S.T.E.A.M. Type 3 – Activity #2

BE SURE TO CHECK OUT: NCR YOUTUBE ACTIVITY PLAYLIST

Dear Parents/Caregivers:

Welcome! This activity sheet, in concert with the accompanying You Tube instructional video (see the URL above), offers your children opportunities to learn about trains, aspects of trains, and valuable thinking skills through "hands-on" science activities. These activities are based on an educational design known as **S.T.E.A.M.** (**S**cience, **T**echnology, **E**ngineering, **A**rt, and **M**ath). S.T.E.A.M. offers children unique opportunities to examine the world and to think about what they see.

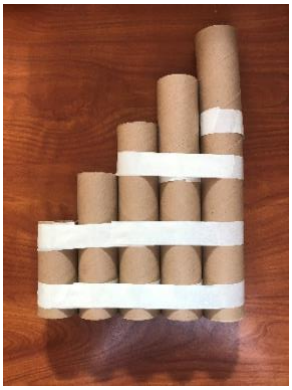
These projects can be done at home using simple and easy to locate materials. I urge you to watch the accompanying video with your child and then gather all the necessary materials for each activity. Encourage your child to complete each activity to the best of her or his ability. Don't do the activity for your child; rather, assist where necessary. I invite you to take time after each activity to talk about what was learned and what challenges were encountered. You and your child are in for quite a learning adventure!

S (Science):

(Ages: 6-10)

Materials: 8 cardboard paper towel rolls or craft tubes from a hobby store, ruler, scissors, duct tape

Directions: 1) You will be creating five tubes of increasing lengths. To begin, cut two of the paper towel rolls in half. Then, assemble brand new tubes as follows: Tube #1: ½ a paper towel roll. Tube #2: 1 paper towel roll. Tube #3: 1 roll + ½ roll (tape the two together). Tube #4: 2 rolls (tape the two together. Tube #5: 2 rolls + ½ roll (tape the three pieces together). 2) Use the masking tape to connect the five new tubes together as in the photograph. 2) Now, walk through your house and locate different kinds of sound (people talking, TV, music playing, washing dishes). 3) Listen to the sound through each of your five tubes.



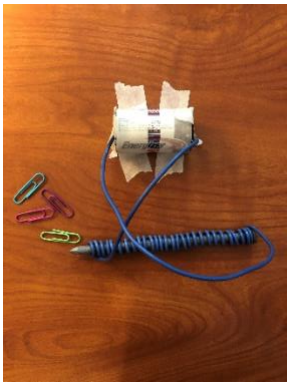
Trains make many different sounds. Some have a high pitch (whistle) and some have a low pitch (engine). Pitch refers to how rapidly air molecules vibrate. When you listen to a sound through the longest tube, the air inside it vibrates more slowly. This creates a lower frequency (lower pitched) sound wave. The shortest tube has a shorter column of air that vibrates more quickly. Thus, it has a higher pitch. In other words, the longer tubes play lower notes, while the shorter tubes play higher notes. Musical instruments (such as the xylophone) use this principle to make different notes. So does a train.

T (Technology):

(Ages: 6-10)

Materials: insulated copper wire (about 5 feet long), long iron nail, wire stripper, masking tape, fresh D battery, small metal objects (paper clips work well)

Directions: 1) Wrap the copper wire tightly around the nail, making sure it does not overlap. Be sure to leave about eight inches of wire free on each end (see the photograph and the video). 2) Remove about one inch of insulation from each end of the wire (using the wire stripper). 3) Use some masking tape to fasten the D battery to a tabletop. 4) Attach one end of the wire to one end of the battery and secure with a piece of tape. Do the same thing with the other end of the wire. 5) You have now created your own electromagnet. You can use it to pick up small metal objects (paper clips).



When you connect the two ends of the wire to the two ends of the battery, you create a complete electrical circuit. As the electrical current flows through the wire, it creates a magnetic field and magnetizes the metal nail. The nail can now "pick up" any metal object (if it isn't too heavy). Maglev trains (short for magnetic levitation trains) are modern trains that use specially designed electromagnets to power them down a specially designed track. Maglev trains are common in many Asian and European countries.

E (Engineering):

(Ages: 5-10)

Materials: several cardboard tubes (from toilet tissue rolls, paper towel rolls, wrapping paper tubes), masking tape, scissors, small ball (ping-pong or Styrofoam ball).

Directions: 1) Cut several cardboard tubes in half (length-wise). 2) Tape the cardboard tubes to a door in your house or to the front of the refrigerator. Choose your own pattern or arrangement of tubes that will allow a small ball to follow a designated course from top to bottom (see the photo and watch the video). 3) Change the arrangements of the tubes so that the ball will go faster or slower down the course.

When engineers design a railroad track they must be aware of all kinds of geographical challenges. How to get a track up and over a mountain, how to design a track that can safely get from one side of a mountain to the other, and how to create a track that won't be too steep as it goes down a mountain side. When you design your "tubular track," you face the same kinds of engineering challenges. How did you solve those challenges? What did you have to think about?

A (Art):

(Ages: 5-10)

Materials: 3 clear plastic cups, water, 2 blue craft sticks, 2 yellow craft sticks, 2 red craft sticks

Directions: 1) Fill each of the cups about ¾ full with water. 2) In the first cup, place a red craft stick and a blue one. 3) In the second cup, place a red craft stick and a yellow one. 4) In the third cup, place a yellow craft stick and a blue one. 5) Check back on the cups every hour or so and you will note that the water in each cup is turning a different color.

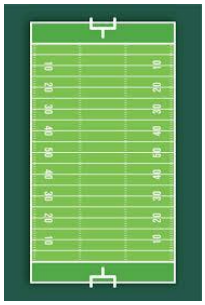
Look at a train and you will see many different colors: red, yellow, blue, purple, green, orange, etc. Some of those colors are primary colors (red, yellow, blue). Other colors are secondary colors (orange, green, purple). Secondary colors are a combination of two of the primary colors mixed together. In the activity above you saw that red + blue = purple; red + yellow = orange; and yellow + blue = green. Cool!

M (Math):

(Ages: 7-10)

Materials: football field, stopwatch (or cell phone)

Directions: 1) With a friend or parent, go to a local high school football field. 2) Locate the end zone lines at each end of the field (watch the video). Those lines are exactly one hundred yards apart. 3) Ask your friend or parent to time you as you run (as fast as you can) from one end zone line to the other. 4) Now it's time to do some math:



- Divide the distance (100 yards) by the time to get your speed in yards per second. Example: Let's say you ran the 100 yards in 25 seconds. 100 ÷ 25 = 4 (or four yards per second)
- Convert your speed to miles per hour (MPH) by first multiplying the number above by 3,600. Example: 4 x 3,600 = 14,400.
- Then, divide that answer by 1,750. Example: 14,400 ÷ 1,750 = 8.23
- That means you ran the 100 yards at a speed of 8.23 MPH

The Northern Central Railway trains travel at an average speed of 10 MPH. So, who is faster - you or a NCR train?

BE SURE TO CHECK OUT OUR YOUTUBE CHANNEL FOR TUTORIALS ON EACH ACTIVITY

These activities support the following National Science Education Standards (K-4):

- Science as inquiry
- Physical Science
- Science and technology
- Science in personal and social perspectives

This NCR activity sheet was developed by award-winning children's author Anthony D. Fredericks. Dr. Fredericks is Professor Emeritus of Education at York College of PA.