RESPONSE SHEET—PULLEYS

Karl told his brother Charles, "I just couldn't lift that 30-kg bag of cement into Dad's wheelbarrow until I got a pulley and a rope. Then it was easy."

Charles was surprised. "You got the cement into the wheelbarrow!? How did you do it? How much easier was it?"

Explain how you think Karl lifted the cement and how much effort he had to apply.

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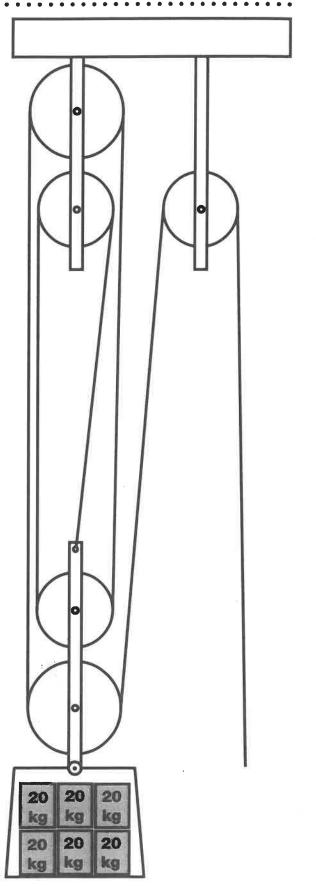_____

RESPONSE SHEET—PULLEYS AT WORK

Belinda and her mother cut and polish rocks to make beautiful bookends. They pack them in crates for shipment. Each crate has a mass of 20 kg. Belinda can lift only one crate of bookends at a time up to the shipping area.

Belinda decided to put together a pulley system to lift the crates up the 2 m to the shipping area. She said,

With this system I will be able to lift six crates at a time. And there is no disadvantage. Using a pulley system is just like getting something for free.

Is Belinda right about the number of crates she will be able to lift? Is her statement right that there is no disadvantage? Explain.

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Name _____

Date _____

PULLEY DATA

Part 1

One- and two-pulley systems	Number of pulleys	Direction of effort	Load (N)	Effort (N)	Number of ropes lifting load
Single fixed pulley					
Single movable pulley					
Single fixed / single movable pulley					
Single fixed / single movable pulley					

Part 2

Distance effort moved	Distance load moved

What relationships can you see in this chart? _____

_____

What are the advantages and disadvantages of using pulleys? _____

_____

PROJECT IDEAS

- Put the scale at the end of a class-2 lever (50 cm from the fulcrum). Find out how much effort is required to lift the load as it moves from the fulcrum to the effort in 5-cm intervals. Graph the results.

- Put the scale 10 cm from the fulcrum of a class-3 lever. Find out how much effort is required to lift the load as it moves from the position of the effort out to the end of the lever in 5-cm intervals. Graph the results.

- Create a diagram of a make-believe lever system (it can be one or more levers). Write an imaginative description of its use, name it, and draw it. Make a model of your lever system.

- Use the half-meter sticks and other materials to build a multiple-lever system where one lever acts on another to provide a double advantage. Compare the effort and load in such a system.

- Assemble pulley systems that use a single and a double pulley (two wheels), two single pulleys, and two double pulleys. (You will need an extra long rope.) Record how many different systems you discover and how much effort is required.

- Get some heavy-duty pulleys and strong rope from a hardware store. Find a place outdoors (tree limb, swing set, etc.) to secure a fixed pulley. Rig up some different pulley systems and lift a heavy load like a bucket of sand or another student. Use work gloves when you haul on the rope.

- Research the other four simple machines (wheel and axle, inclined plane, wedge, and screw) and give a short report to the class.

- A steam shovel is a compound machine made of simple machines—levers and pulleys. Research steam shovels and other machinery, analyze them in terms of simple machines, and write a report. Here are a few examples of compound machines.

  - backhoe
  - crane
  - drilling rig
  - elevator
  - hoist
  - drawbridge
  - exercise equipment

- Use centimeter graph paper to graph the results of your investigations.

  - The number of supporting ropes (x-axis) versus the effort required to lift the load.

  - The number of supporting ropes (x-axis) versus the distance the rope is pulled.

- Assemble a pulley system using two single pulleys that will give a 4:1 advantage in effort reduction. Usually 3:1 is the greatest advantage obtained from two single pulleys. The solution, called a Spanish Burton system, involves two ropes.

- Set up a lever-and-pulley system in which a pulley applies effort to one end of a lever that in turn lifts a load. Compare effort and distance.

PROJECT PROPOSAL

1. **What is the question or the project that you are proposing?**

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2. **What materials or references will you need to complete the project?**

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3. **What steps will you follow to complete the project?**

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PRESENTATION GUIDELINES

You will have exactly 3 minutes to present your project to the class. In those 3 minutes you should answer these questions.

- What were you trying to find out (your question)?
- What materials or references did you need to do your project?
- What procedure did you follow to complete your project?
- What did you learn from doing your project?

When you begin speaking, you will see the *green card* held up for 2 1/2 minutes. When you see the *yellow card*, you have 30 seconds left. When you see the *red card*, it means you can finish your sentence, but you must stop within the next few seconds.

Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.