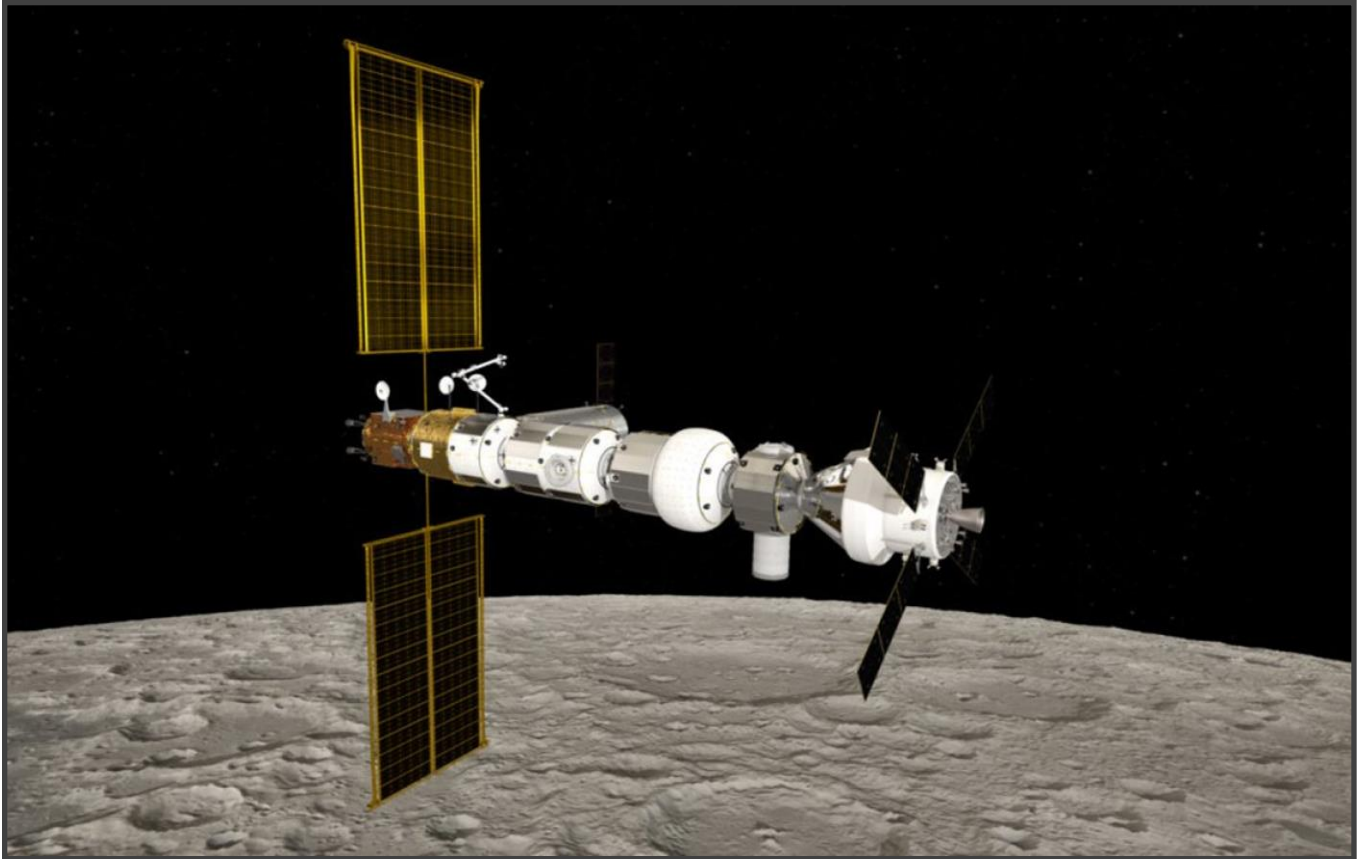


Spacegate Station

Episode 4 Resources



Resource Contents

- Review of Motion Work Sheet
- Teacher Directions and Supplies list
- Articulating Finger Build Instructions
- Articulating Finger Template
- Next Generation Sunshine State Standards (Florida)

This program was designed specifically to be used as part of science subject instruction, science remediation and science enrichment. The determination of the appropriate science standards that correlate to this program was established by a board of Science Specialists and teachers in Duval County Public Schools, Jacksonville, FL.

Spacegate Station Episode 4 - The Miracle of Motion

Review of Motion Worksheet

Skeletal System

Word Bank

Articulate Bones Cartilage Ligaments Protection Structure

- The human skeletal system provides the human body with _____ and _____.
- An adult has 206 individual _____ within the skeletal system.
- Bones _____ or move to form structures or joints that help facilitate motion.
- These joints contain _____ which are bands of dense and fibrous connective tissue that are key to the function of joints.
- _____ is more flexible than bone but stiffer than muscle and is responsible to provide structure to a joint.

Muscular System

Word Bank

Contract Movement Relax Skeletal muscles Strong cords Voluntary

- Muscles works with the skeletal system to produce _____.
- There are approximately 650 _____ in the human body.
- The skeletal muscle is under the _____ control of the nervous system.
- Muscles are attached to bones by the _____ called tendons.
- When the muscles that cover the joint either _____ or _____ the joint moves in one direction based on where the muscle is attached to the bone.

Nervous System

Word Bank

Brain Feedback Nerves Signals Spinal cord Stimulate

- To control movement of the human body the brain sends _____ via the nervous system.
- The nervous system is made up of the _____, the _____ that branch out from the spinal cord and the nerves that are connected to the muscles in the body.
- The nerves _____ or control the muscles and direct them to either contract or relax.
- When movement is taking place, a wide variety of receptors in the skin, muscles, and bones provide _____ regarding the speed, direction, and force of the movement.
- All this sensory feedback gets transmitted through the nervous system back to the _____, allowing it to make the necessary adjustments to muscular movement, as necessary.

Episode 4 – The Miracle of Motion

Directions

Teacher Instructions: During the development and construction phase students may work either individually or in groups depending on the available resources or classroom limitations.

Recommended Supplies:

- 1 milkshake or Boba straw
- 50 cm braided Dacron kite thread, or fishing line
- 4 felt, 2.5 cm x 7.5 cm
- 4 bone labels
- 1 straw and felt template
- scissors
- clear tape
- Hot glue gun
- Optional: 1 large rubber band

Safety Guidelines

Hot Glue Gun

- Place it on a level surface to avoid tipping over.
- Place the electrical cable out of the way to avoid a tripping hazard.
- Do not touch the tip of the tool or the hot glue coming out of it.

Eye Protection

- Students should wear appropriate eye protection while doing any engineering design or field projects.

Cutting Tools

- Keep the sharp edge of the scissors away from your body.
- When cutting small pieces, do not place fingers very close to the blades.

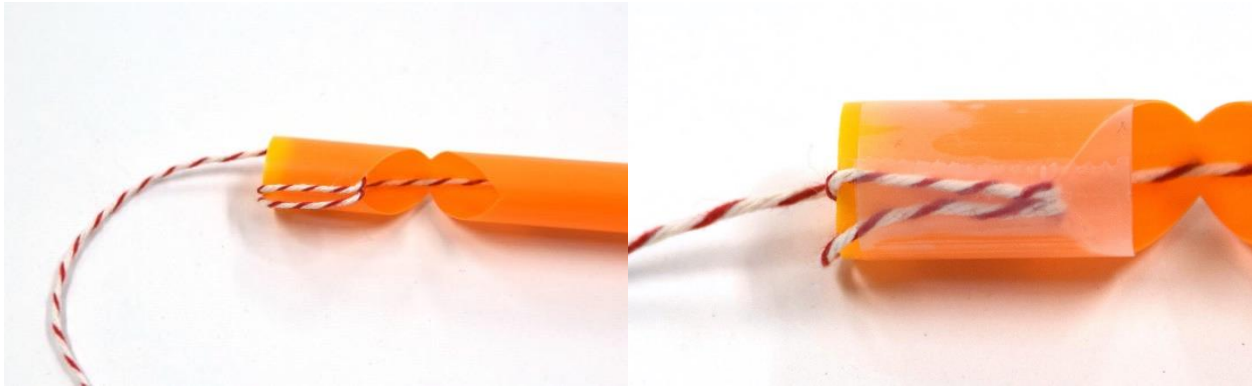
Constructing the Finger



- 1** | Cut out your template and align straw. Use this template as a stencil for making each articulated finger.
- 2** | Using your spacing guide, mark location of cuts on the straw.

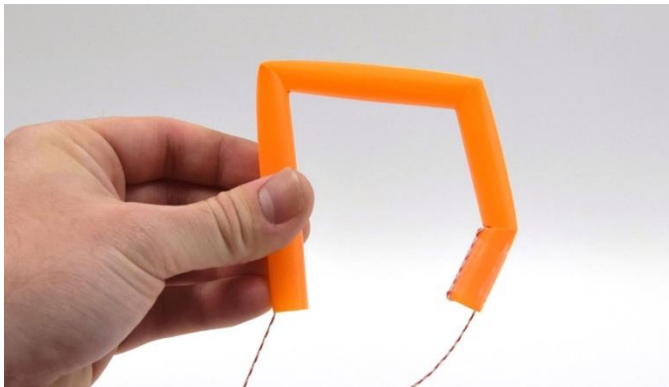


- 3** | Bend your straw at the marks and cut diagonally.
- 4** | Grab your 50 cm thread and drop it through the straw, leaving about 7 cm hanging out of the top (the distal end).



5 | Wind your thread around the top section twice.

6 | Tape your thread to the straw.



7 | Check your finger functionality by pulling the thread. The digits should bend progressively and in order, from top to bottom.

Note: *Straw not bending as expected? Try different cutting techniques and shapes. Test and improve based on your observations.*



8 | Apply your bone labels.



9 | Cut out the finger bones from the felt, using the Articulated Finger template as a guide.



10 | Hot glue the felt bones to your articulated finger opposite your cut holes, except for the metacarpal, which will be applied a bit later when building the robotic finger.



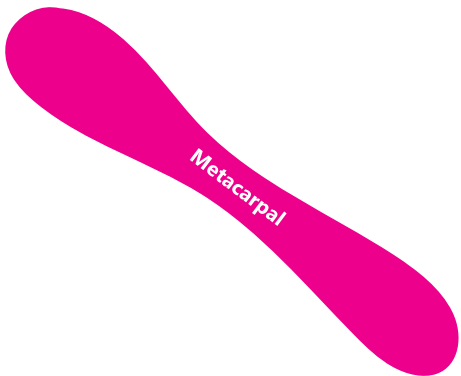
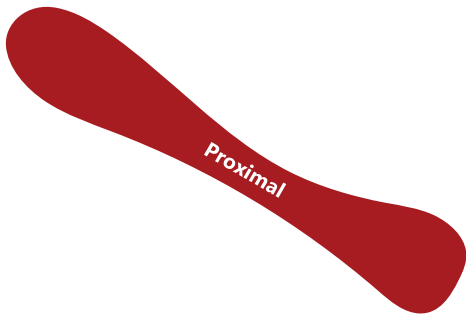
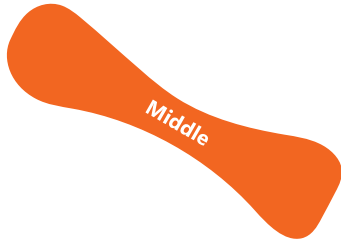
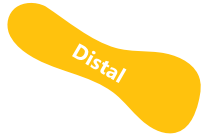
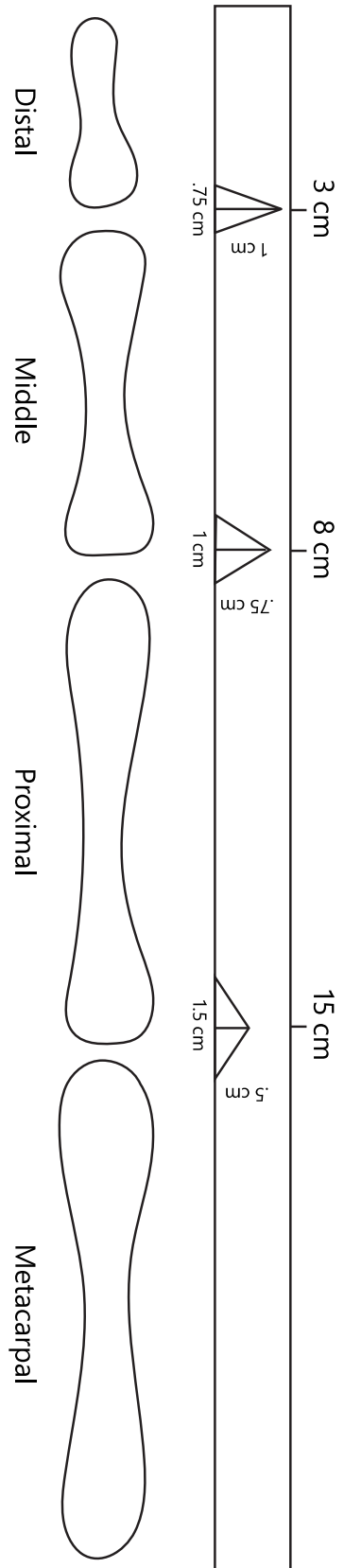
11 | Optional: Cut the rubber band into small pieces and glue them opposite the bones, to act as finger pads and provide grip.



12 | Test your articulated finger by pulling the string.

Congratulations! You've built an articulated finger!

 Make the triangular notches progressively wider and shorter to enable proper bending.



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Episode 4 – The Miracle of Motion

Next Generation Sunshine State Standards (Florida)

SC.4.N.1.2 Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.

SC.5.L.14.1 Identify the organs in the human body and describe their functions, including the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, reproductive organs, kidneys, bladder, and sensory organs.

SC.6.L.14.5 Identify and investigate the general functions of the major systems of the human body (digestive, respiratory, circulatory, reproductive, excretory, immune, nervous, and musculoskeletal) and describe ways these systems interact with each other to maintain homeostasis.

SC.6.N.1.4 Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.

SC.6.N.1.5 Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.

SC.6.N.3.4 Identify the role of models in the context of the sixth grade science benchmarks.

SC.7.L.16.4 Recognize and explore the impact of biotechnology (cloning, genetic engineering, artificial selection) on the individual, society and the environment.

SC.7.N.1.5 Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.

SC.7.N.3.2 Identify the benefits and limitations of the use of scientific models.

SC.8.N.3.1 Select models useful in relating the results of their own investigations.