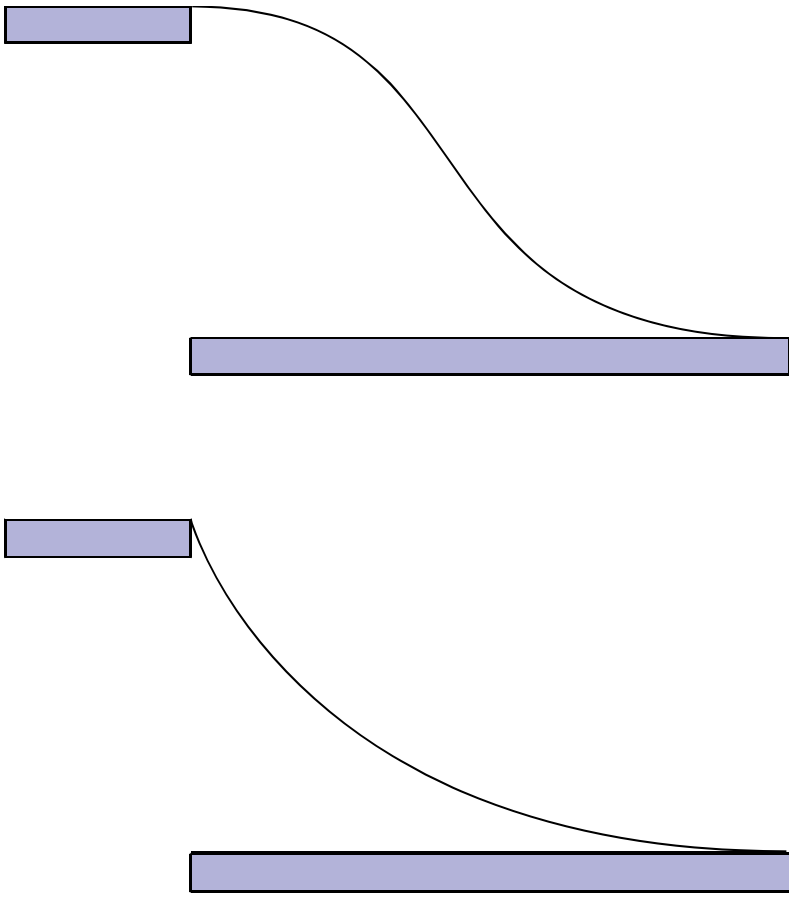
TAP 216- 2: A slide

A child is playing with a nearly frictionless car down a smooth flexible track. She arranges the identical length of track in two ways.



In both arrangements the track runs from the same place on the edge of a table to floor level.

1. She thinks that the car runs off the track at very nearly the same speed in both arrangements when started from rest at the top of the track (the point nearest the table). Is she right or wrong? Give a reason for your answer.

2. She thinks the car takes longer to run down the top arrangement than down the bottom arrangement, when started from rest at the top of the track. Is she right or wrong? Again, justify your answer.

3. Suppose she now lets a car of twice the mass of the previous one run from rest down the top arrangement. Will this car, which has twice as great a mass, take a shorter, the same, or a longer time to run down the track? Give a reason for your answer.

Practical advice

These questions concentrate on the conversion of potential energy to kinetic energy.

Answers and worked solutions

1. Right, as both cars have the same amount of kinetic energy on leaving the track. A good answer would relate this to the same drop in height, explicitly ing the change in potential energy to the change in kinetic energy.
2. Right, as the bottom arrangement gains kinetic energy more quickly, making the average speed greater. A good answer would relate this more rapid change in kinetic energy to the steepness of the slope–top arrangement gets faster sooner!
3. Same, assuming the frictional forces are really negligible as the change in kinetic energy equated to the change in potential energy soon gives:

   $v = \sqrt{2gh}$.

External references

This activity is taken from Advancing Physics Chapter 9, 90S