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Science Fair Studio

Janice VanCleave's
Science Fair Handbook

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Go to...

This handbook is adapted from "A Guide to the Best Science Fair Pro by Janice VanCleave. For information on this book or other books by VanCleave, click here. Ms. VanCleave has also prepared a searchable archive of answers to questions about science fair projects.

So you're going to do a science fair project. Great! Your work could be chosen as an entry in your school fair and even in regional, state, or national competitions. As a participant in any science fair, you'll get to show off your work and possibly receive achievement awards. But more important, you'll also learn a lot about science by observing & sharing with other science fair participants.

A science project is like a mystery in which you are the detective searching for answers. Science projects let you practice and exhibit your detective skills. You not only get to select which mystery to solve, but you can creatively design methods for uncovering clues that will lead to the final revelation of who, what, when, where, how, and why. This bk will give you guidance and ideas. It's your job to discover the answer

This book covers the eight most important points you need to know fo science fair success:

1. **Scientific Method**
   Research, Problem, Hypothesis, Experimentation, Conclusion
2. **Topic Research**
   Project Types, Three Steps to a Topic, Research a Topic, Topic Ideas
3. **Project Research**
   Primary Research, Secondary Research

Please go over the points and helpful hints in this site carefully! It's very good!

4. **A Sample Project**
   Starting Your Project, Procedures, Results, Explaining Your Hypothesis
   Results,

5. **Project Report**
   Title Page, Table of Contents, Abstract, Introduction, Experim
   and Data, Conclusion, Sources, Acknowledgments

6. **The Display**
   Helpful Hints, Do's and Don'ts, Safety

7. **Presentation and Evaluation**
   Judging Information, Do's and Don'ts at the Fair

From *Janice VanCleave's Guide to the Best Science Fair Projects* Janice VanCleave (John Wiley & Sons, Inc., 1997)

So you have to make a Science Fair Project...
How to get an A+ in Science in 7 easy steps.!

Step 1: Select a Topic

Biotechnology	**Physical Sciences**	**Life Sciences**	**Engineering**	**Computer Science**
♦Crop Development	♦Physics	♦Biology	♦Mechanical	♦Language Development
♦Animal Science in Agriculture	♦Chemistry	♦Zoology	♦Civil	♦Operating Systems
♦Microbial	♦Geology	♦Botany	♦Chemical	♦Interfaces
	♦Mathematics	♦Genetics	♦Industrial	♦Software
	♦Meteorology	♦Ecology	♦Bio-medical	
		♦Physiology	♦Environmental	

Project Types
*Experiment
*Innovation

Let's Explore Experiment Projects

Most science fair projects will be experiments, which use the scientific method
Purpose
Hypothesis
Method
Materials
Observations
Conclusions

Experiment Project Examples
To determine the affects of gender identity on short term memory
To determine which bread has the most energy
To determine how the colour of light affects plant growth
Can you drink Little River water after filtration?
To determine which chip contains the least joules
To determine the best fluid used in hydraulics
To determine the best conditions to grow crystals
To determine the best ingredients to create soap
Which floor holds the most dirt?

Let's Explore Innovation Projects

An original:
- ♦Invention (could apply for patent)
- ♦Design (i.e. original bridge concept)
- ♦Computer simulation (program)

Answers.....

♦1. The seeds must all come from the same package and be randomly selected.
♦2. All seeds must be planted in the same size and type of pot with the same type of soil.
♦3. All plants must receive exactly the same amount of water and light.
♦4. The temperature for all test plants should be the same.
♦5. More than one plant should be used for each test group.
♦6. Set one group as the CONTROL GROUP. This group is not given any fertilizer.
♦7. Set up two other test groups. One receives a certain amount of fertilizer each week. The other receives exactly twice as much.

Step 5: Prepare the Scientific Report

- Purpose
- Hypothesis
- Materials
- Method
- Observations
- Graphs
- Charts
- Photos
- Conclusion
- Research

Step 6: Exhibit

This is the visual presentation of your project.
Use :

- Graphs
- Charts
- Clear bold lettering
- Binder with scientific report
- Visuals

Step 7: Judging

- Look neat
- Speak with enthusiasm
- State the purpose of your investigation
- Identify the conclusion
- Discuss any future plans you have to continue research on your topic

Windsor Science Fair Awards

♦Mad Science presentation to top participating school
♦$500 to top performing school
♦Books & prizes for top project in each grade level
♦15 local awards for projects in certain categories (engineering, environmental, etc)
♦Bronze, Silver & Gold medals to all who qualify
♦www.wrstef.ca
♦The chance to go to Calgary for 1 week if you are one of the top 8 students!
♦Top six projects in Grade 7 and 8 will win medals and move on to Windsor Science Fair at the University of Windsor.

Scientific Method Checklist
for Science Fair Project Report

- ☐ **Title Page:** It must have the name of the project and your name (choose a very attractive title for your project).

- ☐ **Table of Contents:** It must have all the contents of the report in order, including page numbers.

- ☐ ***3. Objective:** This is the purpose or the goal of the project.*

- ☐ ***4. Hypothesis:** Explain your prediction about what will happen in your project.*

- ☐ ***5. Variables and controls:** You must explain what stays in your project when you do the testing (controls). Variable means the thing that changes when you do testing.*

- ☐ ***6. Apparatus:** Are the materials that you will use in the project.*

- ☐ ***7. Procedure:** Explain all the steps of the project in order.*

- ☐ ***8. Observations:** Record every thing you see and notice using scientific language.*

- ☐ ***9. The Result:** Record your data in a table and display it in graphs.*

- ☐ ***10. Conclusion:** State whether or not your hypothesis was correct and relate your conclusion to your objective of the project. Make sure that you explain the final result very well using scientific language.*

- ☐ ***11. Next Steps:** Explain what you would change about your project if you were to do the project again in the future, according to what you learned from the project.*

- ☐ ***12. Pictures:** Be sure to take some pictures at each step of your project while you are doing it. Display your pictures on your project.*

- ☐ **13. Resources:** Make a list of all the books, websites or any other resources that you used to get all the information for your project (this is also called a BIBLIOGRAPHY).

- ☐ **14. Journal:** You must keep a journal that you write in daily. Explain what you did, what did not work, and what you've done to change your project in any way.

- ☐ **15. Research:** All your research must be summarized <u>in your own words</u>.

All sections italicized are to be displayed on your project!

Your science fair project report needs to have the following parts:

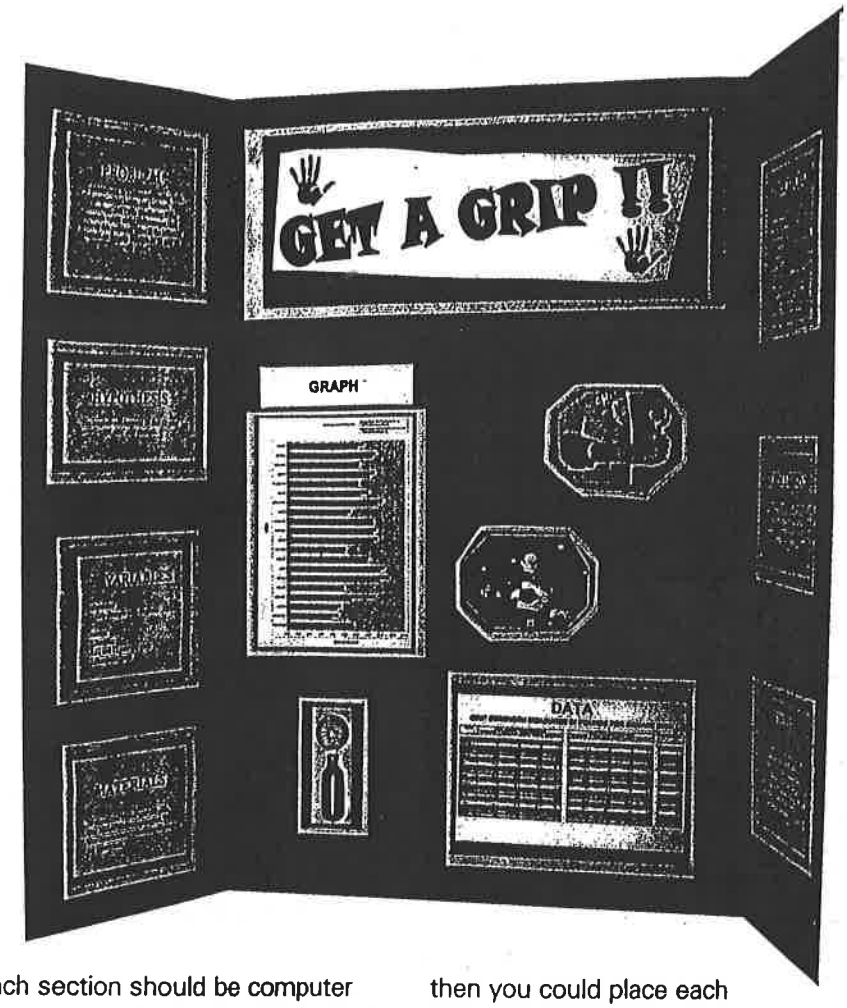
- **Title Page:** Must include your science fair project's title, your name and contact information (address and school), your grade and the name of your science teacher.
- **Table of Contents:** Include the page numbers for the beginning of each section.
- **Introduction**: The Introduction includes your *clearly formulated* and *testable* hypothesis, as well as explanation of your idea, how you got it and why you think the work is interesting. (If don't think your experiment is interesting, give up now. You have no hope of doing a good project! So look around until you find something that interests you!) Also include what you hoped to achieve when you started the project.
- **Experiment:** Describe in detail the method you used to collect your data and organize your observations. Your report should be detailed enough for anyone to be able to repeat your experiment by just reading the paper, so keep this fact in mind when you write it. It's always a good idea to include detailed photographs or clearly-labeled drawings of any device you made to carry out your research.
- **Discussion:** This is where you explain the exact process by which you reached your conclusions. This section should flow logically so that the reader can easily follow your train of thought. Compare your data with the null hypothesis (that is, what would you have expected if the observations you made were completely unrelated to the effect you were expecting), or to your predicted results. What you would do differently if you were to do this project again?
- **Conclusion**: Summarize your results. Make sure not to introduce anything that wasn't already mentioned in the previous parts of your paper.
- **Acknowledgments** In this section you should give credit to everyone who assisted you. This may include individuals, businesses and educational or research institutions. Identify any financial support or material donations you may have received.
- **References** This list should include any documentation that is not your own, such as books or articles, that you used.

or "Bibliography", which should be written in the format given to you by your teacher!

* Notes to remember:
  - A good research report should be written in the past tense, and typed on one side only. It should be checked for: spelling, punctuation and grammar.

Showing Off

Ready to show off all of your hard work? Well, it's time to get ready for the actual science fair. At the science fair, you'll be given space on a table to display your experiment, and it's your job to tell the whole story of your project on that table in an interesting and eye-catching way. You want to show that you know what you're talking about and get the attention of judges with a display that is organized, neat, creative, and fun.

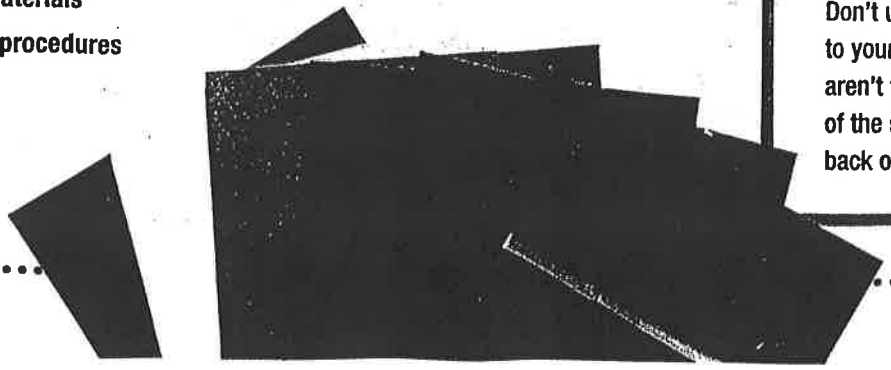


The first thing you should do is choose a title for your project. Pick something short and to the point. If you can think of something witty, use it, but don't get hung up on it. For example, the tomato experiment could be called "The Tomato Race" or "An Unfair Advantage." All of your information will be displayed on a three-paneled display board. This is a large piece of cardboard (usually 48 x 36 inches [1.2 x .9 m] unfolded) that can stand by itself. You can usually find this cardboard in office supply stores. You can create your own, but make sure it's not bigger than what the science fair allows. On this board you will need to present the following:

- **Title**
- **Problem**
- **Hypothesis**
- **Abstract**
- **Experiment materials**
- **Experimental procedures**
- **Data**
- **Results**
- **Conclusion**

Each section should be computer generated, with the heading of each section big enough to see from a distance. The title should be bigger than the headings. Use stencils or a computer to create the title. Also display photographs of the procedure and results, and create attractive graphs and tables to show your data. For an added visual element to your display, you can cover your display with colored, self-adhesive shelf paper (the displays usually only come in black or white), and then you could place each of your sections on colored construction paper, leaving an attractive border around the edges. You could also use light colored paper to type your sections on. When you're ready, first lay the board on the floor and arrange the information so that it looks good. Get family members or friends to look at it and give advice. Make sure your display doesn't look too

Don't use staples to attach pages to your display board. The boards aren't thick enough, and the points of the staples will come out the back of the board.



Checklists for Science Fair Success

Your Checklist for Success #1:

Choosing a Good Topic

- ☐ I'm interested in my topic and am looking forward to learning more about it.
- ☐ I've researched the topic, interviewed professionals, and read extensively about it.
- ☐ My topic can be narrowed down to a question that can be answered by conducting an experiment.
- ☐ My question is open-ended.
- ☐ I can do most of the work myself in the time allotted.
- ☐ My topic follows all rules and guidelines and won't blow up the kitchen.
- ☐ I have teacher approval.
- ☐ I can get all the materials needed for the experiment (I don't need radioactive space debris or an electron microscope).

Your Checklist for Success #2:

Do I Have a Good Experiment?

- ☐ It's not too difficult.
- ☐ I have only one independent variable.
- ☐ I have a control.
- ☐ I've controlled the environment of the experiment so I can measure the dependent variable and know any differences were caused by the independent variable.
- ☐ I have planned to repeat the experiment more than once to verify my results.

Your Checklist for Success #3:

Writing a Good Report

- ☒ I included a title page that lists the name of the project, my name, grade, and school.
- ☒ I devised a table of contents that lists what's in the report and what page everything's on.
- ☒ I included an abstract, which is a brief, one-page overview of the project. The abstract includes the title and a summary of the purpose, hypothesis, procedure, and results.
- ☒ My introduction states my purpose along with any information that led me to choose this topic.
- ☒ The list of materials and equipment needed for the experiment is included.
- ☒ The step-by-step description of my experiment's procedures, including all variables and how I measured and recorded what happened, is included.
- ☒ All of my data is included, along with all charts and graphs with short written summaries for each one.
- ☐ I have a conclusion that tells how I interpreted my results.
- ☐ My sources, including all written materials, as well as anyone I may have interviewed, are listed.
- ☐ I have an acknowledgments page, stating who helped me and how they helped.

ur Checklist for Success #4:

hat the Judges Look For

-] My project shows original thinking and investigation of an original idea. (You won't get a lot of points for a project that has been done every year for the last 30 years.)
-] My project is well organized.
-] I show that I've used the scientific method and have defined my variables and controls.
-] I did my research and documented it.
-] I used a notebook to collect data and research.
-] I worked carefully on the experiment.
- ☐ I presented my materials to the judges in an organized and knowledgeable way and answered questions accurately.
- ☐ I used tables, graphs, and illustrations in interpreting data.
- ☐ I know what I'm talking about, and I understand the science involved in my experiment.
- ☐ I have a display that's attractive, well labeled, and easily understood.
- ☐ I have a complete and comprehensive report.

If you're typing your project on a computer, don't simply spell-check the document and call it a day. Proofread the entire project and look for errors. Then ask an adult to proofread it. Spelling and punctuation errors make your work look sloppy, and you've worked way too hard to be passed over by a judge because you spelled a few words wrong!

Journals

What are they?

Journals come in many forms and teachers should choose their own way of using them in the classroom. In journals, students undertake an important form of writing in the English classroom - writing to learn. When they write to learn, students attempt to make personal sense of their experience as well as build connections between what they know and new ideas they encounter. This type of writing helps students to construct their own knowledge, develop their thinking and reflect on their learning. It is part of the process by which understanding can be communicated to others in a range of written and oral genres.

Journals range from informal personal journals in which students express their private thoughts to structured learning logs in which students record thoughts, questions and comments about their learning and make plans for future work.

What is their purpose?

This depends on the type of journal the student is using. However, teachers find that using journals are useful in that they

- encourage students to think and articulate their thoughts
- make their learning personal
- support self-exploration and self-discovery
- focus student attention on values, attitudes and ethical issues
- support the key learning processes of negotiation, collaboration and reflection
- improve writing

Learning Logs: These are a form of journal that focuses on work that students are doing in the classroom and generally does not include comments about personal matters. Learning logs work best if teachers respond regularly to what students write, but they require fewer responses than dialogue journals. You should negotiate agreed protocols and structures for the dialogue journal. Insist that students bring the learning log to every lesson and let them know that you will be using their logs as an important method of assessment. Learning logs can be used at various times during lesson or unit of work. For example, you could show the opening credits of a film and ask students make predictions in their learning logs about the events that will occur. At different times during the screening of the film, you could stop and ask students to reflect on what they have viewed and predict future action. At the end, you could ask them to evaluate the film. At various stages during a unit, you could ask students to discuss key questions, reflect on their learning and negotiate new goals. From time to time, you can ask students to swap their learning logs and comment on each others' reflections. The notes students make in their logs can form the basis of an essay they write. Learning logs are an excellent support for class and group discussion. By asking students to reflect on a key question in writing before engaging in discussion, you give all students the opportunity to think carefully before making a response. In this way, more students become involved in the discussion and the discussion tends to be richer.

...e:

Project Title:

Experiment: Undertake an investigation to test a scientific hypothesis by the experimental method.
At least one independent variable is manipulated; other variables are controlled.

	Level 1	Level 2	Level 3	Level 4	Mark
Part A Scientific thought	**Mark: 5 - 15** Replicate a known experiment to confirm previous findings.	**Mark; 15 – 25** Extend a known experiment with modest improvements to the procedures, data gathering and possible applications.	**Mark: 25 - 35** Devise and carry out an original experiment. Identify the significant variables and attempt to control them. Analyse the results using appropriate arithmetic graphical or statistical methods.	**Mark: 35 - 45** Devise and carry out original experimental research in which most significant variables are identified and controlled. The data analysis is thorough and complete.	45
Part B Originality & creativity	**Mark: 5 - 10** Project design is simple with little evidence of student imagination. It can be found in books or magazines.	**Mark: 10 -15** Project design is simple with some evidence of student imagination. It uses common resources or equipment. The topic is a current or common one	**Mark: 15 - 20** Imaginative project makes creative use of the available resources. It is well thought out, and some aspects are above average.	**Mark: 20 -25** Highly original project demonstrates a novel approach. It shows resourcefulness and creativity in the design, use of equipment, construction and/or the analysis	25
Part C Communication The level is based on **three** elements: visual display, oral presentation, and logbook.	**Mark: 5 - 12** Most or all of the three elements are simple, unsubstantial or incomplete. Little evidence of attention to effective communication. In a pair project, one member may have dominated the presentation.	**Mark: 12 - 18** Some of the three elements are simple, unsubstantial or incomplete, but there is evidence of student attention to communication. In a pair project, one member may have made a stronger contribution to the presentation.	**Mark: 18 - 24** All three elements are complete and demonstrate attention to detail and substance. The communication components are each well thought out and executed. In a pair project, both members made an equitable contribution to the presentation.	**Mark: 24 - 30** All three elements are complete and exceed reasonable expectations of a student at this age/grade. Visual display is logical and self-explanatory. Exhibit is attractive and well-presented. Logbook is informative and clearly written. Oral presentation is clear, logical, and enthusiastic. In a group project, both members contributed equitably and effectively to the presentation.	30
Total					100

Name: Project Title:

Innovation: Develop and evaluate new devices, models, theorems, physical theories, techniques, or methods in technology, engineering, computing, natural science, or social science.

	Level 1	Level 2	Level 3	Level 4	Mark
Part A Scientific thought	**Mark: 5 - 15** Build a model or device to duplicate existing technology or demonstrate a well-known physical theory or social/behavioral intervention.	**Mark; 15 – 25** Improve or demonstrate new applications for existing technological systems, social or behavioral interventions, existing physical theories or equipment, and justify them.	**Mark: 25 - 35** Design and build innovative technology; or adapt existing technology to social or behavioral interventions; extend or create new physical theory. Human benefit, advancement of knowledge, and/or economic applications should be evident.	**Mark: 35 - 45** Integrate several technologies, inventions, social/behavioral interventions or design and construct an innovative application that will have human and/or commercial benefit.	**45**
Part B Originality & creativity	**Mark: 5 - 10** Project design is simple with little evidence of student imagination. It can be found in books or magazines.	**Mark: 10 -15** Project design is simple with some evidence of student imagination. It uses common resources or equipment. The topic is a current or common one.	**Mark: 15 - 20** Imaginative project makes creative use of the available resources. It is well thought out, and some aspects are above average.	**Mark: 20 -25** Highly original project demonstrates a novel approach. It show resourcefulness and creativity in the design, use of equipment, construction and/or the analysis.	**25**
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Total					**100**

Name: Project Title:

Study: Analysis, possibly collections of, data using accepted methods from the natural, social, biological, or health sciences. Includes studies of human subjects, biology field studies, data mining, observation and pattern recognition in physical and/or socio- behavioural data.

	Level 1	Level 2	Level 3	Level 4	Mark
Part A Scientific thought	**Mark: 5 - 15** Existing published material is presented, unaccompanied by any analysis.	**Mark: 15 - 25** Existing published material is presented, with some modest analysis and/or a rudimentary study is undertaken that yields limited data that cannot support an analysis leading to meaningful results.	**Mark: 25 - 35** Systematic observations and a literature search. **Quantitative studies** include appropriate analysis of some significant variable(s) using arithmetic statistical, or graphical methods. **Qualitative and/or mixed methods studies** include a detailed description of the procedures and/or techniques used to gather and/or analyse data (e.g. interviewing, observational fieldwork, constant comparative method, content analysis).	**Mark: 35 - 45** Correlate information from a variety of peer-reviewed publications and from systematic observations. Reveal significant new information, or original solutions to problems. Criteria for analysis of significant variables and/or description of procedures/techniques as for Level 3.	**45**
Part B Originality & creativity	**Mark: 5 - 10** Project design is simple with little evidence of student imagination. It can be found in books or magazines.	**Mark: 10 - 15** Project design is simple with some evidence of student imagination. It uses common resources or equipment. The topic is a current or common one	**Mark: 15 - 20** imaginative project makes creative use of the available resources. It is well thought out, and some aspects are above average.	**Mark: 20 -25** Highly original project demonstrates a novel approach. It shows resourcefulness and creativity in the design, use of equipment, construction and/or the analysis	**25**
Part C Communication The level is based on elements: visual display, oral presentation, and logbook.	**Mark: 5 - 12** Most or all of the three elements are simple, unsubstantial or incomplete. Little evidence of attention to effective communication. In a pair project, one member may have dominated the presentation.	**Mark: 12 - 18** Some of the three elements are simple, unsubstantial or incomplete, but there is evidence of student attention to communication. In a pair project, one member may have made a stronger contribution to the presentation.	**Mark: 18 - 24** All three elements are complete and demonstrate attention to detail and substance. The communication components are each well thought out and executed. In a pair project, both members made an equitable contribution to the presentation	**Mark: 24 - 30** All three elements are complete and exceed reasonable expectations of a student at this age/grade. Visual display is logical and self-explanatory. Exhibit is attractive and well-presented. Logbook is informative and clearly written. Oral presentation is clear, logical, and enthusiastic. In a group project, both members contributed equitably and effectively to the presentation.	**30**
Total					**100**

81 / 90