CHS SCIENCE FAIR

2009-2010 SCHEDULE (RESEARCH PHASE)

Th/Fr 9/10-11 **Submit Project Category (Science Only)**

- include a typed paragraph (minimum five sentences) identifying the category you are choosing and explaining why it is of interest to you

Mon/Tu 9/21-22 **Submit Specific Research Topic (Science/English)**

- include a typed one-page essay explaining your reasons for studying this particular topic within your project category

Mon/Tu 10/26-27 **Submit Research Paper Outline (Science/English)**

Monday 11/9 **Submit Rough Draft to Turnitin**

- **submit an electronic copy to turnitin.com on or before this date to your science teacher only (English teacher receives typed copy)**

Monday 11/16 **Submit Final Research Paper (Science/English)**

- submit a typed copy in standard MLA format (i.e. double-spaced with 1 inch margins, and in 12-point Times New Roman font)
- minimum length is **four-plus pages of text (two-plus pages for ninth grade students)** – use of illustrations is encouraged but they do not count as text
- include a title page (in place of the standard heading) and include a header on all subsequent pages
- include a works cited page that cites a **minimum of five "reliable" sources (three for ninth grade students) – one must be a non-electronic print source and one must be an AVL source (Wikipedia will not be allowed as a source)**
- include a bibliography page with a minimum of seven entries (five for ninth grade students)
- **attach a copy of all non-electronic print sources** (i.e. encyclopedia pages, book pages, journal articles) **with referenced passages highlighted to your science teacher only**
- **submit an electronic copy to turnitin.com on or before this date to your science teacher only**

CHS SCIENCE FAIR

2009-2010 SCHEDULE (PROJECT PHASE)

Wed/Th 12/2-3 **Submit Science Project Plan (Science Only)**

- summary of your hypothesis or goal, **all** the materials you anticipate using in your project, and a **detailed** list of the procedure you tentatively plan to use to test your hypothesis or achieve your goal
- **Approval Form (1B)** signed by you and your parents
- **Additional Forms 3, 4, 5A, and/or 6A if project deals with human subjects, vertebrate animals, bacteria, fungi, other potentially hazardous microorganisms, hazardous chemicals, hazardous activities, and/or hazardous devices**
- project plan must be approved in writing by your science teacher by **Monday, December 14**

Mon/Tu 12/7-8 **Submit Corrected Research Paper (Science Only)**

- turn in a corrected, clean copy of your research paper

Mon/Tu 1/11-12 **First Project Notebook Check**

Mon/Tu 1/25-26 **Second Project Notebook Check**

Monday 2/1 **Submit Science Fair Project**

- backboard, project notebook, and any additional notebooks (i.e. binders with surveys or collected tests)

Thursday 2/4 **Catholic High School Science Fair (Attendance is Mandatory)**

- you must wear your school uniform and follow all dress code rules
- props should only be brought to the school for the actual science fair and then brought home after judging
- you must be present for actual assigned judging time slot only – you may leave after your judge finishes talking with you

SPECIFIC SCIENCE FAIR POLICIES

1. The following students are **not** required to do a science project:
    - seniors
    - students enrolled in an AP science course
    - students on the Science Olympiad team (any member kicked off the Science Olympiad team by the Science Olympiad sponsor must do a science fair project)
2. **There will be a grade penalty for any project that does not follow the science fair policies.** This includes not having the appropriate paperwork turned in on time, carrying out unapproved projects, administering unapproved surveys or tests, etc. Please talk to your science teacher if you have questions about any of the science fair forms.
3. **Team projects** involving 2 or 3 members are allowed. However, it is up to their science teacher(s) whether or not they will be allowed to work together on a team project. You need to discuss possible team projects with your science teacher well in advance to get approval to do a team project. Team members can receive different grades based on their notebooks and how much work each member performed.
4. All official science fair forms can be found on the Intel International Science and Engineering Fair website at http://www.societyforscience.org/isef/document/index.asp.
5. All projects involving **human subjects** must follow these rules:
    - You must complete the **Human Subjects Form (4)** and submit it with your project plan.
        - only fill out the top section including questions 1-5
        - Brian Finzel is the adult sponsor (email is bfinzel@chsfalcons.org)
        - **surveys or questionnaires may be submitted at a later date, but they must be submitted for teacher recommendations and be approved prior to passing them out to subjects**
        - check yes for questions 3 and 4 and ignore question 5 unless your project involves any of the activities mentioned in the next bullet
    - The following activities involving human subjects can only be performed if an informed consent form has been signed by all participants (and parents if subjects are under the age of 18) – a sample informed consent form is available at the ISEF website **(Sample Informed Consent Form)**
        - **exercise** other than ordinarily encountered in daily life by that subject
        - **ingestion, tasting, smelling, application of a substance** or exposure to any potentially hazardous materials
        - any activity (i.e. survey, questionnaire) that could result in emotional stress (i.e. questions related to depression or anxiety)
    - Students are prohibited from asking subjects questions related to sexual behavior, drug use, suicide, divorce, personal abuse, personal health problems, etc.

- Confidentiality of subject information must be ensured by:
  - taking careful measures to ensure that the research data and/or responses are not disclosed to the public or unauthorized individuals with identifiable information
  - collecting data anonymously without names or other personal identifiers

6. A good **survey** is primarily dependent on three things – the quality of the survey, the number of people surveyed, and how well the results are analyzed. **You must submit surveys for teacher recommendations before passing out surveys**. Also, be sure to survey a **minimum of 100 people**. A good survey will be given to at least several hundred people, but the number of people needed to survey is dependent on the type and length of the survey. Please ask the teacher for recommendations on an appropriate number of people to survey. Finally, be sure to collect all completed surveys into a 3-ring binder that will be part of your display, and make sure a copy of your survey is on your display board.
7. Any projects involving **human or animal blood, human body fluids**, or unpasteurized animal milk are prohibited.
8. Any projects involving **vertebrate animals** must follow these rules:
   - Studies must involve animals in their natural environment, animals in zoological parks, or livestock using standard agricultural practices.
   - Research must involve agricultural, behavioral, observational, or supplemental nutritional studies on animals.
   - Research must involve only non-invasive and non-intrusive methods that do not negatively affect an animal's health or well-being.
   - Animals may not be captured from or released into the wild.
   - You must complete the **Vertebrate Animal Form (5A)** and submit it with your project plan. Complete questions 1-3 only.
9. Any projects involving **bacteria, fungi, or other potentially hazardous microorganisms** must follow these rules:
   - Experimentation is prohibited in a home environment (specimens can be collected at home as long as they are immediately transported to the CHS laboratory or another approved laboratory).
   - All cultures of unknown microorganisms must be kept in sealed Petri dishes that remain sealed throughout the experiment; these sealed dishes must be given to a CHS science teacher for proper disposal.
   - Experimentation involving known human, animal, or plant pathogens is prohibited.
   - You must complete the **Potentially Hazardous Biological Agents Risk Assessment Form (6A)** and submit it with your project plan. Only complete the top of the form and questions 1-5.
     - The biosafety level risk group (question 1), level of biological containment (question 2), and final biosafety level (question 5) are all **one**.
     - The method of disposal of all cultured materials will include soaking in a bleach solution for 24 hours.
     - Procedures used to minimize risk include sterilization of work surfaces with isopropyl alcohol, as well as use of lab coats and latex gloves.

10. Any projects involving **hazardous chemicals, activities, or devices** must follow these rules:
    - You must complete the **Risk Assessment Form (3)** and submit it with your project plan if you use any of the following materials:
        - **alcohol or tobacco** (a designated supervisor must be responsible for acquisition, use, and disposal)
        - **potato guns**
        - **explosives** including gunpowder, black powder, detonators, and ignitors (must be directly supervised by a science teacher or qualified scientist with the appropriate expertise)
        - **hazardous chemicals** that are highly toxic, reactive, flammable, or corrosive (must be directly supervised by a science teacher or qualified scientist with the appropriate expertise)
        - **lasers**, including laser pointers
    - **You must have a designated supervisor that provides direct supervision** for the project and that helps you complete Form 3 (including their signature)
11. Planning and analysis are vital to a good project. Expect an emphasis on the grading of the materials and methods, analysis, and conclusions sections. These sections should be concise, but **very** thorough.
12. Approximately half the school year is spent developing and completing a science fair project. Therefore, teacher expectations are rather high for this project – it will not be graded like a project completed in two weeks.
13. Use of photographs in your display is highly recommended. Your face **can** be shown in these photographs. Photographs showing you actively working on your project are very beneficial.
14. All data collected during experimentation should be summarized in one or more data tables in your results section. Charts and graphs illustrating the relationships among data points are strongly recommended, but are not a substitute for data tables. Make sure all tables, charts, and graphs are properly labeled with titles, metric measurement units, etc.
15. **Engineering** projects are encouraged. You have a goal rather than a hypothesis that is being tested. However, you do need to test your creation, complete with data collection, data analysis, and conclusions about its performance. Discuss with the teacher ideas on how to best test your creation.
16. **Computer programming** projects are encouraged. Be sure to compile a notebook that contains a complete listing of your program, as well as sample inputs and outputs. Also, be sure to thoroughly analyze and make conclusions about the performance of your program.
17. The CHS Science Fair will have approximately ten categories, depending upon the number of projects in particular categories. Some routine categories may be combined to ensure a good science fair. Qualifiers for the regional science fair will be selected by Mr. Finzel. These selections will be based on anticipated competitiveness at the regional fair. Placement in each category at the CHS fair, including first place, does not guarantee qualification for the regional science fair. In addition, ISEF rules violations can keep excellent projects from being selected to compete at the regional fair.

18. This list of science fair policies includes a simplified summary of rules. A complete list of rules can be found in the Intel International Science and Engineering Fair Rules and Guidelines available online at http://www.societyforscience.org/isef/about/rules_regulations.asp.

SCIENCE FAIR PROJECT TYPES AND CATEGORIES

- **Animal Sciences:** development, ecology, animal husbandry, pathology, physiology, population genetics, systematics, etc.
- **Behavioral & Social Sciences:** clinical & developmental psychology, cognitive psychology, physiological psychology, sociology, etc.
- **Biochemistry:** general biochemistry, metabolism, structural biochemistry, etc.
- **Cellular and Molecular Biology:** cellular biology, cellular and molecular genetics, immunology, molecular biology, etc.
- **Chemistry:** analytical chemistry, general chemistry, inorganic chemistry, organic chemistry, physical chemistry, etc.
- **Computer Science:** algorithms, data bases, artificial intelligence, networking & communications, computational science, computer graphics, software engineering, programming languages, computer systems, operating systems, etc.
- **Earth and Planetary Science:** climatology, weather, geochemistry, mineralogy, paleontology, geophysics, planetary science, tectonics, etc.
- **Energy & Transportation:** aerospace and aeronautical eng., aerodynamics, alternative fuels, fossil fuel energy, vehicle development, renewable energies, etc.
- **Engineering (Electrical & Mechanical):** electrical eng., computer eng., controls, mechanical eng., robotics, thermodynamics, solar, etc.
- **Engineering (Materials & Bioengineering):** bioengineering, civil eng., construction eng., chemical eng., industrial eng., processing, material science, etc.
- **Environmental Management:** bioremediation, ecosystems management, environmental eng., land resource management, forestry, recycling, waste management, etc.

- **Environmental Sciences:** air pollution and air quality, soil contamination and soil quality, water pollution and water quality, etc.

- **Mathematical Sciences:** algebra, analysis, applied mathematics, geometry, probability and statistics, etc.

- **Medicine and Health Sciences:** disease diagnosis and treatment, epidemiology, genetics, molecular biology of diseases, physiology and pathophysiology, etc.

- **Microbiology:** antibiotics, antimicrobials, bacteriology, microbial genetics, virology, etc.

- **Physics and Astronomy:** atoms, molecules, solids, astronomy, biological physics, instrumentation and electronics, magnetics and electromagnetics, nuclear and particle physics, optics, lasers, masers, theoretical physics, theoretical or computational astronomy, etc.

- **Plant Sciences:** agriculture/agronomy, development, ecology, genetics, photosynthesis, plant physiology (molecular, cellular, organismal), plant systematics, evolution, etc.

PROJECT NOTEBOOK

1. The project notebook should contain **everything** relevant to your project. This includes but is not limited to initial plans about the materials and methods, ideas or notes related to your project, actual procedures as they are done, all collected data, any preliminary/final results and conclusions, etc. A project notebook can never be too long or too thorough.

2. Each entry should have a date.

3. You can tape items into the notebook (i.e. structural diagrams off the internet).

4. A well kept notebook is a gold mine. The information for the backboard can be typed on the computer directly from your notebook and then edited.

CHS SCIENCE FAIR EXTRA CREDIT

Students with Mandatory Projects

- Place (1st, 2nd, or 3rd) at CHS Fair: 5 points added to science fair grade (based on a 100 point scale)
- Honorable Mention at CHS Fair: 3 points added to science fair grade (based on a 100 point scale)
- Regional Qualifier: 2 Points added to both 3rd and 4th quarter final averages
- State Qualifier: 4 Points added to both 3rd and 4th quarter final averages
- ISEF Qualifier: 6 Points added to both 3rd and 4th quarter final averages

Note: extra credit earned by qualifying for regional or subsequent fairs is accumulated in addition to extra credit earned by placing at CHS fair

Students with Optional Projects
(points added to both 3rd and 4th quarter final averages)

- CHS Fair Award Winner (at least Honorable Mention): 2 Points
- Regional Qualifier: 4 Points
- State Qualifier: 6 Points
- ISEF Qualifier: 8 Points

SCIENCE RESEARCH PAPER
GRADING WORKSHEET

Student Name: _____ **Total Points:** _____

1. Structure (40 points)
- focus of paper is on science and/or technology rather than on historical facts
- thesis statement is clearly stated and appropriately focused (not too narrow or broad)
- material is presented in a logical, sequential order
- good sentence/paragraph structure is utilized
- grammar, spelling, and punctuation errors are limited
- title page is properly utilized _____

2. Sources: Quality (15 points)
- sources selected are reliable
- sources selected are understandable to the typical high school student
- sources selected are all relevant to the main topic
- strong evidence of research is apparent in the type and amount of sources
- minimum of three sources are cited within the body of the paper
- minimum of five sources are included in the bibliography
- at least one print and one AVL source are cited in the paper _____

3. Sources: Utilization (30 points)
- sources are properly integrated into each paragraph and a single source is not overused
- all material directly relates to the thesis statement
- an understanding of material is properly demonstrated
- quotes are not over-utilized (15% or less is reasonable) _____

4. Citations/Bibliography (15 points)
- parenthetical documentation is properly used throughout the paper
- Works Cited page is properly formatted and only includes cited sources
- Bibliography page is properly formatted _____

5. Automatic Deductions
- 10 points for each day late
- 5 points for each quarter page short of minimum required length
  (10 points for ninth grade students) _____

PROJECT DISPLAY

GENERAL RULES

1. The backboard can be any color and can be made of any nonhazardous material, such as foam, wood, cardboard, etc.

2. Backboards must be able to stand on their own, without any additional support.

3. No live animals, bacteria, or other organisms may be displayed; however, live plants may be displayed. Also, you may not display taxidermy specimens, preserved animals, human/animal parts or body fluids (except teeth, hair, nails, dried animal bones, and microscope slides), waste samples, poisons, drugs, controlled substances, hazardous substances or devices, dry ice or other sublimating solids, sharp items, flames or highly flammable materials, batteries with open top cells, awards, medals, business cards, accomplishments, addresses, phone and fax numbers, or photographs or other visual presentations depicting vertebrate animals in other-than-normal conditions.

4. The project notebook and research paper should be displayed in front of the board. If you handed out any type of survey or test, all collected surveys or tests should be placed in a separate three-ring notebook. In addition, a copy of the survey or test should appear on the backboard.

5. Put your name on the **back** of the backboard. **Your name and the school's name must not appear on the front of the backboard.**

6. Material on the board should be typed, and spelling, grammar, and punctuation should be checked.

7. Only displays completed during the present school year are accepted. Improvements of exhibits, using some of the basic parts, are permitted. You may exhibit research on a continuing problem provided the research shows significant progress when compared with the previous year. Differences in research over more than one year must be clearly delineated.

8. All exhibits must be constructed by the student. Parents or sponsors may supervise and/or assist, but must not perform the research for or the construction of an exhibit.

BACKBOARD SET-UP

1. The **title** should be capitalized, centered, and large enough to be read from 10 feet away. It can be on the board or on a strip resting across the top of the board. The title should be clear, concise, specific, and descriptive of the project.

2. On the top left side, begin with your **ABSTRACT**. Label it "ABSTRACT", in capital letters large enough to be read 3 feet away. The abstract itself should be typed in any size that is easy to read and should be mounted below the "ABSTRACT" heading. The abstract is a short summary of the entire project. It should consist of about 5 to 7 sentences, be written as one paragraph, and contain the following four parts:
    1. What you set out to discover
    2. Short summary of your procedure
    3. Short summary of your results
    4. Short summary of your conclusions (was your hypothesis correct and how can you apply what you learned from your results)

3. Below the abstract should be the **HYPOTHESIS** (or GOAL). Give it the same type of heading as the abstract. Mount the hypothesis below its heading and check carefully for spelling and punctuation. Your hypothesis (or goal) should be written in first person and future tense. It consists of the following parts:
    1. The question you set out to answer (or the goal you set out to achieve) – state this question directly and concisely, and don't forget your question mark
    2. Your hypothesis or answer to the question

4. "**MATERIALS AND METHODS**" come next. **Do not** list materials separately. Mention them as they are needed in the steps of your procedure. Be very detailed in your procedure – write it so that another person could follow your procedure **exactly** to see if they get the same results. The following are some important additional points regarding the materials and methods section:
    a. Number your steps (1., 2., 3., etc.).
    b. Start each step of your procedure on a separate line.
    c. Use second person command sentences (i.e. Place 5mL of water in a 50mL beaker).
    d. Include all materials you used and how much of each material you used.
    e. Mention what apparatus you were using, including a diagram, if necessary.
    f. Be sure to mention how many subjects (people, organisms, etc.) were in each group and how many times a trial was repeated. Insufficient subjects or trials are major flaws.
    g. include the underlined scientific name of any uncommon biological specimens (i.e. <u>Clematis morefieldii</u>).

5. In the center portion of the board, mount your **RESULTS** section. Label it clearly "RESULTS". Use data tables, supplemented by graphs or charts, whenever possible. Include photographs or drawings. Be sure to give your graphs and tables specific, descriptive labels and titles. Label all units very, very clearly. **Use metric units only!** If you have too much data to mount on the board, mount summarizing and important data, and put the rest in a notebook or folder on the table in front of the backboard. If you collected qualitative data, include your descriptions and observations.

6. The right wing of the backboard starts with the **ANALYSIS** section. This should be a short summary of your findings. What patterns or relationships can be deduced from the data? What were your controlled and experimental variables? Be sure to summarize the data in each table, graph, chart, etc.

7. The **CONCLUSIONS** section should be mounted below the analysis section. This section should consist of the following four parts:
    1. State whether your hypothesis was correct or incorrect.
    2. Explain why your hypothesis was correct or incorrect (if your hypothesis was incorrect, that is not a problem – the goal of science is to learn new things, not to win a guessing contest).
    3. State any conclusions you formed from your data other than those that answer your hypothesis, and what in your "results" brought you to these conclusions.
    4. Describe at least one way in which your project could be improved, expanded, or changed in the future, and state why this change would be advantageous.

ORAL PRESENTATION TO JUDGES

1. Be prepared to give a three to five minute speech to the judge. It should include what you did, your results, what you learned, what conclusions you formed from doing this project, and how you might improve or continue with this topic in future experiments. You will have a 15-minute time slot with the judge. The remainder of this time will be spent answering questions the judge has about your project. It is unlikely that the judge will spend a full 15 minutes talking with you.

2. Talk naturally about your project. Practice giving your oral presentation to your parents or friends before presenting it to the judge.

3. Be prepared to answer questions about your project. Know the strengths and weaknesses of your project and be prepared to answer many of the questions you anticipate being asked. Be especially ready to explain how you prepared your display, including all tables and graphs. The judge wants to know that you, and not your parents, did this work.

CATHOLIC HIGH SCHOOL SCIENCE FAIR
JUDGES/GRADING WORKSHEET

Student Name: _____ **Total Points:** _____

A. Creative Ability (20 points)

1. The problem is original or is a unique approach to an old problem ……1 2 3 4 5 6 7 8 9 10
2. Equipment, use of materials, collection of data, analysis of data, and interpretation of data show originality ……..1 2 3 4 5 6 7 8 9 10

Creative Ability Total _____

B. Scientific Thought (30 points)

3. Scientific procedures are appropriate and organized, with variables carefully identified and properly controlled ……..1 2 3 4 5 6 7 8 9 10
4. Recording of data and analysis of data and results show scientific thought ……...1 2 3 4 5 6 7 8 9 10
5. Conclusions are logical and based on the data collected ……..1 2 3 4 5 6 7 8 9 10

Scientific Thought Total _____

C. Thoroughness (20 points)

6. The project shows depth of study and effort, including a thorough, well-organized project notebook ……..1 2 3 4 5 6 7 8 9 10
7. The study is complete within the scope of the problem, experiments have been repeated, and sample sizes are appropriate ……..1 2 3 4 5 6 7 8 9 10

Thoroughness Total _____

D. Skill (10 points)

8. Skill is evident in design of experiment, use of equipment, collection of data, and observations ……..1 2 3 4 5 6 7 8 9 10

Skill Total _____

E. Clarity (20 points)

9. The methods of experimentation, data collection, and analysis are clearly designed ……..1 2 3 4 5 6 7 8 9 10
10. The project display is well organized and effectively explains the project ……1 2 3 4 5 6 7 8 9 10

Clarity Total _____

SCIENCE FAIR IDEAS

Animal Sciences

- Associating stimuli with rewards and punishments in animals (i.e. bell with food)
- Best conditions for raising brine shrimp (i.e. salinity, temp.)
- Observation of conditioned responses in animals
- Learning and perception in animals
- Factors affecting the rate at which a cricket chirps
- Observation of insect or animal behavior versus population density
- Observations of urban wildlife
- Reaction of ants to a food shortage
- Nutritional preferences of ants, fruit flies, etc.
- Attraction of mosquitoes to skin chemicals
- Effect of magnetic and electric fields on insects
- Effect of color on attracting insects and animals
- Best conditions for hatching chicken eggs
- Bird seed preferences of various bird species
- Feeding behavior of birds (time, food, etc.)
- Effect of temperature and pH on the growth of tadpoles
- Effect of phosphates on fish
- Territoriality of fish and other animals
- Factors affecting ability of mice to run a maze (i.e. music)
- Effect of artificial lighting on sleeping habits
- Effect of soil pH on earthworms
- Analyze ant trails for patterns and clues to their behavior
- Compare ant speeds on various surfaces

Behavioral and Social Sciences

- Learning and perception in humans
- Memory span and memory retention
- Effect of age on learning ability
- Audio versus visual learning
- Effect of sex on ability to estimate object sizes
- Effect of sex on color preference in clothing
- Sex differences in body language
- Sex comparison of teenage values
- Effect of age on response time
- Measure the effect of peer pressure
- Examination of issues affecting teenagers
- Effect of sex on planned career choices
- Comparison of rewards versus punishments as methods of controlling behavior

- Effect of study habits on test performance (i.e. cramming)
- Sex differences in short-term memory skills
- Effect of background music on memory
- Effect of nutrition on test scores (i.e. breakfast, snacking before an exam)
- Effect of sleep on test scores
- Relationship between letter size (font size) and reading comprehension
- Comparison of methods of memorizing information
- Accuracy of room temperature judgement
- Effect of distance on the apparent brightness of a light source
- Factors affecting attention span
- Accuracy of eyewitness accounts
- Studies of ethnic biases
- Studies of urban problems
- Effect of scents on memory
- Effects of birth order on personality

Biochemistry

- Factors affecting enzyme reaction rates (pH, temperature, concentration)
- Inhibition of enzyme reactions by various inhibitors
- Best conditions for gel electrophoresis
- Comparison of starch content of various vegetables
- Factors affecting the rate of reaction between rennin and milk

Chemistry

- Factors affecting crystal growth rates and crystal sizes
- Observation of freezing rates of water for different starting temperatures
- Effect of solutes on the freezing point and boiling point of water
- Effect of temperature on viscosity of oil, molasses, syrup, etc.
- Effect of concentration on viscosity of molasses, syrup, etc.
- Comparison of homemade perfumes
- Comparison of flammability of various materials
- Effect of sunlight and heat on dyes used in colored paper
- Effect of air humidity on the rate of paint drying
- Effect of salt and other contaminants on rate of rusting
- Effect of impurities on crystal growth and formation
- Effect of swimming pool water (with chlorine) on swimsuit fabrics
- Effect of solutes on the conductivity of water
- Comparison of storage methods to prevent freezer burn
- Effect of heat on adhesiveness of glues
- Factors affecting temperature of a candle’s flame
- Factors affecting how long a candle burns
- Effect of color on the ability of a liquid to absorb heat
- Effect of air flow on the evaporation of water

- Factors affecting the bouyancy of materials (i.e. coke cans)
- Effect of temperature on the volume of materials
- Effect of temperature on the rate of chemical reactions
- Chemical reactions that produce or give off considerable amounts of heat
- Best conditions for specific chemical reactions
- Effect of acids on different metals under different conditions
- Best substances for melting ice
- Best substances for absorbing water from the air
- Measure calorie content of foods using a calorimeter and compare to reported data

Computer Science

- Storage/retrieval techniques for computer systems
- Handling of data transfer between I/O devices
- Data manipulation and information management techniques and procedures
- Educational applications of the computer
- Compiler design
- Computer simulations
- Developing a video game
- Comparsion of effectiveness of WWW search engines
- Develop a program which administers and grades tests
- Linux clusters and parallel processing
- Factors affecting wireless internet signal strength
- Develop an algorithm to solve a multivariable problem like class scheduling

Earth and Planetary Science

- Observational orbit determination of planets
- Effect of solar activity on radio propagation
- Observations of experimentally induced seismic waves
- Methods of controlling erosion
- Fossil studies in limestone and other rocks
- Observations of fluctuations in stream flow following rain
- Comparison of soil types in their ability to absorb and retain water
- Use of internet weather data to predict local weather conditions
- Effect of wind speed on the temperature of an object
- Effect of weather conditions on lake and pond water levels
- Effect of building shape on wind forces measured in a wind tunnel
- analyze internet climate and weather data for patterns

Energy and Transportation

- Build a generator that uses wind as a power source
- Efficient design of a windmill

- Design and construction of a wind tunnel for aerodynamic testing
- Construction of a magnetically levitated train
- Construction of a hovercraft
- Construction of a solar collector
- Design of a model rocket to improve thrust and maximum height
- Production of electrical energy from mechanical sources

Engineering: Electrical & Mechanical

- Design considerations for solar heated homes
- Design and construction of simple electrical circuits
- Construction of a personal computer
- Effect of regular maintenance on car engine performance
- Design and construction of simple robots

Engineering: Materials & Bioengineering

- Comparing insulating properties of materials
- Effect of sunlight on rubber
- Ability of various surfaces to retain and reflect heat
- Comparison of bridge designs using toothpicks or popsicle sticks
- Effective methods of protecting a raw egg dropped from a designated height
- Methods for improving strength of wooden beams
- Effect of temperature on the strength of rubber bands
- Comparison of new materials for use in dance shoes
- Computer analysis applied to bridge design
- Determine the effectiveness of windshield reflectors in keeping a car cool in the sun
- Compare tensile strength of paper and recycled paper under various conditions

Environmental Management

- Effective methods of composting
- Study of local recycling methods and suggested improvements
- Effective methods of flood control
- Effects of deer population control on endangered plant species
- Effect of dams on biological diversity

Environmental Sciences

- Effect of phosphate detergents on pond water oxygen levels
- Effect of chemical fertilizers on growth of pond water algae
- Chlorine concentrations in local drinking water supplies
- Effect of water pollutants (animal wastes, fertilizers) on growth of bacteria

- Fertilizer concentrations and pH of local water samples
- Effect of CO_2 and methane concentrations on temp. of an enclosed environment

Mathematical Sciences

- Age comparisons of height distribution (mean, median, and range)
- Comparison of real-world variation in processes to normal distribution (bell curve)
- Effect of sample size on statistical accuracy
- Use of statistics to predict contents of consumer products (i.e. M&Ms)
- Comparison of various coins to predicted 50-50 probability of tossing a head
- Probability applied to lotteries and other real-life situations
- Numerical analysis of patterns in music

Medicine and Health Sciences

- Distribution on skin of nerves responsive to heat, cold, pain, etc.
- Relationships between fingerprints in a family
- Relationships between fingerprints on an individual's fingers
- Effect of vision and smell on the sense of taste
- Effect of exercise on body temperature
- Variation of pulse rate during the day
- Exercise and post-exercise pulse rate studies of athletes and non-athletes
- Exercise and post-exercise pulse rate studies of people of various ages
- Blood pressure comparisons among different groups
- Effect of jet lag on performance of professional sports teams
- Sex comparison of size of visual blind spot
- Comparison of sense of smell among different groups
- Family studies of inheritance patterns
- Effect of sex on peripheral vision
- Effect of stretching on athletic performance and injury prevention
- Changes in body temperature during sleep

Microbiology

- Factors affecting the growth of bacteria and molds
- Best conditions for growing mushrooms
- Reaction of protists to pH, light, and temperature conditions
- Methods of preventing mold growth on foods
- Comparison of mouthwashes on control of oral bacteria
- Comparison of antibiotic soaps
- Effectiveness of handwashing and alcohol swabbing on eliminating bacteria
- Effectiveness of various tile cleaners in killing shower mold
- Comparison of bacterial concentrations in different poultry samples
- Effect of magnetic and electric fields on bacteria

- Effect of microwave radiation on bacteria
- Effect of light and temperature on bread mold growth
- Effect of microwave radiation on bread molds
- Comparison of bacterial concentrations in drinking fountains
- Effectiveness of household products in inhibiting bacterial growth
- Comparison of bacterial concentrations on wash cloths versus sponges
- Comparison of bacterial concentrations in milk with different expiration dates
- Best conditions for growing bacteria
- Comparison of media used to grow bacteria
- Isolation of antibacterial-resistant bacteria
- Effect of natural substances on bacterial and mold growth

Physics and Astronomy

- Effect of temperature on electrical resistance
- Factors affecting sound propagation and dampening
- Index of refraction of liquids versus temperature or concentration
- Effect of magnetic fields on recording mediums (i.e. tapes, disks)
- Effect of mass and shape on speed with which an object falls
- Effect of angle of a ramp on speed of a rolling ball
- Measuring mechanical advantage to using a ramp or wedge to raise objects
- Estimating force of gravity
- Comparison of lubricants in reducing friction
- Comparison of ability of suction cups to stick to various substances
- Effect of scuffing on the flight of a baseball
- Effect of bat weight and swing speed on how far a baseball can be hit
- Factors affecting the bounce of a dropped ball (i.e. basketball)
- Comparison of frisbee size and shape for long distance throwing
- Effect of heat on a recording tape
- Factors affecting the period of a pendulum
- Effect of aperture size on the resolution of a camera picture
- Effect of shutter speed on the brightness of a camera picture
- Effect of electromagnet coil characteristics on the strength of a magnetic field
- Shielding of magnetic fields with various materials
- Factors affecting the vibrations of strings
- Comparison of parachute shapes
- Determine and compare appliance power usage to reported values

Plant Sciences

- Effect of soil type on plant growth
- Effect of soil characteristics on plant growth
- Plant tropisms (movements in response to gravity, light, and touch)
- Effect of plant hormones on plants
- Fruit ripening (caused by a gaseous hormone which diffuses through the air)

- Transpiration (water loss) rates under different conditions
- Factors affecting seed germination (temperature, moisture, light, density, etc.)
- Factors affecting flowering
- Factors affecting root formation in plant cuttings (fertilizer, hormones, temp., etc.)
- Effects of nitrates, phosphates, and potassium on plant growth
- Effect of salt on plants
- Effect of electric and magnetic fields on plants or seeds
- Effect of radiation on seeds
- Effect of various fertilizers on plant growth
- Factors affecting vegetative reproduction
- Study of plants in a given area
- Effect of population density on plant growth
- Effect of temperature on plant growth
- Impact of ground up food waste as a fertilizer
- Effect of insecticides on plant germination and growth
- Hydroponics (growing plants in water solutions)
- Comparison of additives to best preserve cut flowers
- Comparison of drought resistance of various grasses
- Comparison of water content of fruits and vegetables
- Effect of electrical stimulation on seed germination
- Effect of increased carbon dioxide levels on plant growth

Tables in Microsoft Word

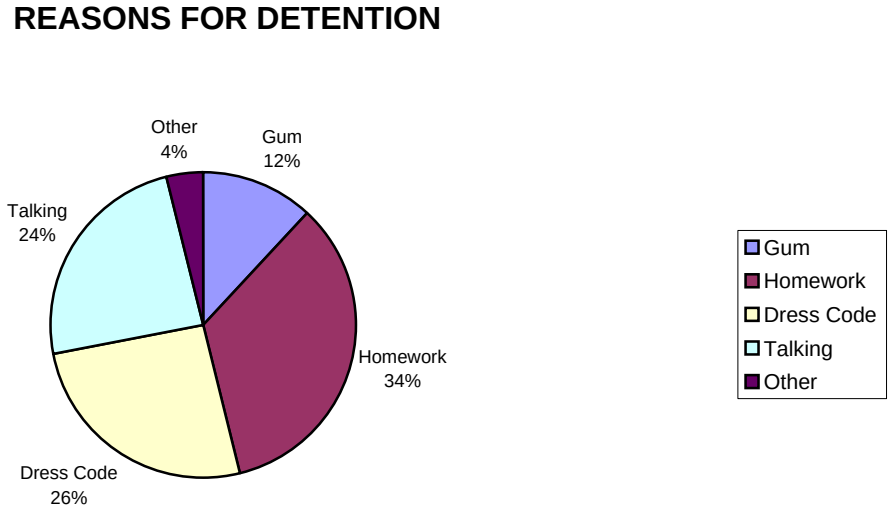
1. Type a descriptive title in large font, center it, and then skip a line.
2. Click on Table. Then click on Insert (Table).
3. Choose the number of columns and rows you want.
4. Place headings in the appropriate columns. Boldface and center the headings. Be sure to label all units.
5. Enter data. Center the data in each cell.
6. To adjust column/row height, click and drag column/row lines.
7. To add more columns or rows, click on Table and then Insert (Columns/Rows).

AVERAGE TEMPERATURE CHANGE OF VARIOUS MATERIALS

Material	Initial Temp. (°C)	Final Temp. (°C)	Temp. Change (°C)
Nylon	25.6	67.8	42.2
Steel	26.2	99.3	73.1
Iron	25.4	91.2	65.8
Glass	24.1	38.1	14.0
Rubber	26.0	57.6	31.6
Foam	24.5	36.3	11.8

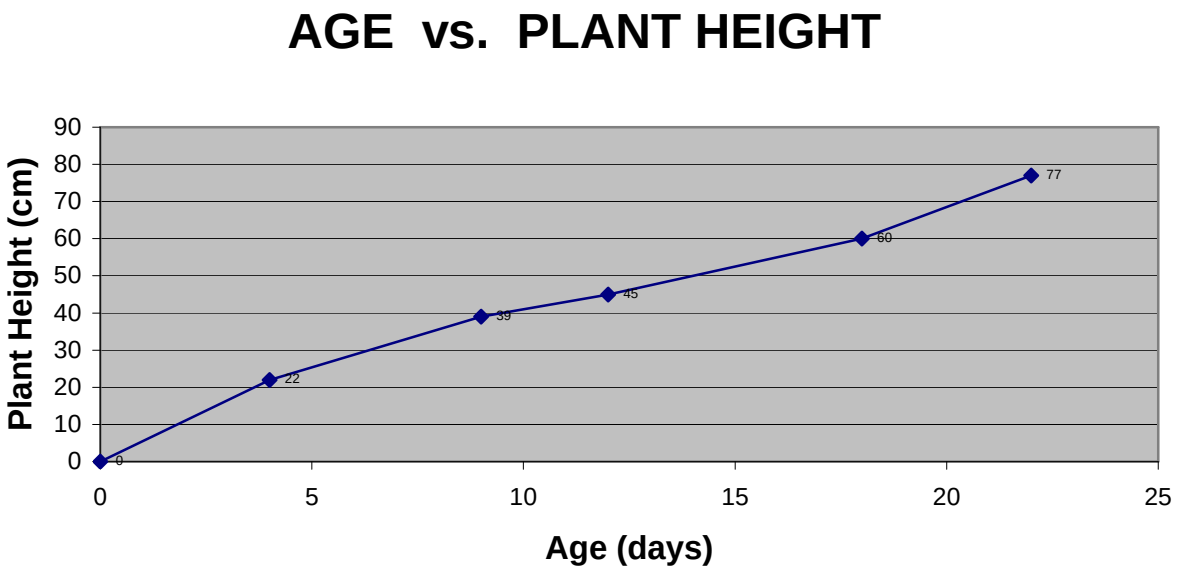
Pie Charts in Microsoft Excel

1. Insert your list of categories in Column A. Insert your corresponding percentages or values in Column B.
2. Click on Insert. Then click on Chart.
3. Click on Pie for chart type.
4. Double click on the 1st chart sub-type. This is the simplest pie chart, but you may find others more useful.
5. Click on Next twice.
6. Under Titles, insert an appropriate chart title.
7. Under Legend, you can remove or adjust the location of the legend.
8. Under Data Labels, you can label your pie chart with your percentages or values (from Column A).
9. Click on Next.
10. Place chart as new sheet. Click on Finish.
11. To make changes once done, click on Chart and the items under Chart.
12. To size the chart, click on File and then on Page Setup. Under Chart, click on either Use full page or Scale to fit page.
13. To adjust title size or font, right click on the title and click on Format Chart Title. Adjust the font size and style as necessary.
14. To add color outside your chart, right click outside your chart and then click on Format Chart Area. Under Patterns, you can select custom borders to add or change colors.



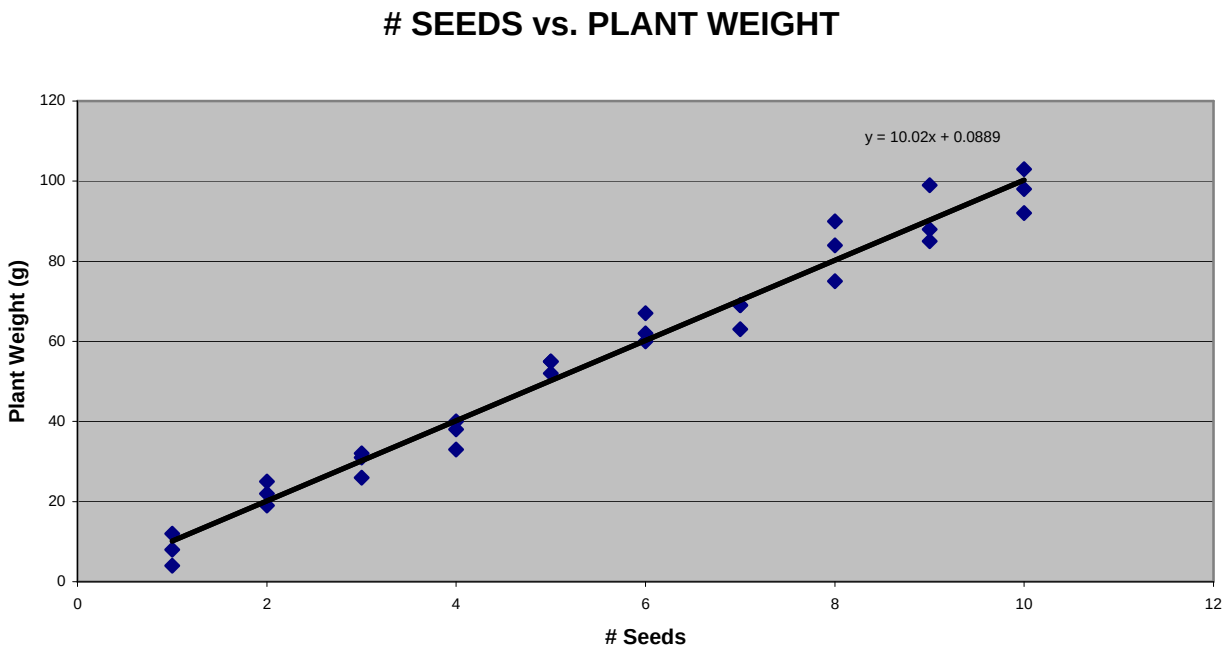
Line Graphs in Microsoft Excel

1. Insert X data in Column A and the corresponding Y data in Column B.
2. Click on Insert. Then click on Chart.
3. Click on XY (Scatter) for chart type.
4. Double click on the last chart sub-type in the first column. This is the simplest way to make a line graph, but you may find others more useful.
5. Make sure Series is in columns (not rows). Also, make sure Data range is from $A$1:Bn (where n equals your number of rows of data).
6. Click on Next.
7. Under Titles, insert an appropriate chart title, X-axis label (value X axis), and Y-axis label (value Y axis). Be sure to include units in parentheses after your labels.
8. Under Axes, you can eliminate or adjust your axes labels. (Leave this alone.)
9. Under Gridlines, you can adjust the gridlines on your graph.
10. Under Legend, you can remove or adjust the location of the legend. Click on Show legend to remove the legend (it is inappropriate for most line graphs.)
11. Under Data Labels, you can label your X-axis or Y-axis values. Click on Show value (assuming it looks good for your graph).
12. Click on Next.
13. Place chart as new sheet. Click on Finish.
14. To make changes once done, click on Chart and the items under Chart.
15. To see if your data fits a mathematical pattern, click on Chart and then click on Add Trendline. Select Type and double-click on the trendline that looks appropriate (if any). If you select Options, you can display the equation on your chart, among other options. To remove a trendline, right click on the trendline and click on clear.
16. To size the chart, click on File and then on Page Setup. Under Chart, click on either Use full page or Scale to fit page.
17. To adjust title/label sizes or fonts, right click on a title or axis and click on Format Chart Title or Format Axis Title. Adjust the font size and style as necessary.
18. To add color to your chart, right click on your chart and then click on Format Chart Area or Format Plot Area. Under Patterns, you can select custom borders to add or change colors.



Scatter Plots in Microsoft Excel

1. Insert X data in Column A and the corresponding Y data in Column B.
2. Click on Insert. Then click on Chart.
3. Click on XY (Scatter) for chart type.
4. Double click on the 1st chart sub-type. This is the simplest scatter plot, but others are useful too.
5. Make sure Series is in columns (not rows). Also, make sure Data range is from $A$1:Bn (where n equals your number of rows of data).
6. Click on Next.
7. Under Titles, insert an appropriate chart title, X-axis label (value X axis), and Y-axis label (value Y axis). Be sure to include units in parentheses after your labels.
8. Under Axes, you can eliminate or adjust your axes labels. (Leave this alone.)
9. Under Gridlines, you can adjust the gridlines on your graph.
10. Under Legend, you can remove or adjust the location of the legend. Click on Show legend to remove the legend (it is inappropriate for most scatter plots.)
11. Under Data Labels, you can label your X or Y-axis values. This is usually not done for scatter plots.
12. Click on Next.
13. Place chart as new sheet. Click on Finish.
14. To make changes once done, click on Chart and the items under Chart.
15. To see if your data fits a mathematical pattern, click on Chart and then click on Add Trendline. Select Type and double-click on the trendline that looks appropriate (if any). If you select Options, you can display the equation on your chart, among other options. To remove a trendline, right click on the trendline and click on clear.
16. To size the chart, click on File and then on Page Setup. Under Chart, click on either Use full page or Scale to fit page.
17. To adjust title/label sizes or fonts, right click on a title or axis and click on Format Chart Title or Format Axis Title. Adjust the font size and style as necessary.
18. To add color to your chart, right click on your chart and then click on Format Chart Area or Format Plot Area. Under Patterns, you can select custom borders to add or change colors.



Bar Graphs in Microsoft Excel

1. Insert your first set of bar heights in Column A. Further sets of bar heights go in Columns B, C, D, etc. If you want your X-axis to display names, dates, times, etc., place these in Column A. Place your bar heights in Columns B, C, D, etc.
2. Click on Insert. Then click on Chart.
4. Click on Column for chart type.
5. Double click on the 1st chart sub-type. This is the simplest bar graph, but you may find others more useful.
6. Click on Next.
7. Under Series, insert the name for each series of bars.
8. Click on Next.
9. Under Titles, insert an appropriate chart title, X-axis label (category X axis), and Y-axis label (value Z axis). Be sure to include units in parentheses after labels as appropriate.
10. Under Axes, you can eliminate or adjust your axes labels. (Leave this alone.)
11. Under Gridlines, you can adjust the gridlines on your graph.
12. Under Legend, you can remove or adjust the location of the legend.
13. Under Data Labels, you can label your bar values. Click on Show Value (assuming it looks good for your graph).
14. Under Data Table, you can show your data table under your graph. (A separate data table made in WORD generally looks better and is easier to deal with.)
15. Click on Next.
16. Place chart as new sheet. Click on Finish.
17. To make changes once done, click on Chart and the items under Chart.
18. To size the chart, click on File and then on Page Setup. Under Chart, click on either Use full page or Scale to fit page.
19. To adjust title/label sizes or fonts, right click on a title or axis and click on Format Chart Title or Format Axis Title. Adjust the font size and style as necessary.
20. To add color to your chart, right click on your chart and then click on Format Chart Area, Format Walls, or Format Floor. Under Patterns, you can select custom borders to add or change colors.
21. To adjust bars, right click on a bar and then click on Format Data Series. Under Patterns, you can select custom borders to add or change colors for that set of bars. Under Options, you can adjust the space between bars.
22. To adjust the X-axis, including values, right click on an X-axis value. Click on Format Axis. If you click on Number, you can select text, date, or time to show these under your bars. It will use your Column A data as labels.

PLANT HEIGHTS AS A FUNCTION OF SALTWATER CONCENTRATION