Lucy V. Barnsley PTA

Science Fair

Information Packet

Saturday, May 5, 2018

3-6 PM

Barnsley Gymnasium

PACKET CONTENTS

KEY DETAILS YOU NEED TO PARTICIPATE

- Students are asked to pick a topic and either do a **Science Experiment** or a **Science Inquiry Display**. You may also choose to show your knowledge in a non-traditional way by making a game or doing a character reenactment of a famous scientist. Feel free to be creative! Look at the guidelines below for descriptions and suggestions for each type of project.
- Students in all grades are eligible to participate. For most students, completing a project is optional. Your teacher will tell you if this is a required project.
- Projects can be worked on either individually or in groups of 2 or 3 students. Projects should be worked on at home, unless your teacher specifies otherwise.
- Projects must be written up and displayed on a tri-fold board. The display must stand by itself. Equipment and materials can be displayed in front of your board.
- Due to space limitations, please do not have a display bigger than the standard tri-fold display board of 28-30 inches long x 40 inches high. Make sure your name is on your display board.
- If you would like to receive a free tri-fold board from the PTA, please tell your teacher or email science fair chair. Boards will be available after winter break via the main office. They are standard size of 28x40 in White.
- Science Night is a non-judged event. The evening is all about sharing and enjoying science. You do NOT need to sign up to attend the event as a spectator - all Barnsley students, all grades and their families are welcome! There are hands-on activities for all those who attend.

Questions? Contact PTA Science Night Coordinator and Barnsley Parent
Kathleen Herrold, kathleen.herrold@gmail.com

Students are strongly encouraged to register individual and group projects through this Google forms link: https://goo.gl/forms/L7J6SS5H1OcPj1Xo2 Or **https://tinyurl.com/y829wprg**

The registration link will also be found at http://www.barnsleypta.org

Please register your projects NO LATER than Monday, April 23, 2018!

PLEASE DO NOT BRING COMPLETED PROJECTS TO SCHOOL UNTIL THE DAY OF SCIENCE FAIR ON MAY 5th!

<u>I. Science Experiment Guidelines:</u>

A. What goes into making a Science Experiment:

A science experiment is begins with a "Why" or a "What" question. That's when you observe or think of something you'd like to understand better. For example, you might think to yourself: *Why does the plant in the window grows faster than the one in the hall?; What happens to the bounce of a rubber ball when it is really cold outside?; Which laundry detergent cleans best? Does aspirin really prolong the life of a cut flower?* Once you've come up with a question you are interested in pursuing you need to figure out a way to test your hypothesis. After designing your experiment you need to collect your data, draw your conclusions, and finally display all of this in a meaningful way to your audience. Then on the night of the Science Fair, be prepared to explain to people what you did and what it means.

B. The main parts that you should consider and that will form the basis for your display board are the following:

1. Testable Question

Your question must be <u>testable</u>. This means that you should be able to devise an experiment that will prove or disprove some aspect of the question.

In the example below (see page 4), the testable question is "I wonder if a plant in the window will grow more than a plant in the hallway?" This can be tested by growing plants in both conditions to see is there is a difference.

2. Hypothesis

Make a simple, clear statement about how you think the system works. This educated guess is called the <u>hypothesis</u> and it should be the testable part of your theory.

In the example, the hypothesis is "If I plant a seed and keep it in a sunny spot, then it will grow more than a plant kept in a darker location." This presents a single prediction that can be experimentally confirmed or disproven.

He bases this on his <u>library/web research</u> where he learned about plants moving toward their light source and their need to synthesize food using a process known as photosynthesis. He reasons that the more light plants are exposed to, the faster they will grow.

3. Rational and Background

In order to formulate and refine your hypothesis, it is important to find out what others know about your question. This involves going to the library or online and finding out what is already known about your topic. This background information will help you improve your hypothesis and will help you design your experiment. In the example, two things were mentioned that suggests light is important to plant growth rate.

4. Experimental Design

Test your hypothesis by designing and performing an experiment. Usually, there is <u>one</u> thing you change (test variable), there are things that stay the same (constants), and then one thing you can observe as a result of your changes (data).

In the example in order to test his hypothesis, Sy N. Tist, our 4th grade student <u>designs an experiment</u> where he keeps all the conditions that the plant is exposed to the same (these are constants) so that only the amount of light that each plant is exposed to differs (the test variable). This means that the plants must be grown under the same exact conditions (water, soil, etc.) After a specified amount of time (another constant), measure the change in height of the plant (these measurements are the "data" that are the results of your experiment). In addition he repeats the experiment multiple times by creating replicates. This enables him to have more certainty in his results.

Advanced concepts:
Controls: Controls aren't used in the example above, but for many kinds of experiments, you need to do a positive control and a negative control. A positive control is meant to demonstrate that everything in your test procedure works. For example, if you are testing for presence of bacteria on people's fingers by having them touch an agar plate to see what grows, you should make one plate and infect it with bacteria intentionally, to show that it will grow on that plate. If nothing grows there, it means something was wrong with your conditions. A negative control is meant to demonstrate what happens when nothing is supposed to happen. In the bacterial example, you would keep one plate untouched. If something grows there anyway, it means you have contamination and the bacteria observed on other plates may not be from fingers at all. Positive and negative controls are a way to ensure that your experiment is testing what you think it is.

Replicates: When you're testing a variable on a subject, it is often a good idea to have more than one trial. This controls for variation in test subjects and gives insurance against accidents. In the example, if you were using only 1 plant in bright light and 1 plant in dim light, by bad luck, your bright-light plant might happened to be sickly. In that case, it might not grow well even with the better light. Using 3 plants in bright light and 3 in dim light, if 2 of the 3 in bright light grew well but one failed, you might conclude that the light improved growth in two trials, and the other plant may have failed for some other reason. It is also important to repeat your experiments under the same conditions.

5. Materials and Methods

In order for your experiment to be meaningful, it must be clearly described in enough detail that someone else can repeat it.

Carefully describe every item that was used in your experiment. For the plant example, this includes the types of plants, the size of the pots, the type of soil used, the types of light, etc.

Explain every procedure you used to conduct the test. This would include the frequency of watering and, especially, how you controlled the amount of light each test subject received.

6. Results and Conclusions:

Display your raw data neatly, with graphs, charts or tables, as appropriate for your data. In the example, the weekly measurements for each plant were plotted on a line graph. Explain any calculations you made on the data. If you calculate a difference between measurements, or an average, for example, show exactly how the calculation was done.

This information also supports his conclusions or what he learned from his experiment. His results may or may not agree with his hypothesis, but in this example they do. The important thing about any experiment is to report the results accurately and if it doesn't agree with the original hypothesis to reexamine the assumptions that the hypothesis was based on.

Make conclusions based on your data, with regard to your initial hypothesis. Say whether the experiment supported the original hypotheses, or disproved it. In the plant example, the plants with more light were taller than the ones with less light at the end, so the conclusion was that more light has a positive effect on plant growth, and these results support the hypothesis. If they had ended up the same height, the conclusion would be that different amounts of light did not change growth and therefore you have disproved the hypothesis.

This is also the place to add more thoughts to your discussion. If you saw something unexpected, you should comment on it here. If your results suggested ideas for further experiments or changes to improve the current one, you can discuss that here. Finally, if you learned something that you think is useful, suggest how you think it is useful to you and to others.

Below are two examples of a completed experimental display boards

Remember to put your name on your display and keep size to less than a standard trifold size of 28-30 inches long x 38-40 inches high

Questions	**Title**	
	Student Name/Grade/Teacher	Materials
Hypothesis		
	Data/Observations	Conclusions
Procedures		

Testable Question:
I wonder if a plant in the window will grow more than a plant in the hallway?

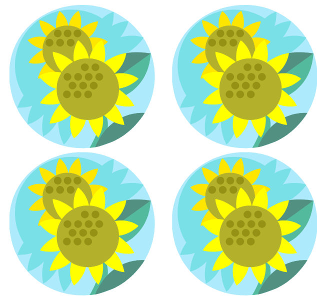
Hypothesis:
If I plant a seed and keep it in a sunny spot, then it will grow more than a plant kept in a darker location.

Materials:
4 sunflower seed
medium-sized pots
potting soil
water/ watering can
2 locations with different amounts of sunlight – high and low.

Methods:
1. Plant a seed in potting soil in each pot.
2. Water ¼ cup of water daily
3. 3 Plants were grown in direct sunlight and 3 were grown in a room with indirect (dim) daylight.
4. Plants in bright light were labeled A, B, and C. Plants in dim light were labeled D, E, and F.
5. Maintain the light levels with regular day/night cycles.
6. Measure sprouts each week for three weeks
7. Growth rate was calculated as cm/week (final size)/weeks, because all plants started as seeds

Rationale & Research:
I think my hypothesis will be correct because I have done research at http://www.sci-journal.org. There is a chemical in plant cells called auxin, abbreviated IAA and "In shoot tips, a higher concentration of IAA promotes growth, and also causes the shoot to bend towards the nearest and/or brightest light source." Plants make their own food from sunlight by the process of photosynthesis. This suggests that more sunlight will allow faster plant growth.

Lighting the Way to A Bigger Plant
by Sy. N. Tist
4th grade, Mr. Frank N. Stein



Photos of experimenting
OR hand drawn illustrations

Raw Data

Plant	Wk1	Wk2	Wk3
A	1	2	3
B	0.5	1.2	2
C	0.5	1.5	2.5
D	0.5	0.75	1
E	0.25	0.5	1
F	0.25	0.75	1

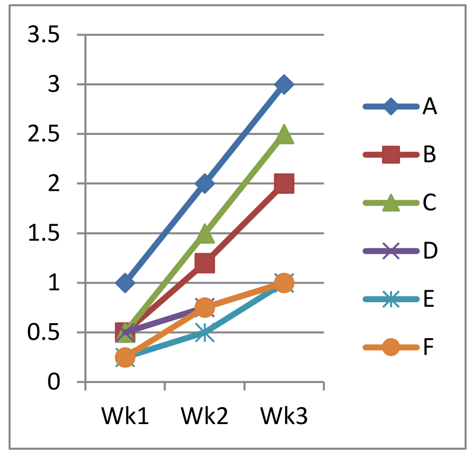
measurements in cm

Growth rate

Plant A	1
Plant B	0.67
Plant C	0.83
Plant D	0.33
Plant E	0.33
Plant F	0.33

calculated as cm/week

Graph of Results:



Conclusion:
I found my hypothesis was correct..

My data showed that all 3 plants (A, B, C) grown in light grew more than the 3 (D, E, F) grown in dim light. The plants in direct sunlight grew 2 to 3 times as much as the plants in dim light.

I was surprised when (what didn't you expect to happen).

If I was going to do this again I would change (what would you do differently next time).

I think other scientists could use this research to (how could this research be useful to other people).

The example above shows one way the key items can be displayed, but feel free to change the format to whatever works best for your project. The display board is a great way to share your knowledge with others. Make sure that your display is attractive and eye catching by making it easy to read and by using colorful graphs, charts, pictures, photographs, or labeled drawings to explain your data.

II. Scientific Inquiry Guidelines

If you don't want to conduct an actual experiment yourself, you can pick a subject of your choice and share the information in a fun, yet informative way. The subject can be anything you're interested in. Some examples include Rocks and Minerals, Alternate Energy Sources, Global Warming, Animal Conservation in Africa, Native Plants of Maryland, Einstein's Theory of Relativity, and many more.

After choosing a topic you should spend some time researching it. You can learn about your topic from various sources such as the library, online web resources, museum displays, talking with experts in the field, etc. The important thing is to gather information about the subject from several different sources. If there are conflicting opinions be sure to share and discuss it. Once you've gathered your facts it's time to think about how best to share your knowledge by either doing a display board, a movie poster, character re-enactment, etc. Think outside the box.

A. Scientific Inquiry Display Board

Your display should begin with an introduction that explains what the topic is and gives an overview of what you will be presenting. This is a very important step, because it tells the reader why they should think this is an interesting problem. The rest of the display can vary a lot, depending on the subject. Usually, you will show examples and lay out the details of the topic. This should all be based on your research and should cite the source for all information. This is where you make the display educational and entertaining for the viewer.

What is Global Warming

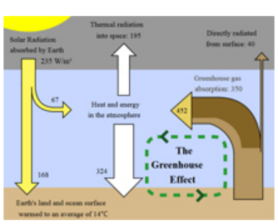
Global warming refers to the rise in the average temperature of Earth's climate system.

What causes Global Warming

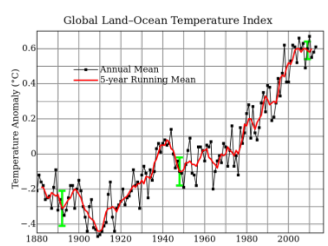
Carbon dioxide, methane, and other greenhouse gases, emission from fossil fuel combustion, and deforestation. These contribute to the Greenhouse Effect.

What is the Greenhouse Effect

The greenhouse occurs when thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions. This results in an increase of the average surface temperature above what it would be in the absence of the gases and causes the earth to heat up over time.



Global Warming
by
Sue Na Mee
5th grade, Ty Phoon



Effects of Global Warming

Global warming results in large scale changes in weather patterns including droughts and more severe weather. It also causes the melting of ice caps and receeding glaciers which in turn leads to raising the sea level. It will also change ecological zones so animal habitats will be affected.

Is Global Warming Real

There is some debate as to whether or not this is a real phenonmena. I think it's real. See the graph on the rising temperature

Conclusion:

Global warming is real. I hope that we can all try to cut down on our consumption and work as a nation and world to save our planet.

References:

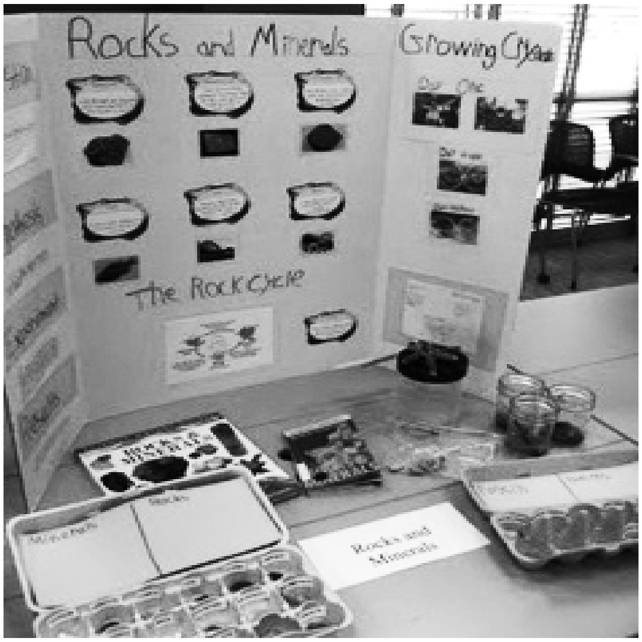
America's Climate Choices. Washington, D.C.: The National Academies Press. 2011.

Karl, TR, et al, ed. (2009). "Global Climate Change". Cambridge University Press

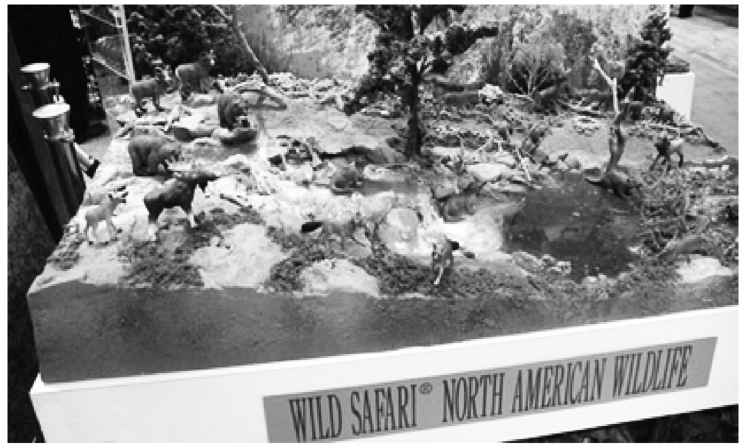
http://data.giss.nasa.gov/gistemp/

http://www.nrdc.org/globalwarming/

Remember to make it lively, make it fun, all while making it scientifically accurate and easy to understand. You can also make it more engaging by building a diorama or doing a demonstration of the scientific principle you are examining.



Demonstration of scientific principle



Diorama

III. Other Ways to Share Your Knowledge

Besides doing a display board, you could choose to share your knowledge in a different way such as doing a character reenactment of a famous scientist where you would present his/her scientific accomplishments and answer questions about his/her research, or you might present data and information on the Effects of Global Warming by making a movie poster, or you might make a game about gravity where the players have to answer fun facts in order to move ahead on the board. There are lots of ways to engage others in what you've learned so feel free to be creative.

Whatever your project is and however you choose to share your newfound knowledge, you should pick something you are excited about. Include lots of interesting facts and be prepared to answer questions and explain the topic in a way that will make your listeners excited, too!

Use the suggested timetable on page 10 for science experiments to plan out your project. Good luck!

IV. Sources for ideas:

Barnsley School Library or your local public libraries have numerous books on science fairs.
Online web searches. There are lots more than what is listed here. Just Google search "science fair experiments".

This site has project ideas that can be filtered by grade and by subject.
http://www.education.com/science-fair/

This site has project ideas arranged by subject
http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml

This site has a lot of great ideas. (**Requires login and email: kids, enter this info only with your parent's permission!) http://www.stevespanglerscience.com/

YOUR OWN MIND: Parents, don't forget this vast resource of ideas. Kids are full of wonderful questions that can be explored. Simply ask them what they have wondered about. This alone is much of the fun.
TV commercials: Test their claims! Does one brand of diapers really absorb more moisture than another brand? Can kids tell the difference between Coke and Pepsi?

V. Safety Rules to keep in mind:

- No Flammable, corrosive, explosive, or highly poisonous substances
- No aerosol cans
- No experimentation on live animals (observations are O.K.)
- No live pathogenic cultures (bacteria, yeast, mold, etc.)
- No hypodermic syringes or needles
- No radiation hazards
- No armed rockets or propellants
- No electrical hazards (no electrical cords; batteries are O.K.)
- No open flames
- No glass containers if plastic can be substituted
- No dry ice

VI. A note to parents about their role:

The level of involvement that you have with your child's science fair project is up to your child and you. The project should be the child's project, but parents can support the child in a number of ways. Some students will want to "go it alone", but, if your child asks, help brainstorm the problem. The child should come up with his/her own topic, but talking over a subject with a knowledgeable person is something all scientists do. This can help your child clarify the problem and avoid pitfalls in designing the project.

You will, of course, need to help provide needed materials. You may also want to help with construction of any apparatus that may involve the use of potentially dangerous tools.

MCPS Guides showing what your elementary schooler has been studying in Science and Technology this year can be found at:
http://www.montgomeryschoolsmd.org/curriculum/elementary/guides.aspx

VII. Suggested Timetable

Below is a suggested timetable to help guide you as you work on your project! The timetable is geared for students doing a science experiment. Adjust accordingly for a science inquiry display. Good luck!

√	**Recommended Date to stay on track (suggestions only, modify accordingly)**	**Science Experiment Checklist**
	By the end of March	Ask your question: "I wonder…?" Predict: prepare a hypothesis using the words "if" and "then", "I think ***if*** this happens, ***then*** that will happen." Research what others have to say about your question & prediction in the library, encyclopedia, or internet sources. Talk with your family and teacher about your ideas Plan your procedure for experimenting. Gather your materials.
	March	Experiment. If possible, repeat your experiment more than once (trials) and show all sets of data.
	March – early April	Write conclusions, prepare display. Was your prediction correct? Were you surprised by anything? Do you have new questions? **REGISTER YOUR PROJECT BY MONDAY, APRIL 23, 2018 – use this link:** https://goo.gl/forms/L7J6SS5H1OcPj1Xo2 Or **https://tinyurl.com/y829wprg** **This will help the Science Fair Committee organize projects and have all the information to print participation certificates. Please don't wait till the last minute to register your project!**
	Saturday, May 5, 2018 3 to 6 PM Bring your project to school by 3pm the day of Science Fair so that you can set up before the fair begins.	Relax and congratulate yourself for completing your project on time. Come to the fair and be ready to present your project to fellow students, teachers and families!