Investigation 12B: Pulleys

Essential Question: How can ropes and pulleys create mechanical advantage?
How does a block and tackle machine work?

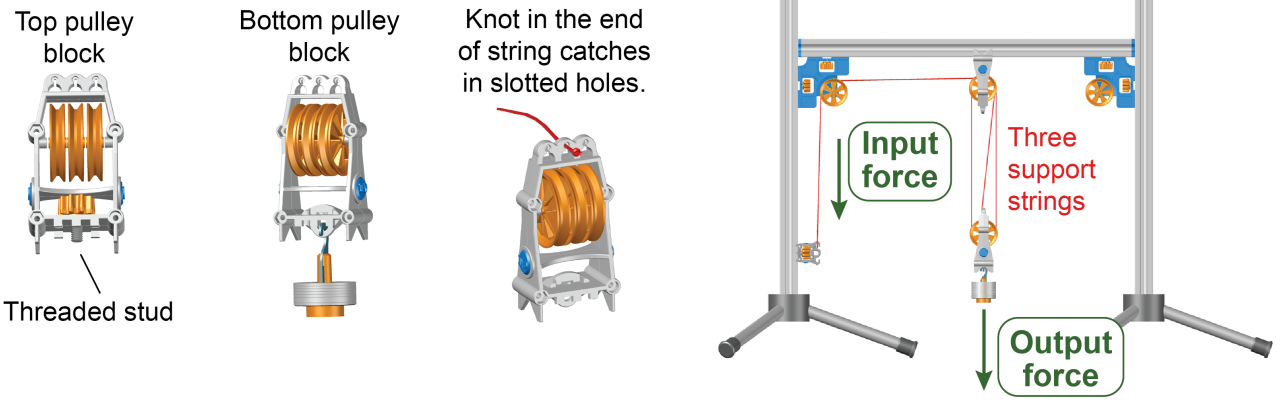


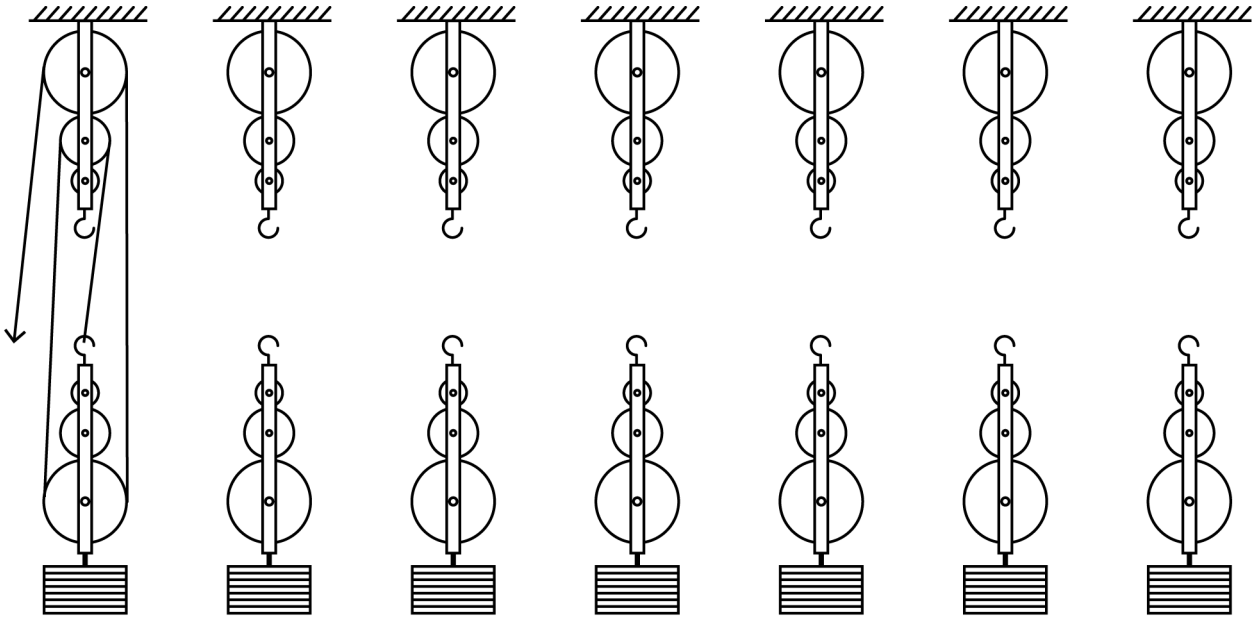
Table 1: Input and output force data

	Input	Output	
Mechanical advantage	Force (N)	Washers	Weight (N)
1			
2			
3			
4			
5			
6			

- Design machines that have the different mechanical advantages in the table.
- For each design, test the real mechanical advantage by measuring the force it takes to slowly raise the output load.
- Keep the load (output force) constant. Measure the weight of the load with your spring scale and record it in the table.

HINT: you will have to switch the connection of the "fixed" end of the rope between the top and bottom pulley block to get all of the combinations.

Sketch each of your designs in a way that identifies the connection of the rope and how the rope is wrapped around the pulleys.



Questions

1. What is the rule that tells you the mechanical advantage of a pulley system?

2. What was the largest mechanical advantage you could construct? Why is this the limit of this system of pulleys?

3. Was the actual measured mechanical advantage greater or less than you think it should have been? Propose an explanation for any differences you observed.

4. Is it possible to build an infinite mechanical advantage using an infinite number of pulleys? Why or why not? What limits they realistic advantage of a machine made with blocks and pulleys?

5. How does the property of an ideal string to "have the same tension everywhere" explain the mechanical advantage of a block and tackle machine (you constructed) in which four strands of string support the load?