ACTIVITY 2B

Constructing Potential Energy Diagrams

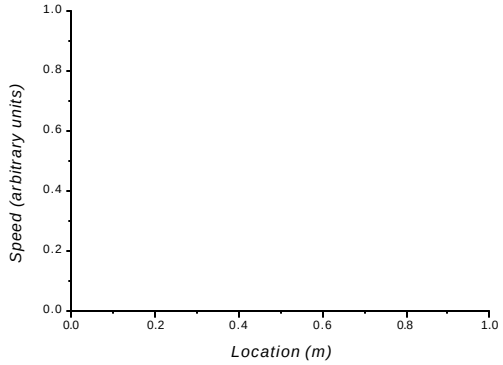
Goal
In this activity, you will explore energy diagrams for magnets in repulsive configurations. From these and the previous diagrams you will learn more about how to use these diagrams to describe motion.

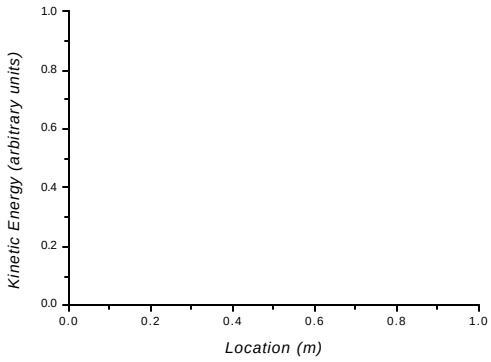
The experimental arrangement in this activity is similar to the previous one. The major difference is that we will arrange the magnets so that the ones along the track repel the one on the cart. Again we will assume that friction between the cart and the track is extremely small.

Use the same set up as in the previous activity and arrange the magnets so that the magnets along the track repel the magnets on the cart. Push the cart and watch carefully as it goes through the magnets. In the first observations we wish to consider a situation in which the cart has enough energy to go past the magnets and continue along the track. If the cart does not go beyond the magnets, try again with a stronger push.

? How did the speed of the cart change as it went through the magnets? Record your observations below.

As you did in Activity 1, plot *approximate* graphs of speed vs. location and kinetic energy vs. location. You may create the graphs by laying a piece of paper along the track and sketching them there. Then, transfer the shape to the graphs below. Mark the position of the magnets on the location axis.

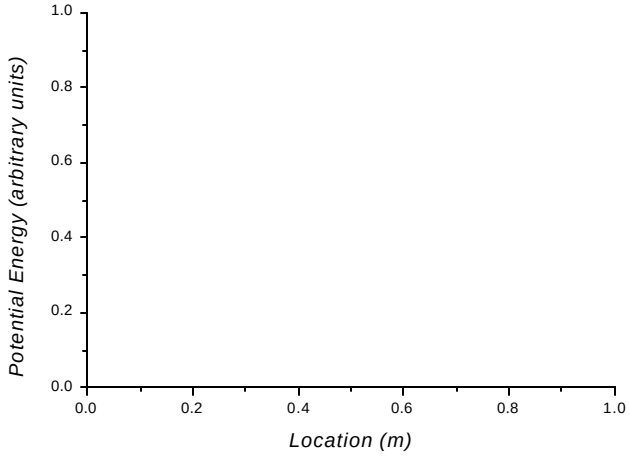




On the graph below draw a line which represents the total energy of the cart .

Transfer to this graph the kinetic energy from your previous graph.

Sketch below the potential energy diagram of the cart by subtracting the kinetic energy from the total energy (applying the conservation law).



? How is this potential energy diagram different from the ones for the attractive situation?

? Explain the reason for this difference in terms of how the energy of the cart changes.

The number and types of magnets available limit how you can change the system. To create more flexibility we will use a computer simulation of the experiment.

Start the *Energy Diagrams Creator* program. With this simulation you can place pairs of magnets along the track and give the cart a push. Set up a computer version of the experiment that you just completed. Describe the results below.

Set up the experiment for Activity 1 --- attraction. Describe the results below.

To check your partners' understanding of these ideas try a little game. While they are not looking at the computer screen, set up a configuration of magnets and a coefficient of friction. Run the cart along the track to get the energy diagrams. Then cover the part of the screen that shows the cart and magnets. Your partner(s) should look at the energy diagram and tell you

- the location(s) of the magnets,
- if each set is repulsive or attractive,
- the level of friction (zero, low, high), and
- how the speed changes as the cart moves along the track.

Don't make it too difficult. Your partners should set up a situation for you also.

The potential energy diagrams can provide information about many details of the motion other than increasing or decreasing the speed of the object. Now that you are familiar with the two basic arrangements of magnets and their corresponding energy diagrams, you can use this knowledge to explore a new, more complex situation - motion restricted in a small region of space (a trap). In the next activity you will study the condition that allows the trapping and some other concepts such as *turning points* and *binding energy* associated with this type of motion.

Homework

1. The quiz show "Jeopardy" has opened a physics category. Below are two answers in the form of potential energy graphs. In this version of "Jeopardy" you need to give and explain the experimental arrangement and motion.