Name _____ Date_____

Activity 2: Drive a Nail

Guiding Question: How can you track the transfer of energy in a system?

Key Words: ***gravitational potential energy, kinetic energy, potential energy***

Get Started:

1. Read the introduction scenario to Activity 2, "Drive a Nail" in your Student Book. What are some other forms of energy transfer?

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2. Read the complete introduction and Guiding Question to Activity 2, "Drive a Nail?" in your Student Book. Note that *energy transfer* is the transfer of energy from one object to another, such as the transfer of kinetic energy of the moving hammer to the moving nail.

Do the Activity:

Part A: Effect of Release Height on Energy Transfer

1. Read Procedure Steps 1-8 in your Student Book.

2. *Watch the LABsent video (found here:* https://labaids.s3.us-east-2.amazonaws.com/labsent-videos/3e+Energy+2+v2.mp4*), to watch the experiment.* Each time the video says to record, you may want to pause the video to give you ample time to complete your observations.

Procedure Step 1: Record the similarities and differences between them in the space provided. Be as specific as you can about each tube.

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Procedure Step 2: How can you use the plastic tubes and short steel cylinder to transfer energy from the cylinder to the nail to drive the nail into the foam block? Record your ideas in the space provided.

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Name _____ Date_____

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Procedure Step 5: How can you use what you observed as a measure of energy tranfer? Record your observations and ideas in the space provided.

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Procedure Step 6: Repeat Step 4 until you have driven the nail into the foam. Record your data.

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Procedure Step 7: Repeat Steps 3-6 with the short plastic tube instead of the long plastic tube. Record your data.

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3. Look at the sample class data shown.

Sample Class Data

Group	Number of drops	
	Long plastic tube	Short plastic tube
1	4	8
2	5	8
3	4	8
4	4	9
5	3	7
6	4	8
7	4	8
8	4	8
Class mean	4	8

Do you see any patterns? What do you think is causing this pattern?

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Name _____ Date_____

4. A *pattern* is a set of repeating things or events. Scientists observe patterns in their data. Patterns lead to questions about relationships and ideas about what causes these relationships. How does the crosscutting concept of *patterns* relate to this activity?

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5. The crosscutting concept of *cause and effect* refers to the idea that events have causes. If "A" causes "B" to happen, they have a cause-and-effect relationship. A major activity of science is to explain how this happens. Sometimes the causes are simple and sometimes they are complex. Sometimes both A and B occur, but one does not cause the other. How does the crosscutting concept of *cause and effect* relate to this activity?

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<u>Part B: Effect of Mass on Energy Transfer</u>

6. Design an experiment that will determine which cylinder transfers the *most* energy to the nail and which cylinder transfers the *least* energy to the nail.

When designing your experiment, think about these questions:

- What is the purpose of your experiment?
- What variable are you testing?
- What is your hypothesis?
- What variables will you keep the same?
- What is your control?
- How many trials will you conduct?
- Will you collect qualitative or quantitative data, or both?
- How will the data help you form a conclusion?
- How will you record the data?

7. Record your hypothesis and your planned experimental procedure in the space provided.

Hypothesis:

_____

_____

Procedure:

_____

Name _____ Date_____

Name _____ Date_____

8. Make a data table that has space for all the data you need to record during the experiment.
Data:

Name _____ Date_____

9. When you return to class, obtain your teacher's approval for your experiment, conduct your experiment, and record your results.

10. Read the passage in Procedure Step 14 in your Student Book. List two things you learned in this passage.

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Analysis:

1. Where were the cylinders located when they had the most…
    a. gravitational potential energy?
    b. kinetic energy of motion?

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2. At which release height did the metal cylinders have the most gravitational potential energy? Explain the evidence you gathered from Part A to make this conclusion.

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3. When about to be released from the same height, which metal cylinder had the most gravitational potential energy, and which metal cylinder had the least gravitational potential energy? Explain the evidence you gathered from Part B to make this conclusion.

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Name _____ Date_____

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4. Do you think that all the energy from the cylinder was transferred to the nail? Describe any evidence that showed it was or was not.

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5. How do the following variables affect how much energy was transferred to the nail?

a. Mass of the cylinder

b. Height of the cylinder

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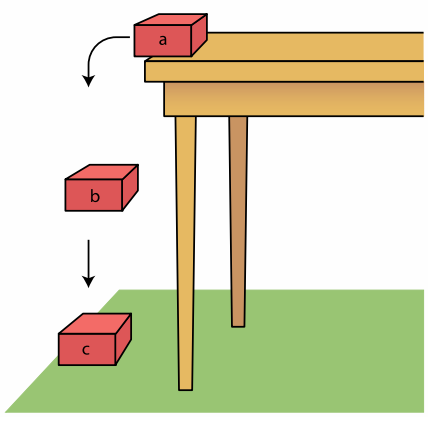
6. In the situation shown below, how much gravitational potential energy and kinetic energy does the block have at each position?



a. When released from rest:

Potential energy = 100 J

Kinetic energy = _____

Name _____ Date_____

b. Halfway down:

Potential energy = _____

Kinetic energy = _____

c. Just before it hits:

Potential energy = 0 J

Kinetic energy = _____

Build Understanding:

1. What is the pattern regarding the effect of changing two variables – the mass of the cylinder and the height from which the cylinder is dropped?

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2. What are some examples of real-world situations where gravitational potential energy is transformed to do work?

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3. What is the difference between gravitational potential energy and potential energy?

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