

6th Simple Machines & Energy Summative Assessment Teacher Rubrics

1. A hiker is at the bottom of a canyon and needs to get to the medical station at the top of the canyon, which is located one mile above the canyon floor. There are two paths (**Path A** and **Path B**) that lead to the top of the canyon. Both paths require the same amount of energy to reach the top of the rim.

The hiker prefers to use **Path A**, saying it is “easier” than using **Path B**. How is this possible? Explain using the concepts of effort force, effort distance, and energy.

This item measures the student’s ability to compare the force and distance relationship in terms of energy.

Criterion for a complete response:

1. The student describes that Path A zig-zags across the canyon and states that it involves the greatest distance to travel, but requires the least amount of effort force.

Code	Response
	<i>Complete Response</i>
10	Meets the criterion for a complete response.
19	Any other completely correct response.
	<i>Incorrect Response</i>
70	Student discusses only effort force (no effort distance).
71	Student discusses only effort distance (no effort force).
76	Repeats the stem of the question.
79	Any other incorrect response.
	<i>Non-Response</i>
90	Crossed out/erased, illegible, or impossible to interpret.
99	Blank.

2. A teacher is standing on one end of a beam, and a 3rd grade student is standing on the other end. The student has been challenged to lift the teacher. She can place the fulcrum anywhere under the beam to create a lever system to accomplish this task.

Draw where the fulcrum should be placed under the beam to provide the student with the greatest mechanical advantage. Explain why your placement of the fulcrum makes the task easier.

This item measures the student’s ability to position a fulcrum to create the maximum mechanical advantage in a lever system and explain their understanding of mechanical advantage in terms of force and distance.

Criteria for a complete response:

1. Student identifies the position of the fulcrum as close as possible to the feet of the teacher (within 2 cm for the greatest MA).
2. Student explains that the closer the fulcrum is to the load force, the effort force needed to accomplish the task is decreased. The student may also discuss the relationship between effort distance and load/resistance distance.

Code	Response
	<i>Complete Response</i>
20	Student meets criteria for correct response.
29	Any other completely correct response.
	<i>Partial Response</i>
10	Student has correct placement of fulcrum, but no explanation.
11	Student has correct placement of fulcrum with incomplete or incorrect explanation.
12	Student provides correct explanation but does not place fulcrum correctly for the <u>greatest</u> mechanical advantage.
19	Any other partially correct response.
	<i>Incorrect Response</i>
70	Incorrect placement of fulcrum.
76	Repeats the stem of the question.
79	Any other incorrect response.
	<i>Non-Response</i>
90	Crossed out/erased, illegible, or impossible to interpret.
99	Blank.

Joe and Bob need to move bales of straw up into the loft of the barn for their father. The bales of straw are quite heavy, so they decide to use a system of pulleys similar to what they used in science class. The brothers have two different ideas for possible pulley systems that they could use (Pulley A and Pulley B) to complete this task.

3. Describe the advantages of using each pulley system to assist the brothers in their decision-making process for this task.

This item measures the student’s ability to identify the advantages that each pulley system provides.

Criteria for a complete response:

1. Student explains that the pulley system in **Pulley A** provides directional advantage, which allows them to pull down to lift the bale instead of pulling upwards. (The student may also state the Pulley A provides a MA, but that it is not as great as with **Pulley B**).
2. Student explains that the pulley system in **Pulley B** provides a mechanical advantage because it takes less effort force to lift the bale of straw (as compared to Pulley A).

Code	Response
	<i>Complete Response</i>
20	Student meets all criteria for a complete response.
29	Any other completely correct response.
	<i>Partial Response</i>
10	Student explains only one pulley system correctly.
19	Any other partially correct response.
	<i>Incorrect Response</i>
70	Student does not provide an adequate explanation of either method.
76	Repeats the stem of the question.
79	Any other incorrect response.
	<i>Non-Response</i>
90	Crossed out/erased, illegible, or impossible to interpret.
99	Blank.

4. Susan reviewed the data table and stated that more energy was required to lift the load using pulley system #1 than with any of the other pulley systems. Is Susan correct? Explain your answer using the ideas of effort force, effort distance, and energy.

(Completing the data table may aid in answering this question.)

This item measures the student's ability to compare sample experimental data to support or refute another student's analysis of the data in terms of force, distance, and energy.

Criteria for a complete response:

1. The student states that Susan is incorrect in her analysis of the data.
2. Student states the reason is because all of the pulley systems require the same energy input (20 units of energy).
3. The student states that as the effort force decreases, the distance that the effort is applied increases.

Code	Response
	<i>Complete Response</i>
20	Student meets the criteria for a complete response.
21	Student meets criteria, but states that as the effort force increases, the effort distance decreases.
29	Any other completely correct response.
	<i>Partial Response</i>
10	Student only states that all of the energy is the same but omits the force and distance relationship.
11	Student meets criterion #3 only.
19	Any other partially correct response.
	<i>Incorrect Response</i>
70	Student states that Susan is correct because the effort force in pulley system #1 is the largest amount.
71	Student states that Susan is correct with no explanation.
76	Repeats the stem of the question.
79	Any other incorrect response.
	<i>Non Response</i>
90	Crossed out/erased, illegible, or impossible to interpret.
99	Blank.

5. Choose at least two simple machines to show how the student could accomplish this task. Use the picture below to help illustrate your solution and then describe in words how your idea will work.

This item measures the student’s ability to apply their knowledge of simple machines to solve a real-life situation.

Criteria for a complete response:

1. Student will provide a reasonable written solution to this problem using at least 2 simple machines (wheelbarrow, crowbar, pulley, ramp, etc.).
2. Student provides an illustration as to how the simple machines will complete the task.

Example #1: Student draws a pulley system hanging from the tree to lift food into wheelbarrow. Then the wheelbarrow is pushed across the yard and up an inclined plane laid on top of the steps so that the wheelbarrow and dog food can make it to the porch.

Example #2: The student draws an inclined plane extending from the picnic table to the porch. A pulley system can then be attached to the porch and the dog food bag so that the bag may be pulled along the inclined plane onto the porch.

Code	Response
	<i>Complete Response</i>
20	Student meets criteria for a complete response.
29	Any other completely correct response.
	<i>Partial Response</i>
10	Student illustrates a solution but does not provide a written response.
11	Student provides a written response but not an illustration.
19	Any other partially correct response.
	<i>Incorrect Response</i>
70	Student uses only 1 simple machine in the response.
71	Student uses devices that are not SIMPLE machines (such as a crane, forklift, etc.)
76	Repeats the stem of the question.
79	Any other incorrect response.
	<i>Non-Response</i>
90	Crossed out/erased, illegible, or impossible to interpret.
99	Blank.