Work-Energy Bar Charts

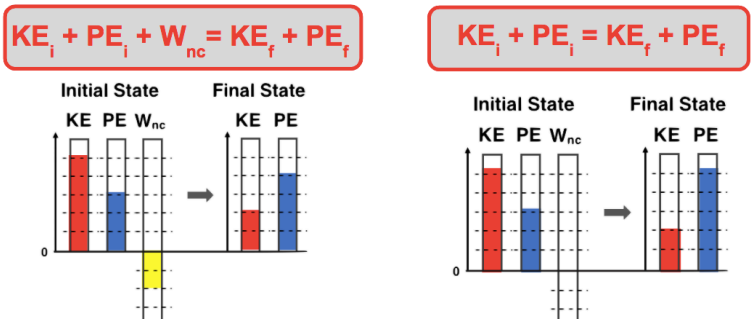
Lesson Notes

Learning Outcomes

- What information does a work-energy bar chart convey?
- How can work-energy bar charts be constructed?

Introducing the Bar Chart

- One theme of these videos on work and energy has been the idea that energy is something we can keep track of. We can know the amount of energy, the form that it takes, and whether it increases, decreases or remains the same over the course of time.
- A **work-energy bar chart** is a conceptual tool that is often used to indicate the amount of energy, the form the energy has, and the manner in which the amount and the form change over time.
- In a bar chart, a bar is used to represent each term in the work-energy equation.

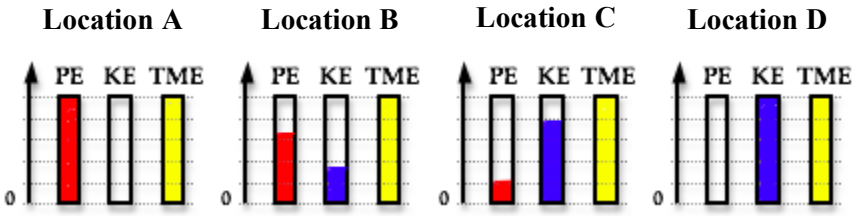


How to Construct a Bar Chart

1. Analyze the initial and final states of the object; determine the forms of energy that are present and absent.
2. Analyze the forces acting upon the object during the motion; determine if non-conservative forces are doing work and whether such work is positive or negative.
3. Construct bars on the chart to illustrate the presence and absence of the various forms of energy for the initial and final state of the object. The exact height of the individual bars is not important; what is important is that the sum of the heights on the left side of the chart is *balanced* by the sum of the heights on the right side of the chart.

A Change of Charts

The bar chart below is often used when there are multiple locations to analyze.

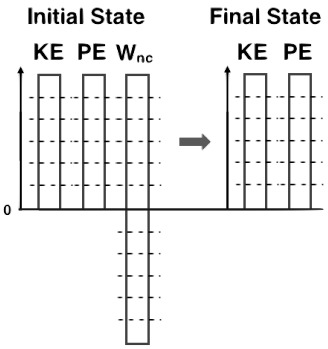


- For every location: TME = KE + PE.
- The amount of PE and KE for one location compared to other locations is what matters.
- There is no W_{nc} term; but if there is some Wnc, then TME will ↑ or ↓.

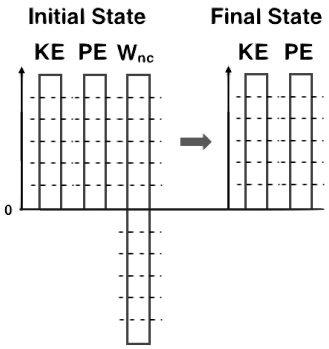
Examples 1-3

Complete the following bar charts:

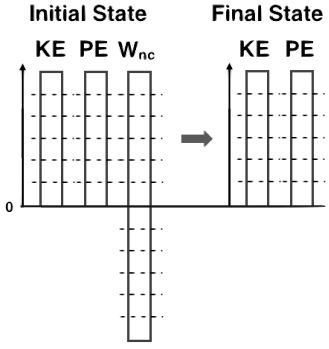
Starting from rest, a ball falls from the top of a pillar to the ground below. Ignore air resistance.



A car skids from a high speed to a stop across a level roadway with its brakes applied.



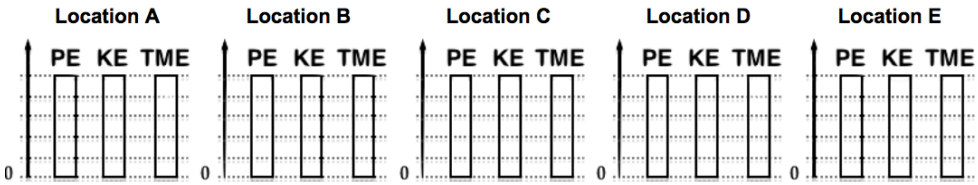
A skydiver falls with a constant speed from a 1000 feet elevation to just above the ground.



Examples 4-5

Complete the following bar charts:

Consider a roller coaster car moving along a track. Five locations - A, B, C, D, and E - are shown. Complete the bar charts for the five locations. Assume negligible resistance.



A pendulum is released from rest and swings to and fro. Four locations - A, B, C, and D - are labeled. Assuming negligible resistance forces, complete the bar charts for the four locations.