Experiment #3

79319

Using a Compound Pulley System

Objectives: Investigate how a compound pulley system increases the applied effort force and makes the job of lifting a load easier

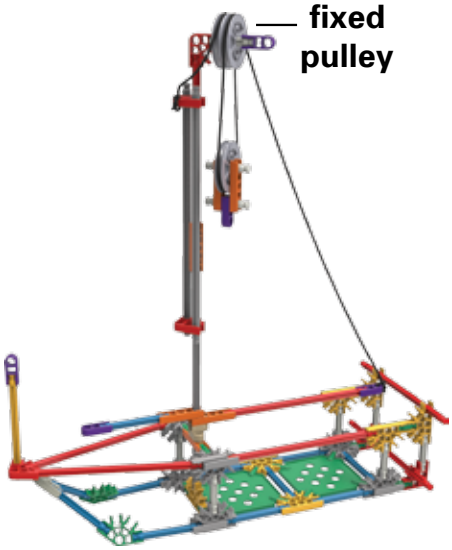
Materials You Will Need:

- built **SAILBOAT** model
- small stickers or pieces of masking tape
- measuring tape
- large paper clip
- paper or a notebook

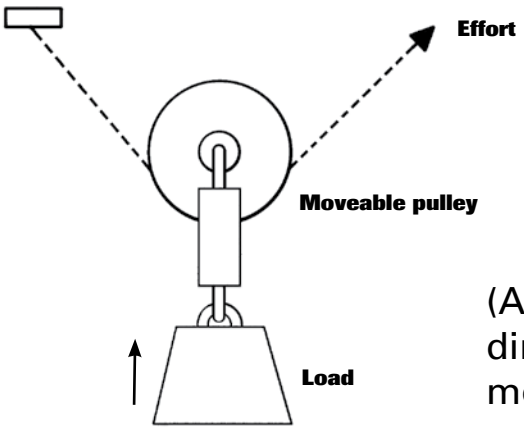
PROCESS:

1. Build the **SAILBOAT** model by following the step-by-step building instructions.

2. Identify the fixed pulley on your sailboat and label it with a sticker or small piece of tape.



3. How does the lower pulley differ from the two at the top of the mast?



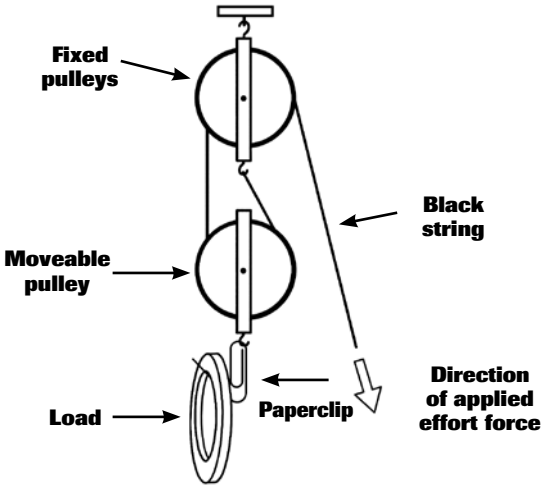
(A moveable pulley is attached directly to the load being lifted; it moves when the rope is pulled.)

4. Label the moveable pulley with a sticker or small piece of tape.

5. Moveable pulleys are usually used with fixed pulleys and this arrangement is referred to as a compound (or double) pulley system. If a moveable pulley is used alone, you will have to pull upwards on the rope or chain – a harder job than pulling down. Combining the moveable pulley with a fixed pulley allows you to pull downwards on the rope to raise the load. Now, let's investigate how a compound pulley system works!

6. Attach a load, such as a K'NEX tire, to one end of a string. You probably have a large amount of spare string extending down from where you have secured it to the gray clip on the end of the red rod (the boom). Tie your load to the free end of this string. Lift the weight by pulling on the string. Feel how much effort it takes to lift the weight.

7. (a) Open a large paperclip so you can use it as a hook. Attach the paperclip to the purple connector on the bottom of the hanging pulley. Untie the load from the free end of the string and hang it on the paperclip. Carefully untie the string from the gray clip at the end of the red rod and pull on it to lift the load. Ask a friend, parent or teacher to help and make sure that the string stays in the rim of the pulley.



(b) In what way(s) do the pulleys on the sailboat work like the pulley on the flagpole?

(c) Does this pulley make lifting easier? If so, how?

(d) What else do you notice about lifting the load with these pulleys?

8. (a) Let the load rest on the desk/table, with the string pulled taut. Grip the string just below the pulley and pull down to lift the load. Ask a friend, parent or teacher should use a measuring tape to see how far the string was pulled. Measure from your fingertips to the pulley.

(b) Then measure the distance between the top of load and the desktop. How far has the load moved?

(c) Compare the measurements.

(d) What do you notice about the length of string you pulled to lift the load and the distance that the load moved?

(e) Why do you think this happened?