

Coopersville South Elementary STEM Fair - Science, Technology, Engineering, Math

Parents and Students,

Welcome to our 15th annual fair, which we now refer to as the STEM fair. STEM (Science, Technology, Engineering, Math) stresses some very specific things that will help our students learn and grow towards future success.

- The standards stress collaboration, sharing of ideas, and working across curriculum (STEM) to solve problems and answer questions.
- The standards recognize the different processes used to answer a science question vs. solving an engineering problem.
- The standards encourage students to use existing science, technology, engineering, and math resources to create physical models that address the problems that they are solving. This includes emulating the work of others, including professional researchers and engineers.

This packet includes instructions for your child's display board, a rubric, and some resources for sample project ideas. Students are encouraged to share ideas with each other on these projects. Collaboration helps everyone work towards a successful end goal.

Please feel free to email one of the team members if you have a question.

Mr. Wikstrom dwikstrom@capsk12.org

Mr. Koning jkoning@capsk12.org

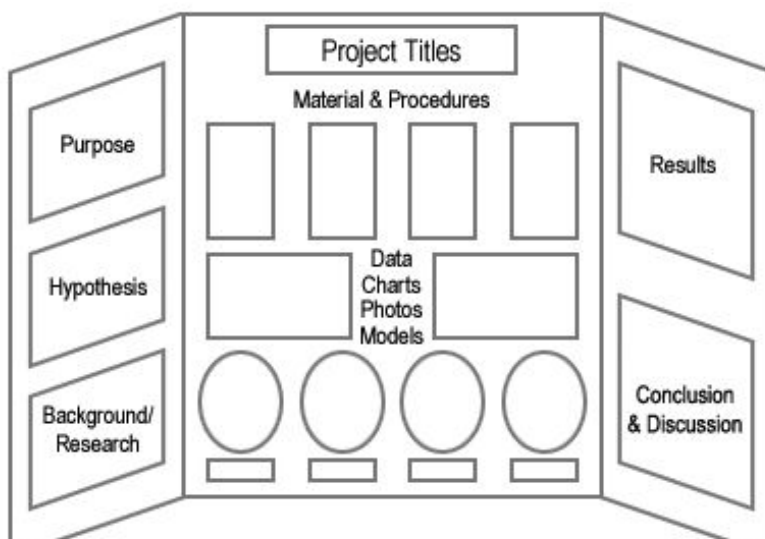
Mr. Hausig bhausig@capsk12.org

The science fair will be held on Thursday March 16th, 2017 from 6:00 to 7:00 P.M.

Sincerely,

The STEM Fair Team

Science and Engineering Questions Display Board



Board example for science question- Also known as the Scientific Method

Keep in mind that the display board is to show what you learned from your research and your experience as you ran your experiments. What you learned as you researched and what you experienced as you ran the trial or experiment are the most important parts of the board!

The following information should be on your board. You should include pictures, graphs, models and examples, or anything else that will help your audience understand what you're presenting.

Problem/Question

- Clearly state the problem you are investigating. Remember, a demonstration is *not* an investigation.
- Research your topic. Is it something you can investigate yourself?

Hypothesis

- Make an educated guess (prediction) as to what you think will happen based on research and your observations in life. You then go on to prove your guess with your experiment. In order to be a scientific hypothesis you must be able to test your prediction with the scientific method. It is OK for your prediction to be wrong!

Background Research

- This should be one of the biggest areas on your board. What did you learn from others as you researched their findings? You should have written information here but remember pictures and models are a wonderful way to share with others what you have found.

Materials

- List all of the materials you need to do the investigation.

Procedure

- Keep a notebook of everything you do in your experiment. Do not forget dates and times, measurements, and materials. Accuracy is very important. You must follow the same procedure for every trial, and someone else must be able to duplicate what you have done. Do not take shortcuts! (Many investigations will need to be done more than once to get results.)
- Neatly display your work on the science board. The attached sheet will be helpful. On the board, give step-by-step directions for your investigation. Make sure you number your steps; it will be easier to follow.

Results

- Collect data from your experiment.
- Record your results neatly on charts, graphs, or pictures. Do not forget to label your data. This will also be displayed on the science board.
- Do not be fooled by drawing conclusions based on one observation or test. Many tests should be made until you are certain of your results.

Conclusion

- The conclusion answers the question you asked in your problem.
- Be sure the conclusion relates to the purpose of the experiment. It is possible you will discover other new information. Stay focused

Your Rubric for your display and your project

The Investigation	Clearly Stated	Stated	Not Stated
Science <i>Question</i> is well defined.			
<i>Hypothesis</i> is based on the Question. (for science projects)			
Do you show your <i>research</i> results? Does the display			
Did you “ <i>collaborate</i> ” with friends, professionals, and others to find the best solutions and gain the knowledge you needed?			
<i>Results or Solution</i> clearly stated and supported with adequate data, pictures, models?.			
<i>Conclusion or Final Discussion</i> is based on the results and reflects project knowledge			
<i>Procedures</i> are clear. States steps followed, materials used, measurements made.			
The Display	Quality Work	Acceptable	Unacceptable
<i>Visual appeal</i> . Color is used to enhance the board.			
<i>Well organized</i> ; follows logical sequence.			
<i>Neatness and clarity</i> . Written materials are easy to understand.			
<i>Creativity and originality</i> in title and the use of materials.			
Does the <i>model</i> reflect the problem/question? Does it show knowledge gained and does it answer the question or solve the problem?			
Does the model reflect time and effort in it’s creation?			
Project turned in <u>on time</u> .			
Total Score			

Collaboration

col·lab·o·ra·tion

kəˌlæbəˈrɑːʃ(ə)n/

noun

1. the action of working with someone to produce or create something.

It is NOT cheating to talk to someone and get ideas that will help you with your project. It is called collaboration and it is how successful projects happen.

You are allowed and encouraged to :

- Work with other students to come up with ideas and solutions to your problems. It is up to your teacher whether you may work in a team on a project. Even if you are each turning in your own project you can still collaborate with others.
- We encourage you to speak to experts on the subject matter you are investigating, as long as you have permission for a parent or guardian. Your final project must only be done by you or you and your group. The display is to show what YOU learned.

Not sure about what project to chose? Want a cool place to get some some good ones? Try ScenceBuddies.org or choose from one of the following cool projects from several of the STEM catagories.

Project One- Engineering Category

Bridge This

For this you will be researching and modeling Beam bridges, Suspension bridges, and Arch bridges

There are many different ways to build a bridge. Each type is used for different needs. Engineers design them to hold amazing amount of weight and last for years. For this project you will learn about the science and engineering behind bridge building. You will be researching Beam bridges, Suspension bridges, and Arch bridges

Your Problem: Answer the following questions and find a way to show your answers using your display. Be sure to read all of the parts to the problem before you begin your solutions!

- What problems might require you to have to build a bridge? (why build a bridge)
- What specific situation might each of the 3 bridges be used in? Why would one be better than another?
- Which of the 3 bridges will support the most *mass*?
- Why might one be stronger than the other? Explain the science and engineering behind a successful bridge. Take a look at the keyword list for some help.
- What are some career paths you might follow if you wanted to build bridges? Design Bridges?
- Model: Choose one type and make a model of the structure. You may use any materials you wish.

You will need to display your answers and results using your display board to show pictures, written information, or anything else you think will help your audience understand what you have learned. Use your pictures, models, data and words to show that you have become an “expert” in your chosen project. Your model will be a part of the display as well. You can place it in front of the board on the table.

KeyWords For Searching: bridge design, stress points, load bearing, weight, mass, supports, strength, beam, cable

Ideas For Bridge Material: Straws, Noodles, Toothpicks, string, balsa wood, legos, clay. Remember, you can use one or combinations. These are just ideas, your idea may be better.

Project 2 - Engineering Category

World's Strongest Structure

For this project you will build a structure that will hold the most weight.

What shapes can hold the most weight? Squares? Triangles? Circles? Using only tooth picks, noodles, or straws build the strongest structure possible using one or a combination of shapes. Remember, engineers try and figure out how to build the strongest structures with the least amount of material so really think.

- What are some real world applications of the need to support a lot of weight? What kinds of structures do we live in, drive on, fly in, and find around us use special shapes to stay together.
- Research shapes used in real world structures. Can you name a few really interesting buildings, bridges, or other forms that use shapes in their structure?
- What are a few of the career paths you might be able to follow if you are interested in designing and or building strong structures?
- Build a model of a structure using one or a combination of shapes. It can be any form.
- How much will it hold?

Keywords for searching: architecture, pillar, arch, triangle, structural engineering,

Engineering Project 3

How Far or long will it fly?

For this project you will design a series of paper airplanes. This is harder than it sounds because you will need to describe the engineering principles behind why one flies further or longer than another.

- Research paper airplanes. Certain designs fly further, others stay in the air longer. Test 3 planes for distance and 3 for longest flight time. Log your results as a graph or spreadsheet.
- Research what makes planes fly. (See Keywords) What makes a plane stay in the air? Describe this on the research part of your board. Pictures and examples or models are great.
- What career paths could you choose to design, build, fly, or work on or around planes and jets?
- Be sure to include models of the planes you experimented with.

KeyWords: Aerodynamics, Drag, Lift, Thrust, Weight

Helpful Sites

http://www.sciencebuddies.org/science-fair-projects/project_ideas/Aero_p046.shtml

Engineering Project 4

Rube Goldberg Machine

Ever played the game mousetrap? Well, not only is it fun, but it is a perfect example of engineering gone wild. There are contests worldwide to see who can build the most amazing Rube Goldberg machine and some of them are mind boggling.

- Take a look online to see some of the amazing machines. Youtube is a great source for examples. Look up Rube Goldberg machines. Notice what task some of the machines accomplish in a very roundabout way.
- Come up with a task you would like to accomplish and design a Rube Goldberg machine to accomplish it. Open a door, turn on a light, you come up with something creative.
- Your machine must fit in a 3x3 area and contain at least 10 events.
- You must explain at least 3 of the events. Is it a pendulum, gear, momentum, simple machine, etc. Explain the science (physics) behind at least 3 of your events. This will be the topic of your display board.
- You may make your tracks and events out of whatever material you wish.

Helpful Sites: With your parents help, do a search on YouTube for Rube Goldberg Machine. They are amazing!

Physics

Pendulum Swings

Ever watch a grandfather clock? If you have, you probably noticed the pendulum swinging in perfect time, back and forth. What if you changed the length of the pendulum? Or perhaps the size of the weight at the bottom? Would it change the rate the pendulum swings?

- Build your own pendulum. You may use something as simple as a string and a washer, or come up with your own idea.
- Guess what will happen as you change the variables such as length and weight.
- Now try different lengths and weights. What changes the timing of the swing? By how much? Try using a stopwatch to get an exact timing of each swing. Try at least three different lengths and weights to get good data.
- Talk about the physics involved with the swing. Can you explain what forces are at work here? Do some research and find out!

Keywords: Pendulum, swing, constant, distance, oscillator, force.

See <http://www.education.com/science-fair/article/what-makes-pendulum-swing-fast-slow/> for an example of this experiment.

Magnets and Temperature -

Does the temp of a magnet affect its strength?

Magnets are found in everything from computers to cars. Even your headphones use magnets. Did you know that temperature affects the way a magnet works? Cold or hot, a magnet will act differently. In this problem, you will change the temperature of magnets and observe the results.

- Materials include 3 or four identical bar magnets, tongs. Ice, hot water, bowl, compass, ruler, and tape.
- Before you start, what is your hypothesis?
- Put your compass on the table and turn it so it points to 0, then tape it to the table.
- Tape the ruler to the table so that its direction is perpendicular to that of the needle. The '0' on the ruler should touch the '0' on the compass.
- Put one magnet in very hot water (use tongs and parents help!). Put the other in a bowl of ice. Leave the last one at room temperature.
- Take a magnet (using tongs for the heated and cooled magnets) and slide it along the ruler towards the compass. You want the needle to move towards the magnet, so if it is moving away, flip it over.
- Take note of the distance between the magnet and the compass when the needle of the compass begins to move. Compare the distances you recorded for all of your magnets. *What do you notice? How do you think you can explain your results? How different was it from your hypothesis?*

Keywords: Force, pull, attract, repel, pole, magnetized

Biological Sciences

Systems -- Human Body - Separating with a Centrifuge

Blood contains several different types of cells. Each one has a function. Doctors and scientists use a centrifuge to separate the different parts so they can measure and study them.

Create your own centrifuge and experiment with different substances in liquid to see how they separate when you spin them.

- Take a look at Science Buddies Glitter Go Round
http://www.sciencebuddies.org/science-fair-projects/project_ideas/BioChem_p041.shtml#procedure
- Science Buddies use a salad spinner, test tubes, and glitter to represent the process a Bio Chemist would go through to spin down blood.
- What did you spin down? Why does this happen? Talk about your hypotheses and conclusions on your board.

Take a look at ScienceBuddies.com - Project Ideas - Life Science - Biotechnology - Glitter Go Round. There are a number of other projects that include separating substances using a centrifuge. Check them out!

Food Chains

In the circle of life, each animal, insect, and ameba has its place. Change a link in the chain, and the entire system can change or even come tumbling down.

- Choose a food web. Examples you could choose: desert, ocean, coral reef, woodland, etc.
- Research the system.
- Build or draw a model of the system. What animals and plants will we find there. Show an example of the food chain. How do the plants and animals interact? How do they depend on each other?
- Now talk about what would happen if a piece was removed or changed in some way. One example would be a temperature change in a coral reef. Another is the loss of an animal (link) in the food chain.

Key Words: Food Web, Food pyramid, ecology, primary, secondary, predator, prey, species, energy, biomass, community

Make Biogas

Ever heard of anaerobic decomposition? It's when something rots without oxygen. The cool part is the gas that the bacteria release. It actually is a source of energy. For this project, you will create an environment for the bacteria that make biogas. You will also capture the gas and see how much is created in each situation.

- Research biogas. What are the gasses that are found in biogas? Does temperature make a difference? Biomass? What use do some of the gasses have?

Procedure

1. First, create some fruit and vegetable purees. That is when you blend them or smash them up. Good examples are $\frac{1}{2}$ and onion, blueberries, lettuce. Try and make the same amount of each and keep them separate.
2. Mark the different bottles with a permanent marker. Label one **Control**, one **Bleach**, Now mark three other bottles. One for each of the vegetables you pureed. Place one batch with $\frac{1}{2}$ a teaspoon of bleach into one container and fill it to the top with water.

Place a Mylar balloon at the top and seal the balloon to the end of the pop bottle using duct tape.

3. Fill each of the other containers to the top with water and label them. Add a Mylar balloon to each. Leave the control container empty and tape a balloon to the top.
4. Watch the balloons and photograph them if possible. Watch what happens to the balloons over the next week, and use this time to make a hypothesis. *What happens to the items in the bottles? Why?*

Keywords: *Organic Matter, ferment, biomass, anaerobic decomposition, bacteria*

Here are some other potential project ideas. These are grouped by difficulty with group A being the least difficult projects.

Project Ideas - Level A

- How much salt does it take to float an egg?
- What kind of juice cleans pennies best?
- Which dish soap makes the most bubbles?
- Do watches keep time the same?
- On which surface can a snail move faster – dirt or cement?
- What brand of raisin cereal has the most raisins?
- How can you measure the strength of a magnet?
- Do ants like cheese or sugar better?
- Can the design of a paper airplane make it fly farther?
- Do roots of a plant always grow downward?
- Can you tell what something is just by touching it?
- What kinds of things do magnets attract?
- What foods do mealworms prefer?
- How long will it take a drop of food dye to color a glass of still water?
- Does a bath take less water than a shower?
- Can you tell where sound comes from when you are blindfolded?
- Can plants grow without soil?
- Does warm water freeze faster than cool water?
- In my class who is taller...boys or girls?
- Do different types of apples have the same number of seeds?
- Do bigger seeds produce bigger plants?
- Which materials absorb the most water?
- Do wheels reduce friction?
- What materials dissolve in water?
- What is the soil in my schoolyard made of?
- Does holding a mirror in front of a fish change what fish does?
- What color of birdseed do birds like best?
- What holds two boards together better – a nail or screw?
- Will bananas brown faster on the counter or in the refrigerator?
- Does temperature affect the growth of plants?
- Do mint leaves repel ants?

- Does a ball roll farther on grass or dirt?
- Do all objects fall to the ground at the same speed?
- Does anyone in my class have the same fingerprints?
- Which travels faster – a snail or a worm?
- Which paper towel is the strongest?
- Can plants grow from leaves?
- Which dissolves better in water – salt or baking soda?
- Can things be identified by just their smell?
- With which type of battery do toys run longest?

Project Ideas - Level B

- How far does a snail travel in one minute?
- Do different types of soil hold different amounts of water?
- Will adding bleach to the water of a plant reduce fungus growth?
- Does water with salt boil faster than plain water?
- How far can a person lean without falling?
- Can you tell time without a watch or clock?
- How far can a water balloon be tossed to someone before it breaks?
- Does the shape of kite affect its flight?
- Does an ice cube melt faster in air or water?
- Does sugar prolong the life of cut flowers?
- How much of an orange is water?
- Which liquid has the highest viscosity?
- Will more air inside a basketball make it bounce higher?
- Does the color light affect the plant growth?
- Does baking soda lower the temperature of water?
- Which brand of popcorn pops the most kernels?
- Which brand of popcorn pops the fastest?
- How much can a caterpillar eat in one day?
- In my class, who has the biggest feet -- boys or girls?
- Do plants grow bigger in soil or water?
- Does the color of water affect its evaporation?
- Can you separate salt from water by freezing?
- How does omitting an ingredient affect the taste of a cookie?
- Do suction cups stick equally well to different surfaces?
- Which student in class has the greatest lung capacity?
- How much weight can a growing plant lift?
- Will water with salt evaporate faster than water without salt?
- Does it matter in which direction seeds are planted?
- Which cheese grows mold the fastest?
- Do all colors fade at the same rate?
- Which brand of diaper holds the most water?
- In my class, who has the smallest hands – boys or girls?
- Which kinds of cleaner removes ink stains best?
- Does a plant grow bigger if watered by milk of water?
- Which brand of soap makes the most suds?
- Does a baseball go farther when hit by a wood or metal bat?
- Do living plants give off moisture?

- Using a lever, can one student lift another student who is bigger?
- What gets warmer – sand or dirt?
- Which kind of glue holds a board together better?

Project Ideas - Level C

- What type of line carries sound waves best?
- Can the sun's energy be used to clean water?
- Does a green plant add oxygen to its environment?
- Which metal conducts heat best?
- What percentage of corn seeds in a package will germinate?
- Does an earthworm react to light and darkness?
- Does the human tongue have definite areas for certain tastes?
- Can same-type balloons withstand the same amount of pressure?
- Does the viscosity of a liquid affect its boiling point?
- Does surrounding color affect an insect's eating habits?
- Do children's heart rates increase as they get older?
- Can you use a strand of human hair to measure air moisture?
- What materials provide the best insulation?
- Is using two eyes to judge distance more accurate than using one eye?
- Do different kinds of caterpillars eat different amounts of food?
- What plant foods contain starch?
- What keeps things colder – plastic wrap or aluminum foil?
- Does heart rate increase with increasing sound volume?
- Do boys or girls have a higher resting heart rate?
- Do liquids cool as they evaporate?
- Which way does the wind blow most frequently?
- Does the size of a light bulb affect its energy use?
- For how long a distance can speech be transmitted through a tube?
- Which grows molds faster – moist bread or dry bread?
- What type of soil filters water best?
- Does the color of a material affect its absorption of heat?
- Does sound travel best through solids, liquids, or gasses?
- Do sugar crystals grow faster in tap water or distilled water?
- Can you see better if you limit the light that gets to your eye?
- How much of an apple is water?
- What common liquids are acid, base, or neutral?
- Do taller people run faster than shorter people?
- Does the length of a vibrating object affect sound?
- Does a plant need some darkness to grow?
- Who can balance better on the balls of their feet – boys or girls?
- Does exercise affect heart rate?
- Which dish soap makes the longest lasting suds?
- What are the effects of chlorine on plant growth?
- Which type of oil has the greatest density?
- How accurately do people judge temperatures?

SCIENCE FAIR

General Ideas

- Do organic or inorganic fertilizers produce the best results?
- What are the effects of salt on seed germination?
- Do bigger seeds produce bigger plants?
- What is the effect of microwaving on plant seeds?
- What is the effect of age on reaction time?
- What is the effect of age on short-term memory?
- What type of mitten provides the best insulation?
- Is my dominant hand stronger?
- Who can reproduce a picture from blocks faster -- males or females?
- Who can put together a 12-piece puzzle the fastest, right or left-handed individuals?
- What is the effect of television viewing on pulse rate?
- Will caffeine improve reflexes?
- Which pan will heat the fastest? Which will stay hot the longest?
- Do frozen liquids melt in the same amount of time?
- What material makes the best insulator?
- Which bridge design is the strongest?
- Is there a difference in the life of different brands of batteries?
- Which facial tissue is the strongest?
- Is there a difference in brand name and generic foods?
- How many raisins are in a box of cereal?
- How often will my favorite flavor or color appear in a box or bag of assorted candy?
- What is the best soil type for seed germination?
- What is the effect of colored light on plant growth?
- What is the effect of acid rain on plant growth?
- What type of sugar do ants prefer?
- Do ants prefer sugar or fat for their diet?
- Do crickets prefer houses with two doors or one door?
- Do earthworms prefer damp or dry conditions?
- Do plants grow differently in salt water?
- Is it best to fertilize plants with each watering, or on a schedule?
- Does the pH of soil effect plant growth?
- Does seed size determine plant size?
- What environment encourages most growth on bread?
- What percentage of food is water?
- Do plants grow under colored cellophane?
- What is the effect of acid rain on seed germination?
- Which liquids reduce friction?
- What happens to a pendulum as the mass increases?
- What happens when the length of the pendulum increases?
- Are brown eggshells stronger than white shells?
- What determines if an object sinks or floats?
- How strong are paper towels?
- What conditions increase static electricity?
- Does the density of a liquid effect its freezing point?
- What colors are easiest to see in the daylight? Night?

- Do people remember best when they see something or hear something?
- Does music interfere with concentration?
- How much of a piece of food is edible?
- Is praise or food a better reinforcement for my pet?
- Does the mass of an object effect the time it takes to fall a measured distance?
- How much stronger is a wood dowel if you double the diameter?
- Does the amount of fat in ice cream effect its melting rate?
- How does the amount of fat in foods you select compare to each other?
- What happens when the position of the fulcrum on a first-class level is changed?

Primary Level Ideas

- Do we need both ears to locate where a sound is coming from?
- How does the shape of ears make a difference in how we hear?
- What senses do we use to find out what is inside a sealed box?
- How long can you smell potpourri?
- Where on our tongues do we taste sweet, sour, and salty flavors?
- What senses do you use when you pick up an object?
- How does a seed grow?
- Do all large fruits and vegetables have large seeds?
- Can plants be grown from cuttings?
- Which soils are good for growing plants?
- Can plants grow with out water?
- Do plants need sunlight to grow?
- Do plants need space to develop?
- How do plants react to temperature extremes?
- What is the function of a plant stem?
- Which color of eyes is found more than any other in the classroom?
- How tall are my classmates? Compare boys and girls
- How can you change the pitch in a glass of water?
- How many kinds of animals are in a box of animal cookies?
- Does fruit float?
- What objects float? Sink?
- How many times does your heart beat when you are at rest? During exercise?
- Does water evaporate at the same rate from different containers?
- Does sound travel through a liquid?
- Will a sugar cube dissolve faster in cold water or hot water?
- Can you grow seeds on a sponge?
- What is the shape of a snowflake? What materials do magnets attract?
- How many ways can I make a complete circuit?
- What is the effect of acid rain on plants?
- Are knit or not knit gloves warmer?
- What kind of tools makes the best bubble machines?
- Do heavier objects fall faster than lighter objects?
- Does the mass of water increase when frozen?
- Which popsicles lasts the longest at room temperature?
- Does the height of the ramp change the distance my toy car travels?
- How can we use our own breath (air) to move a feather in a relay?
- Do mealworms usually move to a corner, to an edge, climb the walls, or stay in the middle of a box?

- How many mealworms seek shelter under a colored lid compared to a clear lid?
- Do mealworms prefer a white or black surface?
- How many cups of snow does it take to make Snowflake Soup?
- How many different ways can Valentine (Christmas) cards be sorted?
- How do you know if something is a solid or a liquid?
- What can we learn about pennies?
- How much water is in snow?
- How does the size and material from which a drum is made change the sound it makes?