

## **Advanced Research 10 (9624)**

### **Mathematics, Science & Social Science**

#### **Mathematics/Computer Science**

**Mr. Chae      emailchae@gmail.com**

Mathematics research can be an exciting and rewarding experience for students. Students will have an opportunity to explore one or two topics in great depth and to experience the thrill of making discoveries and analyzing problems that may never have been examined before.

Problem solving skills and mathematics research are closely related. It is not possible to do mathematical research without spending time doing mathematics. It is expected that each student participating in this program will also involve themselves in the math contests offered to high school students such as the NCIML, MYML, and the MAA sponsored exams. Success on these exams may not be directly correlated to success in research in that these exams are timed and favor the quick thinkers. However, they present problems that encourage initiative and often require a variety of skills that can only be learned after spending time analyzing the problems days later.

In addition to the mathematics competitions, each student is required to participate in the Al Kalfus Long Island Math Fair held each year at Hofstra University.

Research implies a commitment to an area of study beyond the standard classroom obligations. The rewards received by students who perform in depth research projects are far greater than the grades, medals, and plaques awarded at the end of the year. To become an expert in one small area of knowledge requires devotion as well as time. You must want to learn everything there is to know about your topic in order to do a genuinely fine job. The skills that are developed in the process of doing research will be with you for the rest of your life.

Selecting a topic is not only the first step in doing research but it is also the most critical step. Your topic should allow you to examine material that interests you. It is critical to select an area of mathematics that will hold your attention. If, in your math career, you have never asked your teacher or yourself why some particular theorem is true, or how did someone arrive at their particular conclusion, then this is the time to start asking those questions. Research is a class designed for the inquisitive student, the student who wants to know why things work the way they do, or how things relate to each other.

You do not have to be a powerful mathematician to make great observations in mathematics. Once you make the observation you begin your research to see if anyone else ever noticed the same thing you just noted. You will be surprised at how many ideas you have that went unnoticed for centuries. All of the fundamentals have not been discovered yet. Putting two preexisting ideas together in a new way is the foundation for a thesis. Proving an existing

theorem using a different approach from the previous method can also be the basis for a paper. Listen carefully in your math class and I guarantee that every day you will walk away with an unanswered question or thought that begins with “I wonder what would happen if...”. This is where your study begins. Of course you need to have your topic approved by your teacher. My job is to determine if there is enough material available and if it is at an appropriate level for you. Therefore, think of your presentation of your topic to me as your first challenge. You must come in the first day of class with at least two or three viable topic ideas. Try to prove to me that your topic is of interest to you and that you are capable of performing an in depth study to learn about your selected area. You will be working on this project for a minimum of seven months.

You will need to prove to me that you are actively involved in the process of choosing a topic. This means that every week you must do some mathematical reading and writing. Select two articles and write a one-page summary of each one. A summary means exactly that. Read the article and then write the paper in your own words. Do not quote unless necessary. Reorganize the paper so it appears very different than the one you read. Make the written paper yours. Watch out for plagiarism. The articles may be found in mathematics journals, magazines, sections or chapters of mathematics texts, in newspapers, or excerpts downloaded from the internet. Include all pertinent documentation relative to the source of the article. If an internet page was the basis for your paper, print out the entire section or pages from the website and include it as an addendum to your paper. Read each article with thoughts about how you might extend the topic. Ask yourself if you would be interested in learning more about the subject matter. If the author left you with some unanswered questions would you like to do research to discover those answers? Be sure to include these remarks in your summaries. Remember, as you read the articles, you are searching for a main area of study that will keep your interest at an optimum level for many months.

Any student involved in research should realize that the role of the teacher is very different than in other classes. My role is that of facilitator. Although I will be making presentations in class, these are designed to generate excitement and enthusiasm for the study of mathematics not just for you to go home and learn the material presented. I would like to share my passion for mathematics and to have you walk away thinking deeply about what you just heard in class. If you become engrossed in what you hear and would like to learn more about a topic then you have a potential research project.

Finally, a word about grades, your ultimate project and presentation at the Al Kalfus Math Fair in March and April, is the final measuring tool. You will however need to receive grades for first two quarters before that time. Therefore, for the first two marking periods, the following will be used to determine success in the course. Your initial weekly summaries must be of appropriate depth and handed in on time. Once you choose a topic and begin to hand in a weekly report of what you read and learned, you will continue to receive grades based upon the following: development of the topic, interest displayed, and knowledge of the new material. You will be asked to sit down with me near the end of each marking period to keep me apprised of how your

research is going and at that time we will discuss the current status of your grade. Your marking period grades will be determined using the rubric: quality of work produced, timeliness, and class participation.

“Mathematics possesses not only truth, but also supreme beauty” *Bertrand Russell*. I hope you find this to be the most exhilarating, enjoyable, and rewarding course you have ever taken. I know that it can be. All it takes is your commitment to do the best that you are capable of doing.

Summer Assignments:

- 1) By July 1<sup>st</sup>, fill out the Google Form by clicking on the [LINK](#) or <https://goo.gl/QxiqEA>
- 2) Watch all 7 Episodes of YouTube tutorials that will teach you how to write a mathematical paper using the online software called “ShareLaTeX”. Search “Beginners Latex Tutorials” on YouTube or click [HERE](#). You must become proficient at using the software because all the assignments will be created using the program and submitted as a PDF file.

Option A (Choose Option A, if you have already chosen a research topic.)

- 3) On a Google Doc, create a Summer Research Plan with due dates. The plan should focus on learning and becoming an expert in your field with proof of your learning. It should also include an outline of your own research to begin the process.
- 4) An easy way to get introduced to the topic is to watch some lectures or videos. Watch 10 videos that are closely and directly related to your topic and summarize mathematical concepts that are directly related to your research.
- 5) Find two books on the topic and have them in possession either by purchasing them or borrowing them.
- 6) Read 3 mathematical articles or journals from reputable publications, and type a one page summary on each article. These publications should be on the latest development of the topic not an introduction to the concept.
- 7) It is imperative that you have a mentor and unfortunately, if you want to win any nationally recognized competitions then you will need a mentor. To begin the process, accumulate 10 names and their contact information such as their email, school address and/or even social media connections.
- 8) Finally, create a Prezi presentation file that summarizes all the items above and be prepared and ready to present in class.

Option B (Choose Option B, if you have NOT already chosen a research topic.)

Following assignments are designed to help you to choose your research topic, so be diligent in completing them. After you have completed the assignment and decided on the topic, start Option A above.

- 3) Watch any 3 episodes of TV series Numb3rs by CBS and type one page summary of how mathematics is used to solve the crime.

Also, read mathematical explanations to each episode from the link below.

By topics: <http://www.math.cornell.edu/~numb3rs/lipa/Episodes/>

By episodes: <http://www.math.cornell.edu/~numb3rs/>

- 4) Watch and summarize any 3 episodes of Numberphile on www.YouTube.com
- 5) Read the “Mathematical Research Reference” word document from the following link.

<http://goo.gl/YkzhVM>

Email: [emailchae@gmail.com](mailto:emailchae@gmail.com)

## Science (Mr. Belanger and Ms. Bland):

### RECOMMENDED SUMMER ACTIVITY FOR STUDENTS WHO WILL TAKE ADVANCED SCIENCE RESEARCH 10

During Research 1, students learn basic research techniques and conduct a literature search on a topic of choice. However, in Advanced Research 10 students are expected to devise and conduct a hands-on experiment, employing the scientific method. The first several weeks of the school year are spent choosing an acceptable, long-term research project that has a degree of originality. The sooner an idea is approved, the sooner the student can begin conducting a search of the literature to gather necessary background information. Therefore, it is recommended that students record ideas and interests during the summer that may potentially evolve into a research project.

When considering project ideas, keep the following restrictions in mind:

- 1) Students may not use vertebrates, including humans.
- 2) Students may not use pathogens which could cause illness.
- 3) Students may only use Biosafety Level 1 bacteria. Examples include, but are not limited to, the following bacteria: *Agrobacterium radiobacter*, *Aspergillus niger*, *Bacillus thuringiensis*, *Escherichia coli* strain K12, *Lactobacillus acidophilus*, *Micrococcus leuteus*, *Neorospora crassa*, *Pseudomonas fluorescens*, and *Serratia marcescens*.
- 4) A project cannot be entirely comprised of a short-term study which could be completed as a one or two day classroom laboratory activity.
- 5) Students may not conduct psychological, behavioral, or sociological studies.
- 6) Students may not conduct a purely comparative study. For example, water absorption may not be compared between several brands of paper towel to determine which is “best.” However, a student would be allowed to develop an original paper towel and assess its effectiveness.

#### Recommended activity

1. Obtain a new marble covered log book.
2. Date all entries you make in the log book.
3. Record a list of at least three project ideas. Keep in mind that your project may involve any branch of science including earth science, biology, chemistry, physics, engineering, inventing, and electronics.
4. Examine various sources for project ideas. For example:
  - Make a list of your own personal interests.
  - Read articles in science-related magazines such as *Scientific American*, *Discover*, *Popular Science*, *Popular Mechanics*, etc.
  - Watch science related shows such as *Nova* and *National Geographic*.
  - Talk to friends, family and professionals about topics that might warrant examination.

## **Social Science (Ms. Blum and Ms. Polatsidis):**

Social Science Research can be an exciting and rewarding experience for students. Giving preexisting research a new angle that is of personal interest to you is the foundation for a thesis, and affords the student an opportunity to make discoveries and analyze problems that may affect people from all walks of life.

**The Social Sciences consist of studies in: Psychology, Sociology, History, Economics, Political Science, Anthropology, Language, Literature, Women's Studies, Education, Geography and Finance.**

Use what you learned about the Social Sciences in your ninth grade science class, and apply it to this summer activity to help you hone in on a topic that INTERESTS YOU. Once you consider a topic, make yourself aware of any media exposure to that topic by reading *The New York Times*, *The Wall Street Journal*, *Time Magazine*, or by watching CNN or other reliable news sources. Then focus your observations on your topic in a written journal, making observations from real life. This will become your LOG BOOK for the progression of your research for the 10th grade Advanced Research year.

The **Summer Activity** consists of: 1) Written observations 2) Popular reading on your topic and 3) reading, annotating and writing about scholarly articles found in Databases available through the Syosset High School website.

### **Directions:**

- **Choose** one of the Social Science area topics listed above that interest you. Notice these topics in news articles and magazines for the application of your topic in the larger world.
- **Explore** the fields above for areas that interest you.
- **Buy** a Black and White Marble notebook in which to keep exploratory notes this summer. Begin your observation log in July, and continue its use throughout the summer. Bring this notebook to school in September because it will become your Research Log Book for the entire year.
- **Write** in your logbook daily, dating each entry:

### **OBSERVATIONS:**

- a. How people interact with each other in groups: Teams, clubs, camp bunks, etc.
- b. How people interact as individuals. Observe others in restaurants, meetings, the family dinner table, sporting events
- c. How people classify themselves
- d. How people choose surroundings. Activities? Jobs? Leisure activities?
- e. Observe others' personal choices: clothing style, speech, identification with groups
- f. What are some influences under which we operate? Economically? Educationally? Socially?
- g. News story summaries that pertain to your topic

## **ARTICLE SUMMARIES:**

- ❖ Find and read 5 articles from the Scholarly Journal Archive (JSTOR), and from Science Direct, both available through the High School Library on-line. You can access these rich sources of Social Science material through Syosset High School's website by clicking on the Library tab, and using the password as indicated.
- ❖ Annotate the articles, marking interesting concepts and areas of inquiry. Then, write a summary for each article in your log book. Last, write some thoughts of your own on how you can extend the topic by asking yourself what you would like to know more about the topic. If the author left you with some unanswered questions about the topic, what research could you do to answer those questions?
  - **Bring the marble notebook that contains your observations, ideas, and article summaries to the first day of class**
  - **Bring the 5 annotated articles to the first day of class.**
  - **Have a spectacular and safe summer!**

## *Advanced Research Social Science 11 (9664)*

**Mr. Manzo**      **amanzo@syossetschools.org**

It is important that you hit the ground running in pursuing your research project this year. To that end you will be required to complete the following prior to the second meeting of your research class in September.

Identify two possible projects for your research. Identifying truly viable projects is a crucial step here. To be “Competition Worthy” your project must be unique, timely, relevant, well planned and meticulously researched. Your suggested projects must also be possible to complete within the high school setting, with its many limitations which include approval by our in house IRB (Internal Review Board). Use the following steps to construct your project proposals.

- Email Mr. Manzo before the start of the summer: amanzo@syossetschools.org
- Examine the Society for Science website to see a list of past abstracts submitted. Choose Behavioral and Social Sciences to see all projects in this category since 2003. Use these abstracts as your guide. <http://apps.societyforscience.org/abstracts/>
- Examine relevant current sources including *The New York Times*, *Wall Street Journal*, *National Public Radio*, *The Nation*, *The National Review*, etc. Maintain a journal, formatted like an annotated bibliography, identifying the articles you have read, where you found them and any possible research leads they created for you. This will include a minimum of ten items to be submitted with your summer packet in September.
- Acquire a logbook.
- Frame each of your two research questions in the form of an abstract, including the project name, the process you expect to use to find your answer and how your project is relevant. You will also need to demonstrate that your research is unique, vital and practical for the high school setting. If your project has already been thoroughly researched it is inappropriate unless you can find a new and innovative approach to its investigation. This will complete your submission for September. The considerable work you put into coming up with these proposals should result in at least one viable “Intel worthy” project.
- Preliminary proposals are to be due August 15th. Email them to amanzo@syossetschools.org
- Please Note: Students should NOT begin actual research on a project unless they are attending a summer research institute. If you are attending a summer institute, check in with Mr. Manzo and Ms. Ade to ensure the nature of the project is acceptable for competition requirements.
  - Also that if you complete a research project at an institute over the summer, you may then still have to develop a new project to use for senior year.



It is important to understand that a successful research project requires devotion of considerable time and thought. Quality research cannot be rushed. You will need to invest time in identifying projects of interest. By following the guideline above, examining previous submissions, combing the literature and seeking the guidance of a mentor, you should be well on your way. This preparatory project may seem ambitious, but it should help you realize just how large a commitment the advanced research program is.

If you require my assistance you may contact me at [amanzo@syosetschools.org](mailto:amanzo@syosetschools.org). I look forward to working with you next year.

Mr. Manzo

## ***Advanced Mathematics/Computer Science Research 11 (9674)***

**Mr. Chae      emailchae@gmail.com**

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where your study begins. Of course you need to have your topic approved by your teacher. My job is to determine if there is enough material available and if it is at an appropriate level for you. Therefore, think of your presentation of your topic to me as your first challenge. You must come in the first day of class with at least two or three viable topic ideas. Try to prove to me that your topic is of interest to you and that you are capable of performing an in depth study to learn about your selected area. You will be working on this project for a minimum of seven months.

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Option A (Choose Option A, if you have already chosen a research topic.)

- 3) On a Google Doc, create a Summer Research Plan with due dates. The plan should focus on learning and becoming an expert in your field with proof of your learning. It should also include an outline of your own research to begin the process.
- 4) An easy way to get introduced to the topic is to watch some lectures or videos. Watch 10 videos that are closely and directly related to your topic and summarize mathematical concepts that are directly related to your research.
- 5) Find two books on the topic and have them in possession either by purchasing them or borrowing them.
- 6) Read 3 mathematical articles or journals from reputable publications, and type a one page summary on each article. These publications should be on the latest development of the topic not an introduction to the concept.
- 7) It is imperative that you have a mentor and unfortunately, if you want to win any nationally recognized competitions then you will need a mentor. To begin the process, accumulate 10 names and their contact information such as their email, school address and/or even social media connections.
- 8) Finally, create a Prezi presentation file that summarizes all the items above and be prepared and ready to present in class.

Option B (Choose Option B, if you have NOT already chosen a research topic.)

Following assignments are designed to help you to choose your research topic, so be diligent in completing them. After you have completed the assignment and decided on the topic, start Option A above.

- 3) Watch any 3 episodes of TV series Numb3rs by CBS and type one page summary of how mathematics is used to solve the crime.

Also, read mathematical explanations to each episode from the link below.

By topics: <http://www.math.cornell.edu/~numb3rs/lipa/Episodes/>

By episodes: <http://www.math.cornell.edu/~numb3rs/>

- 4) Watch and summarize any 3 episodes of Numberphile on www.YouTube.com

- 5) Read the “Mathematical Research Reference” word document from the following link.

<http://goo.gl/YkzhVM>

Email: [emailchae@gmail.com](mailto:emailchae@gmail.com)

*Advanced Science Research 11 (9654)*

Dr. Hendrickson           dhen@me.com

Mrs. O'Shea               soshea@syossetschools.org

Please email us upon receipt of this letter so that we can invite you to our Edmodo Class

**\*\*\*Please note that regardless of whether you plan to conduct an in-house project or one at a regulated research institution, ALL STUDENTS are required to schedule a meeting with the 11<sup>th</sup> grade research teachers (also known as a pink sheet conference) within the first two weeks of the start of school. A sign up sheet will be posted over the summer.**

**\*\*\*At this meeting, your project will be discussed (proposal or research plan) and your logbook will be checked.**

**FOR STUDENTS THAT PLAN TO CONDUCT AN IN-HOUSE PROJECT:**

Investigate a specific, NOVEL problem you would want to study this coming school year. You must get a logbook (bound marble notebook) and begin recording your ideas about possible research projects following the format provided below. It is expected that you are prepared to "hit the ground running" this September. It is required that you submit a one page typed proposal for your idea to be investigated. Please preview this document and ask any questions you may have *as soon as possible!!*

**DUE DATE - ONE Proposal: First day of research class (which meets on a W Day)**

Proposal should include (use these **BOLD** headings in the text):

- A. Question being addressed**
- B. Hypothesis / Engineering Goals**
- C. DETAILED Description of methods or procedures and experimental design including required equipment to be used for data collection. \*Please see attached available equipment list**
- D. References: MINIMUM of 3 primary and 1 secondary source (NO "dot com" internet sites) must be formatted in APA style**

The most important element in selecting a research topic is **read, read, read!** As you begin to read scientific articles of interest to you pay close attention to who the researchers are and where they work. You should ultimately be able to trace the information back to the primary scientific source (research journal article). Once you have been able to obtain the primary literature, read the materials and methods section to learn about how these experiments were conducted and to obtain useful information about experimental technique. This is where you will get ideas to incorporate into your own procedure. Although it is not appropriate to simply copy another researchers experiment, it is acceptable to use other researchers methods to ask your specific research question. **Start your topic BROAD and work your way to NARROW**

**STUDENTS INTERESTED IN BIOLOGICAL STUDIES MAY WANT TO BROWSE THE FOLLOWING WEBSITES FOR INFORMATION REGARDING THE VALUE AND USE OF TRADITIONAL EXPERIMENTAL MODEL ORGANISMS SUCH AS:**

*Caenorhabditis elegans*

*Arabidopsis thaliana*

*Asimina triloba*

*Drosophila melanogaster*

*Hydra vulgaris*

*Lumbriculus variegatus*

*Dictyostelium discoideum*

<http://www.wormbook.org/>

<http://www.ncbi.nlm.nih.gov/About/model/otherorg.html>

<http://www.ncbi.nlm.nih.gov/About/model/nonmammal.html>

<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/A/Arabidopsis.html>

<http://www.ceolas.org/VL/mo/>

<http://www.arabidopsis.org/portals/education/aboutarabidopsis.jsp>

<http://www.wormclassroom.org/>

<http://www.ucidevcell.org/faculty/hans-bode/>

<http://www.loci.wisc.edu/outreach/text/model.html#character>

<http://www.loci.wisc.edu/outreach/text/celegans.html>

<http://avery.rutgers.edu/WSSP/StudentScholars/project/introduction/worms.html>

<http://www.sanger.ac.uk/modelorgs/>

<http://www.pitt.edu/~biohome/Dept/Frame/drosophila.htm>

<http://www.cbs.dtu.dk/~gorm/modelorganisms.html>

[http://genome.wellcome.ac.uk/doc\\_wtd020807.html](http://genome.wellcome.ac.uk/doc_wtd020807.html)

<http://www.cellbio.com/modelorgs.html>

<http://dictybase.org/>

[http://www.nih.gov/science/models/d\\_discoideum/](http://www.nih.gov/science/models/d_discoideum/)

<http://www.pawpaw.kysu.edu/>

### **PROJECT RESTRICTIONS FOR SCIENCE RESEARCH**

1. Students **may not** use vertebrates, including humans, unless you are working with a veterinarian or research scientist in most cases.
2. Students **may not** use pathogens that could cause illness (Biosafety Level II).
3. Students may only use Biosafety Level I bacteria if the research is conducted at the high school. Examples include, but are not limited to, the following bacteria:  
*Agrobacterium radiobacter*, *Aspergillus niger*, *Bacillus thuringiensis*, *Escherichia coli* strain K12, *Lactobacillus acidophilus*, *Micrococcus leuteus*, *Neorospora crassa*, *Pseudomonas fluorescens*, and *Serratia marcescens*.
4. A project **cannot** be entirely comprised of a short-term study that could be completed as a one or two day classroom laboratory activity.
5. Science research students **may not** conduct psychological, behavioral, or sociological studies using human subjects however, invertebrate animals may be used for behavioral studies.
6. Students **may not** conduct a purely comparative study. For example, water absorption may not be compared between several brands of paper towel to determine which is "best." However, a student would be allowed to develop an original paper towel and assess its effectiveness.



7. Projects conducted by teams of two are allowed. (Please keep in mind that not all national competitions accept team project.)

**If you have any questions about accessing information or would like to discuss any ideas, you are welcome to E-mail us. Places to search using the Internet for primary scientific literature include:**

- Google Scholar
- Pubmed - PubMed comprises more than 20 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites. Some articles are full text and free some you may need to look up on science direct from a school computer.

<http://www.ncbi.nlm.nih.gov/pubmed/>

- HighWire Stanford - As the leading ePublishing platform, HighWire Press partners with independent scholarly publishers, societies, associations, and university presses to facilitate the digital dissemination of 1517 journals, reference works, books, and proceedings.

<http://highwire.stanford.edu/lists/freeart.dtl>

- The Open Directory was founded in the spirit of the Open Source movement, and is the only major directory that is 100% free. There is not, nor will there ever be, a cost to submit a site to the directory, and/or to use the directory's data. The Open Directory data is made available for free to anyone who agrees to comply with our free use license.

[http://www.dmoz.org/Science/Publications/Journals/Free\\_Online\\_Journals/](http://www.dmoz.org/Science/Publications/Journals/Free_Online_Journals/)

- *PLoS ONE*: a peer-reviewed scientific journal for the swift publication of original research in all areas of science and medicine, with innovative user tools for post-publication commenting, rating, and discussion.

<http://www.plos.org/journals/>

...or search google for free online science journals

**\*\*\*\*\*ALWAYS PRINT IN PDF FORMAT if available\*\*\*\*\***

**FOR STUDENTS CONDUCTING A PROJECT WITH A MENTOR AT A REGULATED RESEARCH INSTITUTION (RRI):**

If you are investigating a specific, NOVEL problem over the summer at an RRI, you must get a logbook (bound marble notebook) and begin recording ALL of the thoughts and activities about your project (whether at home or in the lab) following the format provided below. It is required that you submit a research plan that follows the ISEF format seen below. In addition, you must complete the rules wizard (<https://apps2.societyforscience.org/wizard/index.asp>) and appropriate ISEF forms for the project being conducted. Please preview this document and ask any questions you may have *as soon as possible!!*

**DUE DATE – Research Plan: First day of research class (which meets on a W Day)**

Research plan should include (use these **BOLD** headings in the text):

- A. What is the **RATIONALE** for your project? Include a brief synopsis of the background that supports your research problem and explain why this research is important scientifically and if applicable, explain any societal impact of your research.
- B. State your **HYPOTHESIS(ES), RESEARCH QUESTION(S), ENGINEERING GOAL(S), EXPECTED OUTCOMES**. How is this based on the rationale described above?
- C. Describe the following in detail:
  - a. **Procedures: Detail all procedures and experimental design including methods for data collection. Describe only your project. Do not include work done by mentor or others.**
  - b. **Risk and Safety: Identify any potential risks and safety precautions needed.**
  - c. **Data Analysis: Describe the procedures you will use to analyze the data/results that answer research questions or hypotheses.**
  - d. **Discussion of Results and Conclusions: Discuss the data/results and the conclusions that can be drawn.**
- D. **Bibliography: List at least five (5) primary references from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.**

## Maintaining a Project Logbook

A critical skill that each laboratory scientist must develop is the proper documentation of laboratory work. Biological and chemical laboratory researchers advise that one of the most critical skills for scientists is good record keeping. Research notebooks are legal documents that are used to obtain patents and protect research. A good laboratory notebook is complete enough that *you, or someone else, could repeat the work on the basis of the information documented in the notebook.*

*For Advanced Research 11*, your logbook must be a marble covered composition book that contains a daily record of every step you take through the research process. If your mentor requires another type, you must make a duplicate copy for use in class. When writing in your logbook, don't write to your teacher - write for yourself. You should be able to go back to any point in your research and determine exactly what you did, when you did it, where you did it, how you did it, and why you did it. Here are a few hints to keep in mind as you fill out your logbook during the year.

- RESERVE the first three or four pages of the notebook to be used for a table of contents.
- All of the pages after the table of contents pages must be numbered before using the notebook.
- Refrain from the use of *personal pronouns!*
- Bring the logbook to class *every* day.
- Make sure you have a complete record of the work that you did each day including: your scientific thinking, observations, and data.
- The logbook should be reasonably neat. Remember, it will be collected and graded *biweekly*.
- Make sure that each entry uses handwriting that is clear, complete, and legible. Other people expect to be able to read what is written.
- Use only black ink to ensure that the entries will show clearly after photocopying. *Never use pencil except for drawing pictures.*
- Use only a bound notebook. Put your name, your teacher's name, your email address, and your phone number on the inside front cover of the notebook.
- Clearly print your full name on the outside cover of the logbook.
- Never remove pages from the notebook for any reason.

- Record *the date and location* **IN THE MARGIN** each time a new entry is made. This should be the **ONLY** writing in the margins, ever.
- Document any topic, phenomenon, or idea of interest. It can be related to science, music, computers, art, engineering, construction, electronics ... anything at all. If there is something interesting on television, write it down. If you get an idea for an invention, write it down. If a question arises about something seen or heard, write it down.
- If a research idea comes from a source besides your imagination, keep careful records of that source. If it's a book, record all of the information that would be needed for a Reference Page. **Use APA Format.** If the source is another person, record that person's name and any other pertinent information. If the source is a television show, record the name of the show, the channel, and the time it was shown. **Use APA Format.**
- When working on the computer, keep thorough records of databases visited, key words used, and journals examined. Anyone should be able to find important articles again if necessary. **Document what you find in APA Format.**
- Include reference to scientific literature read. **Use APA Format.**
- *Always* bring your logbook to a meeting with a teacher, librarian, professor etc. and record information *as you are speaking with them* so that you do not forget what you were told.
- If there is a conversation with a teacher, a doctor, another student, or anyone about the research project it must be documented in the logbook. This entry should include important points that were discussed. You appear disinterested if you have to go back to someone and ask the same questions again. Never just write —Spoke to Mr. Smith or —Went to library.
- Devising the project procedure involves much trial and error. Record all successful and rejected steps taken.
- When gathering data, it may be easier and more understandable to make data charts rather than recording all measurements in paragraph form.
- Include rough graphs, drawings, tables, and charts in the logbook.
- When analyzing data mathematically, do all calculations in the logbook.
- Record data and observations immediately and directly into the notebook--not on a separate sheet of paper.

- If you have separate pages (such as instrument printouts or graphs) that need to be included in the notebook, you may add them but *never cover information up* when you do so.
- Only a single fold if you have to affix a page into your logbook that is too large.
- For corrections, single strike through and put your initials and a date next to the corrections added.
- In the logbook, write rough drafts of thank you notes to be sent to people who were especially helpful. A thank you in writing will make those people feel appreciated, will make them more likely to help you and others in the future, and is simply the proper thing to do.

Adapted with permission from work by Linda Hobart, Fingerlakes Community College, Canandaigua, NY and Syosset HS Research Manual

**Advanced Research 12**  
**Science 9684**  
**Social Science 9694**  
**Math 9774**

*Please Note: All four assignments are due on the first day of school!*

**1. Research Paper**

Science and Math Students Follow Siemens Competition Requirements

Social Science Students Follow the Intel STS Competition Requirements

**2. The Intel Science Talent Search Essays Questions 1-5.** (Questions 6 & 7 will eventually need to be completed.) (Go to [societyforscience.org/sts](http://societyforscience.org/sts) for more information.)

**3. A research plan** following the Intel International Science & Engineering Fair (ISEF) format written in the future tense. (Go to [societyforscience.org/isef](http://societyforscience.org/isef) for more information.)

**4. All Intel ISEF forms that require prior approval associated with your project.**

(Go to [societyforscience.org/isef](http://societyforscience.org/isef) for more information.)

**Assignment Details:**

**Activity #1 18-page research paper following Siemens formatting requirements.** For additional information visit: [siemenscompetition.discoveryeducation.com](http://siemenscompetition.discoveryeducation.com) (Social Science research students not able to enter Siemens, please follow all Intel STS formatting requirements.)

**Activity #2 Intel STS Essay Questions Page**

Visit [societyforscience.org/sts](http://societyforscience.org/sts) for more information.

1. What inspired you to conduct this research project? \* *Characters - 1000*

2. How has doing this research project helped you clarify your interest in science? \*  
*Characters - 1000*

3. What benefits do you think your research will bring to the world? What additional steps, and by whom, might be needed for this benefit to be realized? \* *Characters – 1000*

4. Your Promise as a Scientist, Mathematician or Engineer

Address through specific and concrete examples what characteristics you have that best demonstrate your affinity and aptitude for being a good scientist. What have you done that illustrates scientific attitude, curiosity, inventiveness, initiative? How does your experience suggest future success as a scientist, mathematician or engineer? \* *Characters – 3000*

5. Major Scientific Question of the Future

What is a major scientific question in your field whose answer you believe will have a significant impact on the world in the next 20 years, and why? Using examples from your own experience or research, explain how you might envision addressing the question over the next 20 years. \*  
*Characters – 3000*

#### 6. Research Project "layperson's summary"

Summarize your project in layperson's terms, while maintaining scientific accuracy. Your explanation should provide easily understandable background, procedures, conclusions and relevance. The summary will aid readers, including evaluators, journalists and the public.\*

*Characters – 750*

#### 7. Scientific Abstract

Provide a scientific abstract of your research project. The abstract should include the purpose of the experiment, procedures, data, and conclusions. It also may include any possible research applications. It must focus on the research conducted by you and should not include work or procedures done by the Supervising Scientist or other researchers.\*

*Characters – 1500*

#### **Activity #3 Research Plan**

Go to [societyforscience.org/isef](http://societyforscience.org/isef) for more information (see attached document).

#### **Activity # 4 All Intel ISEF forms that require prior approval associated with your project.**

(Go to [www.societyforscience.org/isef](http://www.societyforscience.org/isef) for forms and guidelines. To check to see which forms you need, use the **Rules Wizard** on the ISEF web site.)

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# Research Plan/Project Summary Instructions

**A complete Research Plan/Project Summary is required for ALL projects and must accompany Student Checklist (1A).**

1. All projects must have a Research Plan/Project Summary written prior to experimentation following the instructions below to detail the rationale, research question(s), methodology, and risk assessment of the proposed research.
  - a. If changes are made during the research, such changes can be added to the original research plan as an addendum, recognizing that some changes may require returning to the IRB or SRC for appropriate review and approvals. If no additional approvals are required, this addendum serves as a project summary to explain research that was conducted.
  - b. If no changes are made from the original research plan, no project summary is required.
2. Some studies, such as an engineering design or mathematics projects, will be less detailed in the initial project plan and will change through the course of research. If such changes occur, a project summary that explains what was done is required and can be appended to the original research plan.
3. The Research Plan/Project Summary should include the following:
  - a. **RATIONALE:** Include a brief synopsis of the background that supports your research problem and explain why this research is important and if applicable, explain any societal impact of your research.
  - b. **RESEARCH QUESTION(S), HYPOTHESIS(ES), ENGINEERING GOAL(S), EXPECTED OUTCOMES:** How is this based on the rationale described above?
  - c. Describe the following in detail:
    - **Procedures:** Detail all procedures and experimental design including methods for data collection. Describe only your project. Do not include work done by mentor or others.
    - **Risk and Safety:** Identify any potential risks and safety precautions needed.
    - **Data Analysis:** Describe the procedures you will use to analyze the data/results.
  - d. **BIBLIOGRAPHY:** List major references (e.g. science journal articles, books, internet sites) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.

Items 1–4 below are subject-specific guidelines for additional items to be included in your research plan/project summary as applicable.

1. **Human participants research:**
  - a. **Participants:** Describe age range, gender, racial/ethnic composition of participants. Identify vulnerable populations (minors, pregnant women, prisoners, mentally disabled or economically disadvantaged).
  - b. **Recruitment:** Where will you find your participants? How will they be invited to participate?
  - c. **Methods:** What will participants be asked to do? Will you use any surveys, questionnaires or tests? What is the frequency and length of time involved for each subject?
  - d. **Risk Assessment:** What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize risks? List any benefits to society or participants.
  - e. **Protection of Privacy:** Will identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected? Will data be confidential/anonymous? If anonymous, describe how the data will be collected. If not anonymous, what procedures are in place for safeguarding confidentiality? Where will data be stored? Who will have access to the data? What will you do with the data after the study?
  - f. **Informed Consent Process:** Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary and they have the right to stop at any time.
2. **Vertebrate animal research:**
  - a. Discuss potential ALTERNATIVES to vertebrate animal use and present justification for use of vertebrates.
  - b. Explain potential impact or contribution of this research.
  - c. Detail all procedures to be used, including methods used to minimize potential discomfort, distress, pain and injury to the animals and detailed chemical concentrations and drug dosages.
  - d. Detail animal numbers, species, strain, sex, age, source, etc., include justification of the numbers planned.
  - e. Describe housing and oversight of daily care
  - f. Discuss disposition of the animals at the termination of the study.
3. **Potentially hazardous biological agents research:**
  - a. Give source of the organism and describe BSL assessment process and BSL determination.
  - b. Detail safety precautions and discuss methods of disposal.
4. **Hazardous chemicals, activities & devices:**
  - Describe Risk Assessment process, supervision, safety precautions and methods of disposal.