



Curriculum Center Library & NASA ERC
RR # 1 POB 9296
Kingshill, VI 00850-9718
(340) 778-1600 (340) 778-5724 FAX
Curriculum Center Library

What is Engineering?
Grade 5

Materials and implementation assistance are provided by NASA education specialist. Call 778-1600x7507

The simple definition for engineering is to plan and construct something for a purpose. Students will see short videoclip (3 minutes) of a robotic arm in space [://www.nasa.gov/mov/329198main_Robotic_Arm.mov](http://www.nasa.gov/mov/329198main_Robotic_Arm.mov)

VI Science Standards practiced:

- S5.REI.1** The learner will be able to develop a problem, design and solution using scientific inquiry and technological design.
- S5.REI.2** The learner will be able to investigate careers in science
- S5.REI.3** The learner will be able to prepare reports utilizing various media.

Common Core State Standards practiced in this activity [here](#)

Materials needed

Styrofoam coffee cups (2 each)
String
Cellophane tape
Scissors
Plastic picnic knives (serrated)
12 oz plastic bottles
Water
Balance
Graph paper
Pencil
Dictionary

VIRGIN ISLANDS DEPARTMENT OF EDUCATION

Curriculum Center

RR # 1 POB 9296

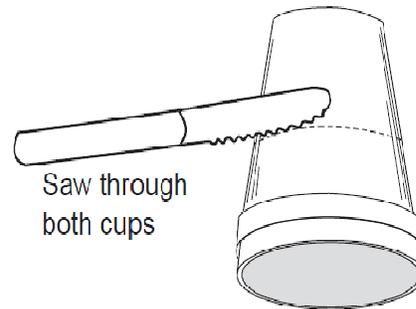
Kingshill, VI 00850-9718

(340) 778-1600 (340) 778-5724 FAX

Curriculum Center Library

Procedure:

1. Nest the two cups together and cut through both cups where indicated in the diagram by the dashed line. Smooth



the cut edges by scraping them with the picnic knife edge.

2. Cut three pieces of string 12 centimeters long each.

3. Tape the end of the first string to the inside of the inner coffee cup just below the cut edge. Tape the other end of the string to the outside of the cup but do not press this piece of tape tightly yet.

4. Repeat step 3 twice more, but place the strings about 1/3 of the way (120 degrees) around the cup from the first string.

5. While holding the rim of the inner cup, rotate the outer cup until the three strings cross each other. The strings will have some slack. Pull the end of the strings on the outside until they are straight and intersect exactly in the middle of the opening. Press the tape on the outside to hold the strings.

6. Use the robotic arm "end effector" to pick up an object such as a pencil. Have someone hold a pencil upright.

Open your end effector so that the strings are not crossing each other. Slip the end effector over the pencil so that the pencil extends down the center and not through any of the loops. Rotate the outer cup until the strings grasp the pencil. Pick up the pencil.

7. You may find that the pencil is too slippery to be held securely. How might you modify the pencil so that it can be held? Design a standard grapple fixture that can be mounted to other objects so that they can be picked up.

Assessment:

Review the tables or charts created by your students. Pay special attention to the ideas students have for improving their grapple fixtures.

Assessment worksheet

Engineering Worksheet

1. What two types of units are found on your ruler?
2. Find the centimeter side, how many total are there? How many inches does that equal?
3. How could you increase the amount of weight that your robot hand can hold?
4. What types of materials cannot be picked up by this type of "hand"?
5. Use the graph space below to show the mass of each object lifted.

VIRGIN ISLANDS DEPARTMENT OF EDUCATION

Curriculum Center

RR # 1 POB 9296

Kingshill, VI 00850-9718

(340) 778-1600 (340) 778-5724 FAX

Curriculum Center Library

- 6. How could you change the object being lifted to make it easier to grasp?

Math Standards

- SMP1** Make sense of problems and persevere in solving them.
- SMP2** Reason abstractly and quantitatively.
- SMP3** Construct viable arguments and critique the reasoning of others.
- SMP4** Model with mathematics.
- SMP5** Use appropriate tools strategically.
- SMP6** Attend to precision.
- SMP7** Look for and make use of structure.
- SMP8** Look for and express regularity in repeated reasoning.

English and Language Arts

- RF.5.3a.** Use combined knowledge of all letter-sound correspondences, syllabication patterns, and morphology (e.g., roots and affixes) to read accurately unfamiliar multisyllabic words in context and out of context.
- W.5.1b** Provide logically ordered reasons that are supported by facts and details.
- W.5.1c** Link opinion and reasons using words, phrases, and clauses (e.g. consequently, specifically).
- W.5.1d** Provide a concluding statement or section related to the opinion presented. **W.5.4.** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.