WEST VIRGINIA SCIENCE & ENGINEERING FAIR

PROJECT GUIDE

Elementary School Students
Grades 3-5

March 28, 2020

West Virginia
Science & Engineering Fair

West Virginia DEPARTMENT OF EDUCATION

Introduction

The purpose of this booklet is to provide information on how to complete a science fair project. Ideas are given on how to choose, develop, and display a project, as well as how to prepare for judging. Although a lot of hard work goes into preparing a project, remember that the purpose of a project, which reflects you and your interests, is to provide you with an enjoyable learning experience, so above all enjoy working and doing science because SCIENCE IS FUN!

Steps to a successful project:

1. **Understand the rules:**
   Before you start your project, familiarize yourself with the science fair guidelines in this packet. Read the list of the important things you need to know, checking off each item as you read. Ask your teacher to explain anything you do not understand.

2. **Pick your topic:**
   Get an idea of what you want to explore! Choose a topic for your project that deals with an area of science that interests you. You can find ideas in books, magazines, textbooks etc. List the categories or ideas that you have selected and pick a specific topic.

3. **Research your topic:**
   Go to the library or internet and learn everything you can about your topic. Look for the unexplained or unexpected. Talk to professionals in the fields that you are interested in or email companies. Take notes on what you learn and keep track of the sources you use with a bibliography.

4. **Organize:**
   Organize everything you have learned about your topic. Next, create a question and hypothesis based on the information you have learned.

5. **Plan your experiment:**
   Once you have a project idea you must design an experiment. Next create a plan in which you list all the materials and steps in your experiment. Design an experiment that can be done in the amount of time that you have. Discuss this with your teacher to make sure that you are on the right track.

6. **Complete your "paperwork":**
   Use a calendar to identify important dates. Leave time to fill out your forms and review with your teacher. Also, leave time to write a paper and put together a display

7. **Conduct your experiment & take photographs:**
   During experimentation take detailed notes on what you see and do. Keep a research journal, including dates and times as needed. Take photographs, not including faces, of your experiment and the results. Make sure to change only one variable at a time in your experiment and start with a control experiment where nothing is changed. Make sure you include at least 5 or more test subjects in the control and experimental groups. Note any changes you made in your results.

8. **Examine your results:**
   When you complete your experiments, examine and record your findings. Use a chart, graph, table, etc. to record your results. Did your experiment go as you planned? Why or why not? Was your experiment performed with the exact same steps each time? Remember, gaining the understanding of unusual or unexpected results is not a scientific failure, but an important lesson to learn.

9. **Draw Conclusions:**
   Answer the following conclusions: Which variables are important? Did you collect enough data? Do you need to conduct more experimentation? Did the results support your hypothesis? If your results did not, what happened? Remember an experiment is done to prove or disprove a hypothesis.

10. **Prepare a report:**
    Prepare a report on what you learned and how you learned it. First start with a rough draft, going into as much detail as possible so another person could repeat your experiment. Leave plenty of space between lines so corrections can be made if needed. A good report will include 1) a title, 2) acknowledgments of who helped, 3) an introduction of your topic, 4) discussion of your problem, 5) list of all materials, 6) your step by step procedure, 7) observation and results, 8) conclusions, and 9) bibliography.

11. **Design your display:**
    Now that your research and scientific report is done, you must now create a display to show what you have done. Neatness, clarity, and organization are keys to a successful display. Check spelling, punctuation, grammar, and the accuracy of your information.

    Your display material does not need to be expensive. You will need a free-standing backboard. It can be poster board, fabric on a frame, cardboard, plywood, Masonite, etc. Make sure that it stays within the measurements specified in the rules. Use color, creativity, and care as you organize a creative display.

    Your display may include whatever objects that are not excluded by the rules. Your display should include title, question, hypothesis, report, list of materials, procedure, observations, conclusions, and abstract. Refer to the back of this booklet for the list of items that may NOT be included in your display and an illustration of a display.

12. **Prepare for judging:**
    Your project will be judged using a point system based on six areas. These areas are: scientific thought, creative ability, understanding, clarity, dramatic value, and technical skill.

    The oral presentation is an important part of the judging process. During your presentation you should discuss
    - why you chose your topic,
    - how you gathered your information,
    - how you tested your hypothesis,
    - what observations you made,
    - and what conclusions you reached.

You may want to write note cards or refer to parts of your display to plan what you are going to talk about. Rehearse what you are going to say, DO NOT READ your presentation. The presentation should only take 3-5 minutes. Practice in front of your family and friends. Keep in mind the judges are looking for a student who has learned from their research and experiment.

Although it is natural to be a little nervous about presenting, remember that the judges are not there to trick or embarrass you. They are interested in you and what your project is all about, so be pleasant, courteous and enjoy yourself. Above all, show them that you are proud of what you have accomplished!

Eligibility/Limitations

- A student must be selected by a regional feeder fair to the State West Virginia Science & Engineering Fair (WVSEF).
- Each student is only allowed to enter one project. That project may include no more than 12 months of continuous research and may not include research performed before January 2019.
- Team projects must have no more than three members. Teams competing at WVSEF must be composed of the original members who competed at the WVSEF regional feeder fair.
- Projects that are demonstrations, 'library' research, informational projects, or 'explanation' models are not recommended or appropriate for WVSEF.
- All sciences and engineering disciplines are represented at ISEF.
  - » Elementary and Middle School projects compete in one of the 18 categories of the WVSEF.
  - » High School projects compete in one of 22 ISEF categories.
  - » Review a complete list of categories and sub-categories with definitions here - *http://bit.ly/ISEFcat*.
- Projects that do not have completed paperwork prior to the submission deadline may be allowed to exhibit but will not be considered for any of the awards.

IMPORTANT to REMEMBER

- Individuals and teams in the same categories and in the same programmatic levels (elementary, middle school, and high school) compete against each other.
- No student or school names should appear on abstracts or projects.
- No student's or participant's facial photos may appear on projects.
- Fair directors have final say on matters not covered in fair rules.

The following are PROHIBITED in all Elementary School (grades 3-5) Science Fair Projects with NO Exceptions.

- Biological Agents projects that use or study microorganisms including **mold, bacteria, viruses, prions, fungi, and parasites**.
- Vertebrate Animal Research (including humans) involving pain or withholding of food or water. (All Vertebrate Animal Research should be reviewed by a Doctor of Veterinary Medicine and a school-based Institutional Review Board (IRB)/Scientific Review Committee (SRC).
- Class IV Lasers (All use of lower-class lasers must be under direct supervision of a qualified adult.)
- Radioactive substances or equipment that emits any form of ionizing radiation.
- Hazardous Chemicals or reagents, DEA Controlled substances, tobacco, alcohol, prescription drugs, firearms or explosives.

The following types of research are discouraged but can be permitted with advanced permission. Students must have their projects approved by the school-based Safety Review Committee BEFORE starting their research (check if a project requires pre-approval)!

- Human Subjects may be used only if all experimentation is conducted under adult supervision and student researchers have notified parents of the conditions of the experiment and provided the opportunities for subjects to opt out of participation. All participants must sign an informed consent form. All guidelines for human participants research must be followed and forms submitted to a school-based IRB committee BEFORE experimentation begins.
- Animal Behavior Studies Research projects should be reviewed by a Veterinarian to ensure the safety of the student and animal. All Vertebrate animal studies MUST be of an observational nature and not be done with any animals other than family pets.
- If you wish to do an animal research project, please use invertebrates!

WV Science & Engineering Science Fair Project Guide To-Do List

__ 1. Choose your category.

__ 2. Develop a topic, question, and hypothesis.

__ 3. Research your question.

__ 4. Be sure your experiment design has been approved by your teacher & the science fair review committee.

__ 5. Gather your materials & set up your experiment.

__ 6. Record your data and observations in a journal as you experiment.

__ 7. Organize data in charts or graphs to be analyzed for conclusions.

__ 8. Write your abstract including your question, hypothesis, materials, procedure, results and conclusion using **no more than 250 words on the approved form**.

__ 9. Organize a display board for your project that is **no bigger than 30 inches or 76 centimeters front to back, 48 inches or 122 centimeters wide, or 108 inches or 274 centimeters tall**.

__ 10. Be sure your project has a title, question, hypothesis, list of materials, procedure, observations, conclusion, a report, and a list of sources used to gather information

__ 11. Be sure your display shows what and how you have learned about your topic. You may show this using pictures, graphs, charts, etc. A collection or model may be displayed if it follows Science Fair guidelines.

__ 12. Do all the work yourself. You may receive direction or guidance from others; if you do- include who helped you in your report.

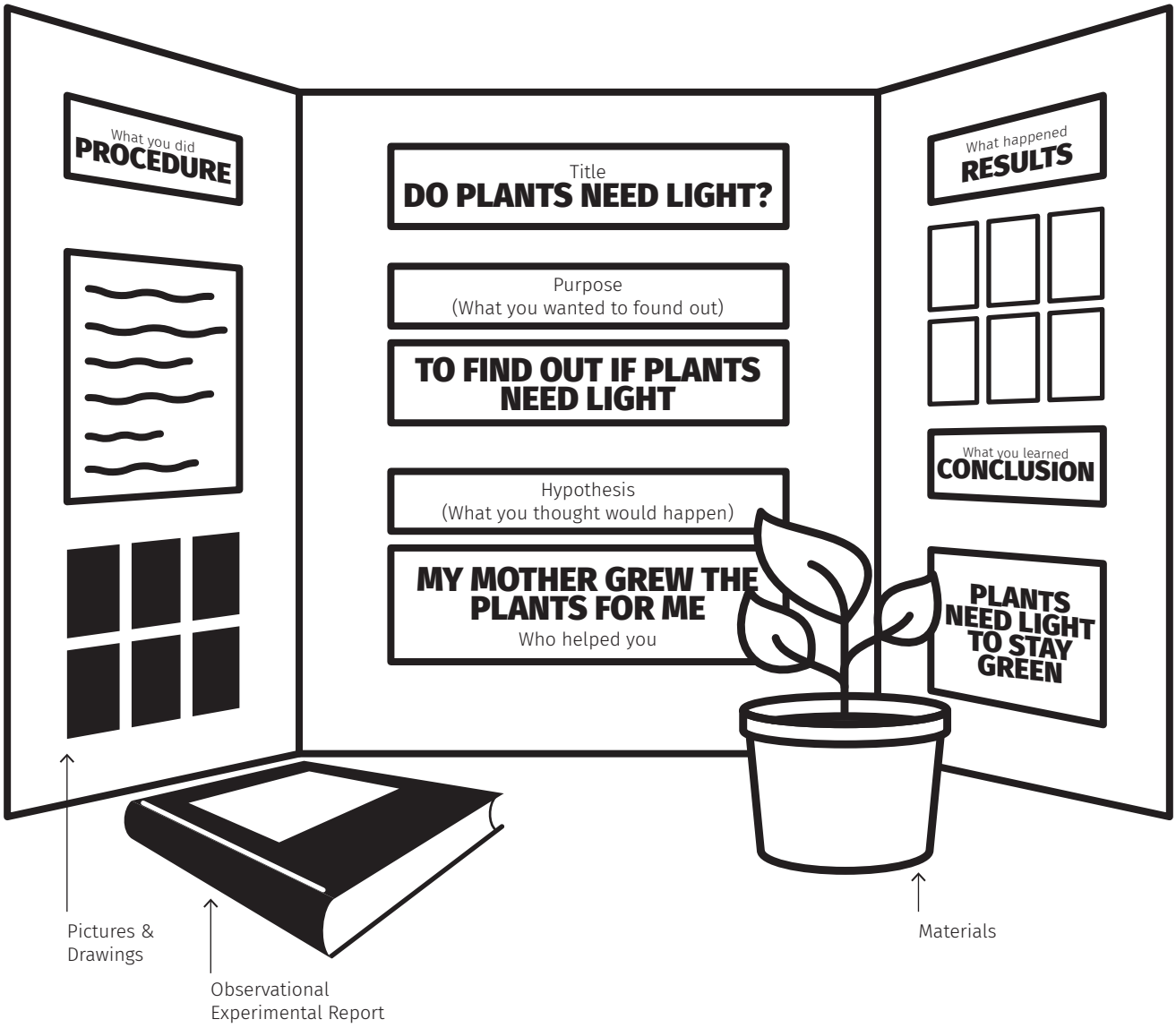
__ 13. Be sure your report includes a title, background information on your topic, description of the experiment, summary of your results, a list of who helped you, and a bibliography.

__ 14. Put together a 3-5-minute presentation for the judges. Substitutes or video/audio presentations are not permitted.

__ 15. Be sure your project adheres to safety restrictions and display regulations. The following are prohibited at all levels of competition (school, county, regional, and state):

a. Live animals;
b. Flames, highly flammable materials, or sources of heat (hot plates, etc.);
c. Dry ice;
d. Weapons and ammunition (including toys and replicas);
e. Sharp items (for example, syringes, needles, knives);
f. Tobacco products;
g. All hazardous substances or devices (for example—chemicals, poisons, and drugs);
h. Batteries with open-top cells (for example—car and motorcycle batteries);
i. Any item prohibited by county or WV Board of Education Policies; and
j. Any item that the fair coordinator deems unsafe or inappropriate for public display.

Displaying a Science Fair Project



West Virginia Science & Engineering Elementary and Middle School Categories 2020

The categories have been established with the goal of better aligning judges and student projects for the judging. Local, country, and regional fairs may or may not choose to use these categories, dependent on the needs of their area. Please check with your affiliated fair(s) for the appropriate category listings at that level of competition. Visit the ISEF website at *http://bit.ly/ISEFcat* for a full description and definition of categories:

ANIMAL SCIENCES (ANIM)
- Animal Behavior
- Cellular Studies
- Development
- Ecology
- Genetics
- Nutrition & Growth
- Physiology
- Systematics & Evolution
- Other

BEHAVIORAL & SOCIAL SCIENCES (BEHA)
- Clinical & Developmental Psychology
- Cognitive Psychology
- Neuroscience
- Physiological Psychology
- Sociology & Social Psychology
- Other

BIOCHEMISTRY (BCHM)
- Analytical Biochemistry
- General Biochemistry
- Medical Biochemistry
- Structural Biochemistry
- Other

MEDICAL SCIENCES

BIOMEDICAL & HEALTH SCI (BMED)
- Cell, Organ, & Systems Physiology
- Genetics & Molecular Biology of Disease
- Immunology
- Nutrition & Natural Products
- Pathophysiology

TRANSLATIONAL MED SCI (TMED)
- Disease Detection & Diagnosis
- Disease Prevention
- Disease Treatment & Therapies
- Drug Identification & Testing
- Pre-Clinical Studies
- Other

CELLULAR & MOLECULAR BIOLOGY (CELL)
- Cell Physiology
- Cellular Immunology
- Genetics
- Molecular Biology
- Neurobiology
- Other

CHEMISTRY (CHEM)
- Analytical Chemistry
- Computational Chemistry
- Environmental Chemistry
- Inorganic Chemistry
- Materials Chemistry
- Organic Chemistry
- Physical Chemistry
- Other

COMPUTATIONAL BIOLOGY & BIOINFORMATICS (CBIO)
- Computational Biomodeling
- Computational Epidemiology
- Computational Evolutionary
- Biology
- Computational Neuroscience
- Computational Pharmacology
- Genomics
- Other

EARTH & ENVIRONMENTAL SCIENCES (EAEV)
- Atmospheric Science
- Climate Science
- Environmental Effects on Ecosystems
- Geosciences
- Water Science
- Other

EMBEDDED SYSTEMS (EBED)
- Circuits
- Internet of Things Microcontrollers
- Networking & Data
- Communications
- Optics
- Sensors
- Signal Processing
- Other

ENERGY:

CHEMICAL (EGCH)
- Alternative Fuels
- Computational Energy Science
- Fossil Fuel Energy
- Fuel Cells & Battery Develop
- Microbial Fuel Cells
- Solar Materials Other

PHYSICAL (EGPH)
- Hydro Power
- Nuclear Power Solar
- Sustainable Design
- Thermal Power
- Wind
- Other

ENGINEERING

BIOMEDICAL ENG. (ENBM)
- Biomaterials & Regen Medicine
- Biomechanics
- Biomedical Devices
- Biomedical Imaging
- Cell & Tissue Engineering
- Synthetic Biology

MECHANICS ENG. (ENMC)
- Aerospace & Aeronautical Engineering
- Civil Engineering
- Computational Mechanics
- Control Theory
- Ground Vehicle Systems
- Industrial Engineering-Processing
- Mechanical Engineering
- Naval Systems

ENVIRONMENTAL ENG. (ENEV)
- Bioremediation
- Land & Reclamation
- Pollution Control
- Recycling & Waste Management
- Water Resources Management
- Other

MATERIALS SCIENCE (MATS)
- Biomaterials
- Ceramic & Glasses
- Composite Materials
- Computation & Theory
- Electronic, Optical & Magnetic
- Materials
- Nanomaterials
- Polymers
- Other

MATHEMATICS (MATH)
- Analysis
- Combinatorics, Graph Theory, & Game Theory
- Geometry & Topology
- Number Theory
- Probability & Statistics
- Other

MICROBIOLOGY (MCRO)
- Antimicrobials & Antibiotics
- Applied Microbiology Bacteriology
- Environmental Microbiology
- Microbial Genetics
- Virology
- Other

PHYSICS & ASTRONOMY (PHYS)
- Astronomy & Cosmology Atomic, Molecular, & Optical Physics
- Biological Physics
- Condensed Matter & Materials
- Mechanics
- Nuclear & Particle Physics
- Theoretical, Computational & Quantum Physics
- Other

PLANT SCIENCES (PLNT)
- Agriculture & Agronomy
- Ecology
- Genetics/Breeding
- Growth & Development
- Pathology
- Plant Physiology
- Systematics & Evolution
- Other

ROBOTICS & INTELLIGENT MACHINES (ROBO)
- Biomechanics
- Cognitive Systems
- Control Theory
- Machine Learning
- Robot Kinematics
- Other

SYSTEMS SOFTWARE (SOFT)
- Algorithms
- Cybersecurity
- Databases
- Human/Machine Interface
- Languages & Operating Systems
- Mobile Apps
- Online Learning
- Other

WV Science & Engineering Science Fair Project Guide

Bibliography

Please remember to keep a record of all sources from which you gather information. Your bibliography should be organized with the following information to show where you found the information. Sources in alphabetical order by the first word in each entry.

Information for a Bibliography

Book: Author, Title, Place of printing: Publishing Co., Date, Pages
EXAMPLE:
Shippen, Katherine B., A Bridle for Pegasus, New York: Biking Press, 1991, pp. 28-42

Encyclopedia: Author, "Title of article," Name of encyclopedia, Year, Volume, Page
EXAMPLE:
Piccard, Don, "Balloon," The World Book Encyclopedia, 1994, Vol.2, pp. 39-44

Magazines: Author, "Title of article," Name of magazine, Volume: Number, Pages, Date
EXAMPLE:
Lewis, C., "The Navy Unveils Rockets," Aviation World, Vol. 68: No. 6, pp,; 49-51, November 3, 1958

Internet: Author (if known), "title of article or webpage," web address, date documented
EXAMPLE:
_____ ,"NASA Space Shuttle Launches," http://science.htc.nasa.gov/shuttle/missions.html, September 11, 2000

Media: Program title, type of media, date
EXAMPLE:
60 minutes, Television, Cable GS Communications Channel 7, September 10, 2000

Interviews: Name of person, Position, Company, Location, Date interviewed
EXAMPLE:
John C. Jones, Lawyer, Jones & Sons, Martinsburg, WV, August 15, 2000

Additional information about bibliographies in MLA format may be found here - *https://style.mla.org/*

WV Science & Engineering Science Fair Registration Process

The registration process for school and county fairs will be determined by the school or county fair coordinator.

County fair coordinators are responsible for registering projects for regional fairs using the **WV Science & Engineering Fair Online Registration System** at *https://wvde.us/wvsef/*. Use of this system is mandatory. Detailed information on the use of the Online Registration System will be provided to county and regional fair coordinators.

Regional fair coordinators are responsible for registering projects for the West Virginia Science & Engineering Fair. Detailed information on the registration process will be provided to regional fair coordinators.

It is the responsibility of the fair coordinator (county or regional) to ensure the accuracy of registration information (student names, project titles, category selections, etc.) prior to submission.

At the West Virginia Science & Engineering Fair, students are not required to register or "check in" on the day of the fair. Upon arrival, students may proceed directly to their assigned project numbers and assemble their projects. Project numbers will be posted to *https://wvde.us/wvsef/* at least one week prior to the fair date.

Required Forms for ALL elementary school WVSEF projects:

- WVSEF Abstract for Elementary School
- WVSEF Rules Agreement Form for Elementary and Middle School

A WVSEF Vertebrate and Human Research Form (VHRF) is require if the project involves vertebrate animal research. (All Vertebrate Animal Research should be reviewed by a Doctor of Veterinary Medicine and a school-based Institutional Review Board (IRB)/Scientific Review Committee (SRC).

Additional information about the West Virginia Science and Engineering Fair may be found here – *https://wvde.us/wvsef/*.

WV Science & Engineering Science Fair

What is an Institutional Review Board (IRB)?
An Institutional Review Board (IRB), is a committee that must evaluate the potential physical and/or psychological risk of research involving humans. **All proposed human research must be reviewed and approved by an IRB before experimentation begins.** This includes review of any surveys or questionnaires to be used in a project.

Federal regulations require local community involvement. Therefore, **it is advisable that an IRB be established at the school level to evaluate human research projects**. If necessary, the local or ISEF-affiliated SRC can serve as an IRB as long as it has the required membership. An IRB must consist of a minimum of three members including the following:

- An educator
- A school administrator (preferably principal or vice principal)
- A medical or mental health professional. The medical or mental health professional may be a medical doctor, nurse practitioner, physician's assistant, Doctor of Pharmacy, registered nurse, psychologist, licensed social worker or licensed clinical professional counselor. The medical or mental health professional on the IRB may change depending on the nature of the study. This person must be knowledgeable about and capable of evaluating the physical and/or psychological risk involved in a given study.

Additional Expertise: If an expert is not available in the immediate area, documented contact with an external expert is recommended. For elementary students, a copy of all correspondence with the expert (e.g. emails) must be attached to the Vertebrate and Human Research Form (VHRF) and can be used in lieu of the signature of that expert.

To avoid conflict of interest, no Adult Sponsor, parent or other relative of the student, the Qualified Scientist, or Designated Supervisor who oversees the project, may serve on the IRB reviewing that project. Additional members are recommended to help avoid a potential conflict of interest and to increase the expertise of the committee.

What is an Affiliated Fair Scientific Review Committee (SRC)?
A Scientific Review Committee (SRC) is a group of qualified individuals that is responsible for evaluation of student research, certifications, research plans and exhibits for compliance with the rules, applicable laws and regulations at each level of science fair competition. Affiliated Fairs may authorize local SRCs to serve in this prior review capacity.

ALL projects, including those previously reviewed and approved by an IRB must be reviewed and approved by the SRC after experimentation and before competition in an Affiliated Fair. Projects which were conducted at a Regulated Research Institution, industrial setting or any work site other than home, school or field and which were reviewed and approved by the proper institutional board before experimentation, must also be approved by the Affiliated Fair SRC.

An SRC must consist of a minimum of three persons, including the following:

- a biomedical scientist with an earned graduate degree
- an educator
- at least one additional member

Additional expertise: Many project evaluations require additional expertise (e.g., on biosafety and/or of human risk groups). If the SRC needs an expert as one of its members and one is not in the immediate area, all documented contact with an external expert must be submitted. If animal research is involved, at least one member must be familiar with proper animal care procedures. Depending on the nature of the study, this person can be a veterinarian or animal care provider with training and/or experience in the species being studied.

To avoid conflict of interest, no Adult Sponsor, parent or other relative of the student(s), the Qualified Scientist, or the Designated Supervisor who oversees the project may serve on the SRC reviewing that project. Additional members are recommended to diversify and to increase the expertise of the committee.

Combined SRC/IRB Committee
A combined committee is allowed as long as the membership meets both the SRC and IRB requirements listed previously.

For additional information about IRBs and SRCs, see the ISEF 2020 Rules at *http://bit.ly/ISEFrulesforms*.

WV Science & Engineering Science Fair
Judging Form

Project Title: _____

Project Category: _____

Project Number: _____

Criteria:

Scientific Thought (30 Points) _____

- Is the problem concisely stated?
- Are the procedures appropriate and thorough?
- Is the information collected complete?
- Are the conclusions based on the data/observations made during the investigation?
- Are the conclusions accurate?

Comments:

Creativity: (20 Points) _____

- How unique is the project?
- Is it significant and unusual for the age of the student?
- Does the project show ideas that were determined by the student?

Comments:

Understanding: (15 Points) _____

- Can the student explain what he or she learned during the research?
- Can the student answer questions about the topic?
- Did the student use appropriate literature/sources for research?

Comments:

Clarity: (15 Points) _____

- Are the problems, procedures, data, and conclusions presented logically?
- Can the objectives be understood by non-scientists?
- Are the written materials clear and articulate?

Comments:

Dramatic Value: (10 Points) _____

- How well did the student present the project?
- Is the proper emphasis given to important ideas?
- Is the display visually appealing?

Comments:

Technical Skill (10 Points) _____

- Was the majority the work done by the student?
- Is the project well-constructed?
- Does the written material show attention to grammar and spelling?

Comments:

Total Points (based upon 100 points) _____

West Virginia Science & Engineering Fair
Elementary School Abstract, page 1 of 2

Division: **Elementary** Category: _____

Title of Project: _____

Briefly complete the information below concerning your project.

1. Describe the purpose of your project.(What did you want to find out?)

_____

_____

_____

_____

_____

_____

_____

_____

2. Describe the procedure you used to test your hypothesis.

_____

_____

_____

_____

_____

_____

_____

_____

West Virginia Science & Engineering Fair
Elementary School Abstract, page 2 of 2

3. Explain the conclusion(s) you reached.

4. Write in the space below or attach a separate list of your sources of information in a form of a bibliography.

West Virginia Science & Engineering Fair 2020
Vertebrate and Human Research Form (VHRF)

REQUIRED for ALL ELEMENTARY SCHOOL Projects Involving Vertebrate Animals including Humans

Student's Name: _____

Name of Project: _____

To be completed by the student researcher:

☐ **Vertebrate Animal Research**

☐ Animals will be treated kindly and cared for properly. Animals will be housed in a clean, ventilated, comfortable environment appropriate for the species.

☐ The research plan has been reviewed by a Veterinarian to ensure the safety of the student and animal.

☐ **Human Research**

☐ I have attached any surveys or questionnaires I will be using in my project or other documents provided to human participants.

☐ I have attached consent forms that informs participants of the research and asks for voluntary participation in the research.

1. Common name and number of animals used.

_____

_____

2. Briefly describe the research project.

_____

_____

_____

_____

_____

_____

To be completed by the local or affiliated Fair SRC/IRB BEFORE experimentation (humans, vertebrates).

The SRC/IRB has carefully studied the research plan. My signature indicates approval of the research plan before the student begins experimentation.

Signature	SRC/IRB Chair's Printed Name	Date Acknowledged (mm/dd/yy) (Must be prior to experimentation.)

The West Virginia Science & Engineering Fair

2020 Rules Agreement Form for ELEMENTARY AND MIDDLE SCHOOL STUDENTS

I grant the West Virginia Department of Education (WVDE) the right to use my image for the creation of marketing materials that will be used in a variety of formats, including but not limited to, television, print and online. I understand that I must be 18 or older to participate without the permission of a parent or guardian. I understand that this permission does not include use of my image by other parties for any other purpose that is not affiliated with WVDE. I waive any right that I may have to inspect and/or approve the finished product or products or the editorial or advertising that may be used in connection with this project. I understand that I will not be paid for my participation in this project.

WVSEF Participant Name	
WVSEF Participant Signature	Date
WVSEF Participant Parent/Guardian Signature	Date

Steven L. Paine, Ed.D.
West Virginia Superintendent of Schools