Dear 7th grader: This year you will be asked to participate in the Science Fair. In order to better prepare, the following work is a refresher on the Scientific Method and important terms involved in the experimental design. Please print out all material, read through each part and complete all necessary written work. This material should be handed in on the first day of school.

Name:_____ Grade:_____

Purpose: To assess thinking and problem solving skills in Science

- All work should be handwritten, no computer generated work.
- All responses should be written neatly.
- Grammar rules should be followed.
- Work should be reflective of beginning 7th grade level work.
- Be sure to include your full name on each sheet of paper you turn in.

Part I: Read the text below. Then match each statement that scientists use in order to learn more about something. By following the scientific method, scientists can gather information, perform experiments, and discover new things about our world. The scientific method follows the general pattern:

1. Identify a problem or question
2. Research information about the problem or question
3. Generate a hypothesis about a problem or question(hypothesis should be testable)
4. Design and perform an experiment
5. Gather and analyze observations from the experiment
6. Draw conclusions that are supported by your experiment

____ Elissa hypothesized that crickets make more noise on hot nights than on cool nights.
____ Elissa concludes that crickets chirp more often on hot nights than on cool nights.
____Elissa wonders what causes crickets to make more noise on some nights than others.
____ Elissa counts the number of chirps made by 2 groups of crickets. One group of crickets is in a cool cage and one group in a warm cage. There are 5 crickets in each cage and she counts for 30 minutes.
____Elissa makes a chart of the number of chirps made by the two groups of crickets and compares the findings.
____Elissa goes to the library to read information in an encyclopedia about the habits of crickets.

Part 2:

1. This year you will be asked to participate in the school science fair. To prepare for this I am asking you to choose 3 final topics that interest you. Be sure they interest you! Do not pick something because you think it will be easy. Talk it over with your parents when you have chosen your topics.

2. Important: this is not simply a research project. Your topics must present a problem or question that you wish to solve. This question will then be used to design an experiment that you will run and record data. From the 2 topics you choose, the hope is that one will be approved for you to begin working on once school starts.

   To help you, I have listed a few sites below for you to browse through as they may give you ideas to investigate.
   https://www.sciencefaircentral.com/

   https://blog.discoveryeducation.com/blog/2018/04/06/science-fair-central-2/

   https://www.familyhandyman.com/diy-advice/home-depot-helps-kids-with-science-fair-projects/

   https://www.sciencebuddies.org/

   Below is the website for the Connecticut Science and Engineering Fair and past projects include a written abstract, which is an abbreviated version of the final science project/report. If you read through some of them you may get some ideas. You will note that many of them are very intense investigations and often require a mentor such as an expert in the field you are investigating. This is not necessary but it is important to note that this can often occur.

   https://ctsciencefair.org/media/2019Abstracts-1

What is the Experimental Design?

Experimental Design- describes the manner in which you test your hypothesis through experimentation. Having correct experimental design is CRUCIAL to accurately testing your hypothesis. The stronger your experimental design is, the more reliable your results will be, and the more confident you can be when you draw conclusions from your data.

Variables:

Scientists try to figure out how the natural world works. In doing so, they use experiments to search for cause and effect relationships. Cause and effect relationships explain why things happen and allow you to reliably predict what will happen if you do something. In other words, scientists design an experiment so that they can observe or measure if changes to one thing cause something else to vary in a repeatable way. The things that are changing in an experiment are called **variables.**

A variable is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: **independent, dependent, and controlled.**
The **independent variable** is the one that is changed by the scientist. Why just one? Well, if you changed more than one variable it would be hard to figure out which change is causing what you observe. For example, what if our scientific question was: "How does the size of a dog affect how much food it eats?"; then, during your feeding experiments you changed both the size of the dog and the time of day the dogs were fed. The data might get a bit confusing— did the larger dog eat less food than the smaller dog because of his size or because it was the middle of the day and dogs prefer to eat more in the morning? Sometimes it is impossible to just change one variable, and in those cases, scientists rely on more complicated mathematical analysis and additional experiments to try to figure out what is going on. To be clear though, for a science fair, it is usually wise to have only one independent variable at a time. If you are new to doing science projects and want to know the effect of changing multiple variables, do multiple tests where you focus on one independent variable at a time.
The **dependent variables** are the things that the scientist focuses his or her observations on to see how they respond to the change made to the independent variable. In our dog example, the dependent variable is how much the dogs eat. This is what we are observing and measuring. It is called the "dependent" variable because we are trying to figure out whether its value depends on the value of the independent variable. If there is a direct link between the two types of variables (independent and dependent) then you may be uncovering a cause and effect relationship. The number of dependent variables in an experiment varies, but there can be more than one. Experiments also have controlled variables.
Controlled variables are quantities that a scientist wants to remain constant, and she or he must observe them as carefully as the dependent variables. For example, in the dog experiment example, you would need to control how hungry the dogs are at the start of the experiment, the type of food you are feeding them, and whether the food was a type that they liked. Why? If you did not, then other explanations could be given for differences you observe in how much they eat. For instance, maybe the little dog eats more because it is hungrier that day, maybe the big dog does not like the dog food offered, or maybe all dogs will eat more wet dog food than dry dog food. So, you should keep all the other variables the same (you control them) so that you can see only the effect of the one variable (the independent variable) that you are trying to test. Similar to our example, most experiments have more than one controlled variable. Some people refer to controlled variables as "constant variables." In the best experiments, the scientist must be able to measure the values for each variable. Weight or mass is an example of a variable that is very easy to measure. However, imagine trying to do an experiment where one of the variables is love. There is no such thing as a "love-meter." You might have a belief that someone is in love, but you cannot really be sure, and you would probably have friends that do not agree with you. So, love is not measurable in a scientific sense; therefore, it would be a poor variable to use in an experiment.
Watch this video to practice identifying variables:

https://www.youtube.com/watch?v=l0jTMDtX4WY

Written work:
Selecting a Topic Worksheet Brainstorm List 5 subjects about which you would like to know more. For example, squirrels, stars, or pollution.

1. _____
2. _____
3. _____
4. _____
5. _____

- Research: Select two of your subjects and do some preliminary investigation. (**Attach research work).**

- List 2–3 areas of your subject about which you would like to know more. For example, the eating habits of squirrels, the emitted light of stars, or the impact of pollution on breathing.
- Note the web sites or books where you found this information; you may be able to use them in your later research. (**Attach this to your work**)

- Topic 1: _____

  Sub-topic 1: _____

  Topic 2: _____

  Sub-topic 2 :_____

  Topic 3: _____

  Subtopic 3:_____

Select: List your preferred topic. It is not necessary to determine your area of interest (sub-topic) at this time. Your Topic:

_____

Note: Each of you will conference with me regarding your choice. Approvals of topics will be made by me and further instructions will be given. The more background research you do on your topic, the better informed you will be to present your topic and why you wish to investigate it.

Determine a Problem Worksheet

Use this worksheet to develop a research/guiding question. The question must be both measurable and testable. Think about your specific sub-topic and your topic statement. Brainstorm 3 problems that you can research, test, and measure. Take notes from your previous research or do more research. Brainstorm how you will test and measure each problem.

Problem 1:

_____

_____

Notes:

Testable: ▢ Yes ▢ No

How?

Measurable? ▢ Yes ▢ No

How?

Problem 2:

_____

_____

Notes:

Testable: ▢ Yes ▢ No

How?

Measurable? ▢ Yes ▢ No
How?

Problem 3:

_____

_____

Notes:

Testable: ▢ Yes ▢ No

How?

Measurable? ▢ Yes ▢ No
How?