Physics Education Laboratory
Lecture 09
PCK for Dynamics / Energy

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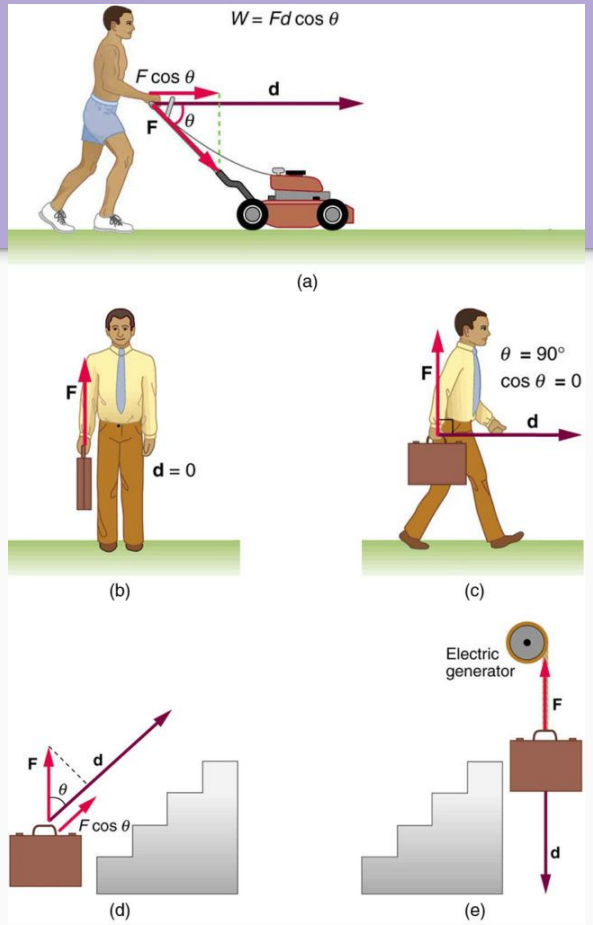
key concepts in Work / Energy

- The concept of Work
- Positive or “Negative” Work
- Kinetic Energy
- Conservative forces and Dissipative forces
- Friction / Air resistance
- Potential Energy
- Power
- Integral along a path …

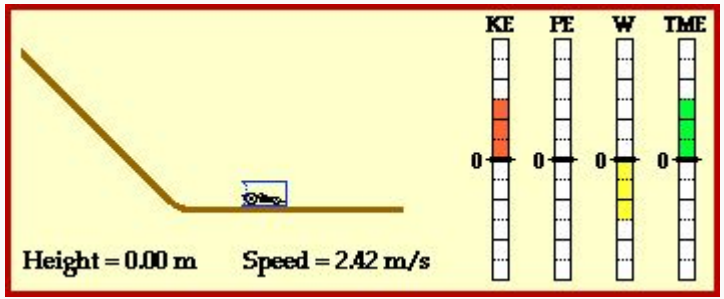


Conceptual ideas and skills about work-energy process that students have to know/possess

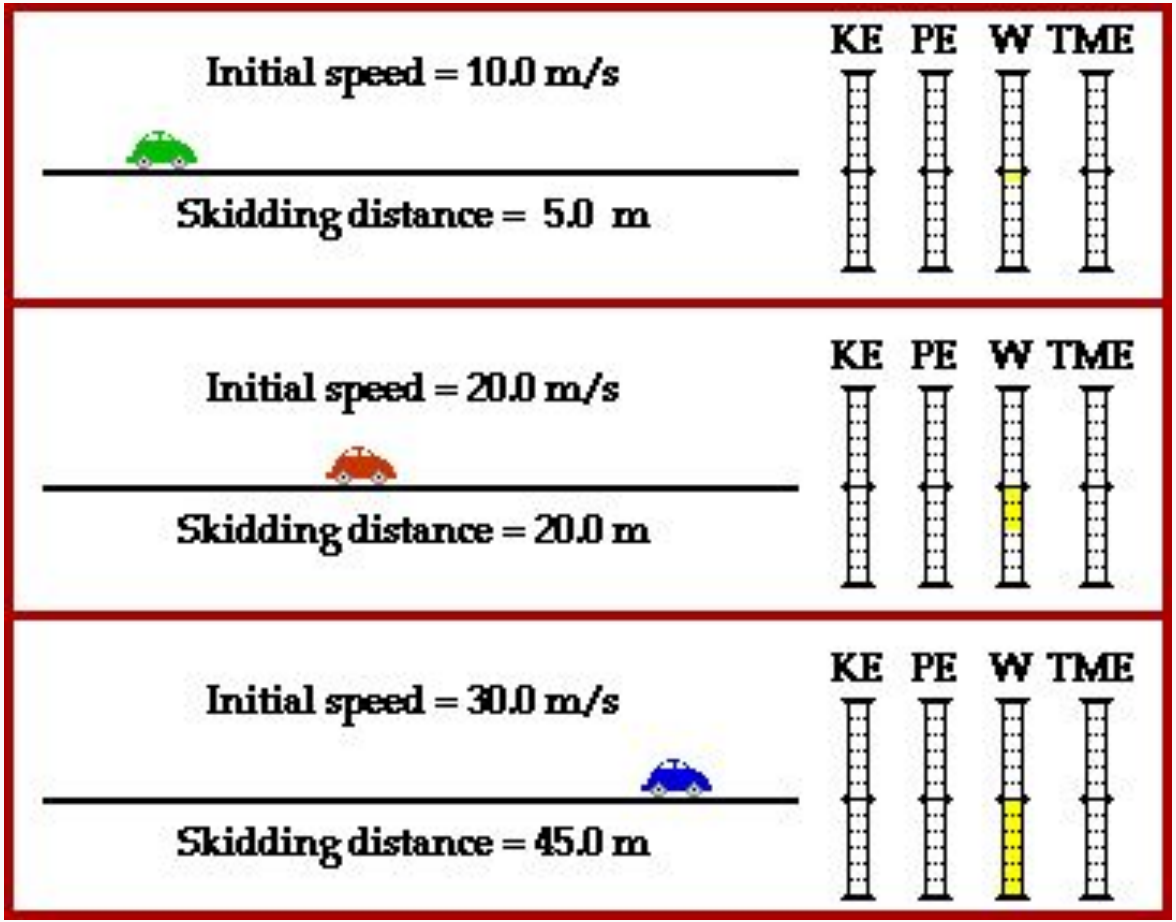
- Choosing a system—the object or objects of interest for the process being considered;
- Characterizing the initial state and the final state of the process;
- Identifying the types of energy that change as the system moves from its initial state to its final state and the signs of the initial and final energies of each type;
- Deciding if work is done on the system by one or more objects outside the system as the system changes states;
- Developing the idea that the initial energy of the system plus the work done on the system leads to the final energy of the system—the energy of the universe remains constant;
- Constructing an energy bar chart—a qualitative representation of the work – energy process;
- Converting the bar chart to a mathematical representation that leads to a problem solution.

Qualitative work – energy bar charts that serve the same role for analyzing work – energy processes as motion diagrams and force diagrams serve when analyzing kinematics and dynamics problems.

The use of these bar charts helps students think more about the physics of a work – energy process rather than relying on formula-centered techniques that lack qualitative understanding.



View animation: https://www.physicsclassroom.com/mmedia/energy/hw.cfm



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https://www.physicsclassroom.com/Physics-Interactives/Work-and-Energy/Work-Energy-Bar-Charts/Work-Energy-Bar-Charts-Interactive

TEST YOURSELF!

The work–energy problem is originally described in the detailed sketch. Students are asked to convert the sketch into a qualitative bar chart —a bar is placed in the chart for each type of energy that is not zero, and the sum of the bars on the left is the same as that of the bars on the right.

Then the generalized mathematical work–energy equation without any numbers is set up with one energy expression for each bar on the chart.

Notice that the work part in the bar chart is shaded so as to distinguish conceptually between work and energy, that is, work is a process quantity, but energy is a state quantity.