TESTABLE QUESTIONS

An EXPERIMENTAL project must begin with a testable question.
A testable question is one that can be answered by designing and conducting an experiment.

- Does changing _____ affect _____?
- How does changing _____ affect _____?
- If I change _____, will it affect _____?

Physical Science Category Testable Question Examples
How does changing temperature of a tennis ball affect the height of its bounce?
How does changing the air pressure of a soccer ball affect how far it travels?
How does changing the type of material affect how long a shirt takes to dry?
How does the size of a rubber band affect how far it can stretch?
How does changing a light bulb's wattage affect the amount of heat detected above a light?
How does changing the amount of sugar in homemade ice cream affect how fast it freezes?
How does changing pot size affect the amount of time it takes to boil water?
How does changing the weight of a paper airplane affect its ability to fly?
How does the amount of air in a balloon rocket affect how far it flies?
Does the weight of a baseball bat affect how far the ball goes?
How does increasing the height of a ramp affect how far a ball will roll?
How does material (sand or salt) affect how long it takes to melt ice?
Does the type of magnet affect the strength of the magnetic field?
How does temperature of water affect the time it takes to dissolve substances?
How does the material of a parachute affect how long it takes for the parachute to fall?
How does changing the amount of vinegar affect how long a baking soda reaction bubbles?
Does temperature affect the strength of a magnet?
How does the size of fins on a straw rocket affect how far it flies?
How does the size of a vibrating surface affect pitch?
How does the shape of a parachute affect its rate of fall?
Does material rubbed on a balloon affect how long a balloon sticks to wall?
How does the volume of water in a cup affect how long it takes to freeze?
How does changing the cereal brand affect how much iron is in the cereal?

Earth/Space Science Category Testable Question Examples
How does type of ground layer (sand, gravel, or soil) affect how much land erodes?
How does changing the speed of a river's current affect the size of the grains on the riverbed?
How does the time of year affect the number of hours of daylight in a 24-hour period?
Which best helps prevent soil erosion on a slope: plants, rocks, or mulch?
Does time of day affect the frequency of thunderstorms?
How does time of night affect which constellations I can see?
How does light pollution affect the number of stars visible?
How does temperature affect how fast a puddle evaporates?
How does the shape of a crater model (using flour and marbles) affect the width of the impact zone?
How does weight of a comet affect how fast it melts?
How does the depth of water affect the temperature of the water on a sunny day?
Does type of soil (sand, clay, or loam) affect how much water is absorbed by the soil?
How does water source (well water or city water) affect the pH level of the water?
Does type of bathing (shower or bath) affect the amount of water used?
How does the shape of a container affect how quickly water evaporates indoors?
How does type of rock (igneous, sedimentary, or metamorphic) affect the hardness of a rock?
Does type of paper (recycled or nonrecycled) affect the speed that the paper decomposes?
How does type of water (fresh or salt) affect the time it takes to boil?
How does changing the liquids of different pH levels affect limestone?
How does water type affect the pH level of the water?
Does changing the direction that a solar oven faces affect the temperature of the oven?
Does the time of day affect the level of UV rays?
How does the color of paper affect how hot it gets in sunlight from a window?
How does the type of roof material (foil, cardboard, plastic wrap) affect indoor temperature in a homemade box house?
How does the amount of water in soil affect the temperature of the soil when left in the sun?

Life Science Category Testable Question Examples
Does the type of paper towel (brand/type) used in sprouting affect how quickly seeds germinate?
If I change the type of seed (bean, sunflower, radish), does it affect how quickly it sprouts?
How does the color of light affect the height of a plant?
How does the time of day affect your body's temperature?
How does the amount of water affect how fast a plant grows from a seed?
How does time of day affect the types of birds that the feeder attracts?
How does changing the type of flower affect the number of butterflies attracted to the flower?
How does humidity affect how often a plant needs to be watered?
Does changing the amount of sunlight affect how tall a plant grows?
Does changing the direction a sweet potato is propagated at affect how many sprouts grow?
How does the size of a seed affect how far it is dispersed by the wind?
Does type of light bulb affect the number of insects drawn to the light?
How does the amount of sugar in a food affect the number of sugar ants attracted?
How does seed depth affect germination time?
How does temperature affect the time it takes for water to move to the leaves of celery?
How does surface affect the travel speed of a mealworm?
How does temperature affect the development of a caterpillar?
Does water temperature affect how long cut flowers live?
How does changing temperature affect the rate of cricket chirping?
How does type of light (bright, colored, or dark) affect the movement of earthworms?
Does the amount of sugar in water affect how long a cut flower stays fresh?
How does changing the amount of heat a radish seed gets affect its ability to germinate?
Does the type of leaf (broad, narrow, thick) affect how fast water evaporates from its surface?
How does the amount of light exposure affect how quickly food coloring moves through a celery stalk?

Mathematics/Technology Category Testable Question Examples
How does changing the magnification of binoculars affect how far you can see?
How does the font type in a document affect how many words fit on a page?
How does changing size of a lemon affect the quantity of seeds inside each lemon?
How does size of a juice box affect the volume it can hold?
How does changing the shape of Play-Doh affect its volume?
How does the number of Aces in a deck of cards affect the probability of picking an Ace from the deck?
What is the probability of a coin landing heads or tails?
Does number of steps in an algorithm affect how quickly a Rubik's cube can be solved?
How does temperature affect the battery life of a cell phone?
Does type of clock (analog or digital) affect the accuracy of the clock?
How does location affect cell phone reception?
Does amount of time an Xbox is on affect the temperature of the Xbox?
Does time of day affect the speed a solar car can travel?
How does height of building affect its ability to withstand an earthquake?
How does the size of a numbered cube affect the probability of landing on a six?
How does the color of a QR code (black, blue, red) affect how quickly a device scans it?
How does temperature affect WIFI speed?
How does type of computer affect how quickly it can do math problems?
How does the brightness setting on a tablet screen affect battery life over a fixed time period?
Does the number of blocks used in a drag-and-drop coding task affect how long it takes to complete the program?
How does increasing the size of a 3-D object affect the characteristics of the 3-D object?
How does the size of an object affect the accuracy of measuring that object?
How does changing candy package size affect the amount of each color candy inside the packages?
Does the angle of a solar panel affect the amount of energy it produces when powering a small fan?
How does the placement of reflective tape on a LEGO robot affect how well it follows a line?
Does the amount of background noise affect the accuracy of a voice-to-text feature on a tablet?
Does the number of segments in an orange follow a predictable pattern across different orange sizes?
How does the pattern of a pinecone's scales affect the number of scales per row?
Does the number of colored beads in a bag affect the probability of randomly picking a red one?
Does the number of stripes on a zebra-patterned spinner affect the chance of landing on black vs. white?

ENGINEERING NEEDS STATEMENTS

ENGINEERING STEM Fair projects must begin with a needs statement based on a problem that needs to be solved. Needs statements can follow the format:

__who?__ **need(s)** __what?___ **because** _why?_.

Engineering Category Sample Needs Statements
Students need an easier way to lock their lockers at school, because combination locks are hard to unlock and often get jammed.
Dogs need a way to go to the bathroom inside homes, because dogs don't like to go outside in bad weather, and there are times when people can't take their dogs outdoors.
Teachers need a better way to erase whiteboards, because erasers are messy and don't remove all the marker.
Parents need a way to store lunchboxes in the refrigerator, because they often make their children's lunches the night before school.
Students need a better way to carry backpacks because they are too heavy.
My brother needs a way to turn on light switches because he is too short to reach them.
My parents need an umbrella that will stay in the sand at the beach because it is dangerous when ours blows away.
My school needs a way to control the echo in our cafeteria because it is so bad that it is hard to hear others even when they talk loudly.
My grandmother needs a way to water her plants when she is away because the automatic waterers that she can buy are too expensive.

Once you have engineered a prototype to solve your needs statement, you must design a test to measure how well your prototype fixed the problem. This experiment should start with a **testable question**, so you have evidence to support if your design was effective or not.

For example, for the needs statement: My school needs a way to control the echo in our cafeteria because it is so bad that it is hard to hear others even when they talk loudly. You might solve the problem by designing plastic barriers for small groups at a lunch table. You would then test if the barriers worked with this testable question: Does the addition of a plastic barrier affect the decibel level at my lunch table? Next, conduct an experiment with and without the barrier to compare the decibel levels to see if the design was able to lower the noise at the cafeteria table. Redesign and draw conclusions as needed once data is collected.
