

## **Nova Counselor Training Task 2**

### **Pull!**

#### **Objective of the Training Task:**

Give participants a Boy Scout STEM Activity to experience and analyze.

#### **Objective of the Boy Scout STEM Activity:**

Make and test pulleys to discover the difference between a single pulley and a double pulley. Consider the use of pulleys at summer camp.

#### **Materials for Each Group:**

- A pulley rack – already constructed. See directions below.
- A pair of pliers (needle-nose is best)
- A yogurt container (6-8 oz size) bucket – already constructed. See directions below.
- Two metal sewing machine bobbins (available in craft, fabric, sewing stores)
- Two 8-inch lengths of 16-gauge wire
- One 6-foot length of poly cord
- Small bag of rocks – enough to fill up the yogurt container
- 4 copies of the two-sided activity page below, so each participant can take one home.
- Zip top bag to hold materials in. (All but the pulley rack will fit.)

#### **Procedure:**

- Divide participants into groups of 2-4.
- Hand out a pulley rack and bag of materials to each group.
- Explain the training objective and the activity objective.
- Explain that for purposes of the training, they will be doing an abbreviated version of what the Boy Scouts would do.
- The Boy Scouts would make the pulley rack and the bucket, as well as the pulleys, and we'll just make the pulleys.
- Explain, then demonstrate how to make the pulley. Set the groups to making the pulleys and offer guidance as needed.
- Explain, then demonstrate the first experiment (single pulley).
- Note that, while a bowline knot is best for this experiment, we are NOT going to worry about learning that knot in this training. It could, however, be a part of the activity when done with Boy Scouts.
- Set the groups to doing both experiments, and to ask for guidance as needed.

#### **Questions to Ask Participants as Pretend Boy Scouts:**

- Is it easier to lift the bucket with the strength of your arms or with the pulley?
- How do you anticipate the two-pulley situation will compare to the one-pulley situation?
- What happens with two pulleys? Is it easier, harder, or the same as the one-pulley situation?

#### **Questions to Ask Participants as Future Nova Counselors:**

- Looking at the requirement for this Nova award, does it say how the boys are supposed to learn about the simple machines?
- Which would most boys pick, a hands-on experience or a lecture?
- Is this activity sufficient to cover this requirement?

# Pull!

Let's make two pulleys, and experiment with lifting a yogurt cup full of weights.

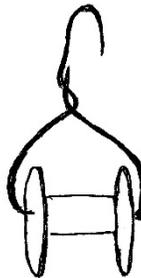
**Tools:** wire cutter, needle-nose pliers, scissors, hole punch, saw

**Materials:** bobbins, 16-gauge wire, poly cord, yogurt cups, wood furring strips, eye screws

## Make Two Pulleys

- Two metal sewing machine bobbins
- Two 8-inch lengths of 16-gauge wire
- One 6-foot length of poly cord

Make what looks like a small coat hanger with the bobbin on the bottom. To do this, slip the bobbin onto the wire. Bend the ends up and around the bobbin, twist them together, and make a hook at the top. Repeat to make another pulley.



## Make a Bucket with a Handle

- One small yogurt cup
- One 5-inch length of 16-gauge wire

Punch holes on opposite sides of the yogurt cup, near the top. Bend the wire into a semi-circle. Bend  $\frac{1}{2}$  inch on each end outwards. Pinch the wire and slip it inside the yogurt cup so the ends come out the holes. Bend the ends upwards to secure the bucket handle. Fill the bucket with beans, pebbles, sand, washers, or anything else that is relatively heavy.

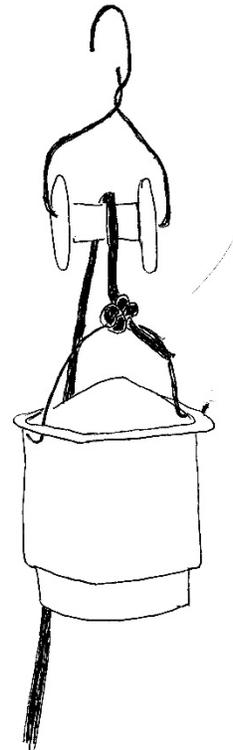
## Make a Pulley Rack

- One 2-foot length of wood ( $\frac{3}{4}$  by  $1\frac{1}{2}$  works - furring strips)
- One eye screw

Cut the wood to length. Twist the eye screw into the center of the length of wood. Lay the wood across two desks or chairs with the eye screw down. Have a partner hold in place during the experiments.

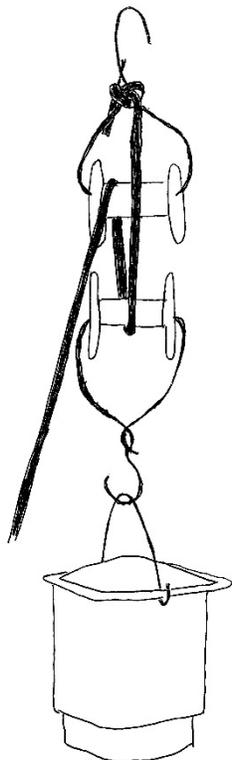
### Experiment 1: Single Pulley

Hang a single pulley from the rack. Use any kind of knot (a bowline knot is best) to tie one end of the poly cord around the bucket handle. Loop the other end of the cord over the pulley. Pull down on the cord to lift the bucket. Is it easier to lift the bucket with the strength of your arms or with the single pulley?



### Experiment 2: Double Pulley

Hang a single pulley from the rack. Use an overhand knot to tie one end of the poly cord around the neck of the pulley hanger. Hook the bucket handle with the second pulley. (The second pulley will be upside down.) Loop the loose end of the cord through pulley #2, back up around and over pulley #1. Pull down on the cord to lift the bucket. Which is easier - lifting the bucket with a single pulley or a double pulley?



What daily activity in BSA summer camp involves the use of a single pulley? Could we do this activity as easily without a pulley?