A roller-coaster car is moving at 20 m/s along a straight horizontal track. What will its speed be after climbing the 15-m hill shown in the figure, if friction is ignored?

Solution:
Conservation of energy:

$$W_{\text{kinetic start}} + W_{\text{potential start}} = W_{\text{kinetic top}} + W_{\text{potential at top}}$$

let's call the level of the horizontal track our reference level, so potential energy will be zero there, so we have:

$$\frac{mV_{start}^{\ 2}}{2} = \frac{mV_{top}^{\ 2}}{2} + mgh$$

$$V_{top}^{\ 2} = V_{start}^{\ 2} - 2gh$$

$$V_{top} = \sqrt{V_{start}^{\ 2} - 2gh} = \sqrt{\left(20\frac{m}{s}\right)^2 - 2 \cdot 9.8\frac{m}{s^2} \cdot 15m} = 10.3\frac{m}{s}$$

Answer: speed of the car will be $10.3\frac{m}{s}$.