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Goals of the Program

The goal of the magnet program is to instill the underlying values, skills, and behaviors that will enable students to enter chosen careers in the fields of science, math and technology. The program will provide students with opportunities to conduct authentic scientific research and complete an internship in an area of interest. The experience will also position students to achieve success at institutes of higher learning.

Admissions

Students who have a high ability, aptitude and interest in math, science, and technology and a desire to engage in research and project-oriented learning should apply during the spring of their eighth grade year. They need to have completed algebra I or higher with at least a B to be eligible for consideration. They will complete a two page application packet with five essay questions. Students will also obtain recommendation letters from each of their math, science, and English teachers; a fourth recommendation letter from another subject teacher is optional.

Once students have applied, they will visit the high school for an entrance exam, which tests their math and English skills, and a group interview with a panel of current magnet teachers and students. Final acceptance into the program will be based on a review of their application and recommendation letters, overall GPA, exam results, and interview.

Required and Recommended Course Schedule

Required courses are bolded. *Italicized* courses are independent study outside of the regularly scheduled classes.

Grade 9	Grade 10	Grade 11	Grade 12
AP Environmental Science	**AP Biology**	AP Chemistry	AP Physics
Pre-AP English 9	**Pre-AP English 10**	English 11 or AP English 11	English 12 or AP English 12
Accelerated Geometry or Algebra II	Accelerated Algebra II or Pre-Calc w/ Math Analysis	Pre-Calc w/ Math Analysis or AP Calculus	AP Calculus or AP Statistics
Elective* (AP Human Geography recommended)	World History or AP World History	U.S. History or AP U.S. History	CWI or AP U.S. Gov't and Politics
Intro to Engineering and Intro to Physics	Elective*	Elective*	Elective*
Elective*	Elective*	Elective*	Elective*
WA State History/PE (independent study)	*PE (independent study)*	*MST Research 11*	*MST Research 12*

*Recommended electives include but are not limited to foreign language, band, choir, art, etc.

Student Expectations Beyond CHS Handbook

Magnet students are expected to display the following characteristics:

- Ability to persevere when faced with complex problems;
- Ethical behaviors in all aspects of learning;
- Creativity, resourcefulness, and ability to contribute to the structure of their own learning experience;
- Ability to be self-sufficient, to follow through, and to produce high-quality work;
- A willingness to work in a team-oriented environment;
- An interest in refining their oral, written, and visual communication skills; and
- Aspirations to strengthen leadership skills and contribute as a citizen of the 21st century.

In addition to the above characteristics, students are required to maintain a minimum cumulative GPA of 3.0 and a grade no less than a B- in each of their core magnet classes (math, science, and English). At the end of each six-week grading period, the academic progress of all students will be reviewed. If a student has fallen below this requirement, the magnet staff will institute a process of remediation resulting in academic probation.

Academic Probation

Students and their parents will meet with magnet staff to develop a probationary contract (signed by all in attendance) to assist them in improving their academic performance (see Appendix A). This contract is viewed as supportive, not punitive, intervention. It is developed for the purpose of preparing students to be responsible and successful by encouraging academic excellence in all subjects and promoting the utilization of problem solving skills. The contract may include the following:

- Tutorial sessions to address study skills and/or time management skills
- Study sessions with appropriate faculty members
- Parental monitoring of student progress through the use of Skyward, as well as other appropriate means of communication
- A timeline of required assignments and their due dates
- Behavioral expectations outlined by the staff

At the end of the first six-week probationary period, students on probation will be reviewed. If the student has met or exceeded all goals outlined in the contract, they will be removed from probation. Those failing to meet the goals and/or make satisfactory progress in that direction will either be placed on a revised contract or removed from the program. In rare cases, probationary status may be extended into the next semester or across academic school years.

Overview of Research Component

At the heart of the coursework you complete for the MST Magnet is the year-long, team-based research and investigation on a topic of limited choice. This project is the vehicle by which you will learn the research process, specific skills related to it, and apply the learning from your core Magnet math, science, and engineering classes. Key performances related to this include the development of a research paper, an investigation, a poster overview of your project, and presentations of your conclusions.

Freshmen, sophomores, and seniors will complete several research projects. The seniors' projects can be embedded with their internship experience. Juniors can choose to conduct a research project, if they want, which can be entered into numerous competitions (see Competition Information). At each level, students will practice, refine, and hone the skills required to complete the research process with success. Each year of the program represents an opportunity to go deeper with the process and build confidence in their ability to work more independently within it.

Research Process

Ninth and tenth grade magnet students will be walked through the following research process during their English and science classes in order to effectively complete their research project. For the eleventh and twelfth grade projects, students are expected to independently follow the same process.

Step 1: Define the Task
Step 2: Choose a Topic
Step 3: Develop Questions and Subquestions

English Class Focus	Science Class Focus
Step 4: Conduct Effective Searches	Step 4: Develop Norms of Collaboration
Step 5: Read and Evaluate Scholarly Papers	Step 5: Choose a Mentor
Step 6: Annotate References	Step 6: Write Mini Investigation Proposal
Step 7: Make and Sort Notecards	Step 7: Conduct Mini Investigation
Step 8: Write the Literature Review	Step 8: Write Investigation Proposal
Step 9: Narrow/Focus Research Questions	Step 9: Conduct Investigation
Step 10: Write Project Abstract	Step 10: Write Investigation Paper

Step 11: Write Project Paper
Step 12: Create Project Poster
Step 13: Present Project

Choosing a Topic and a Team

"This most important step in getting started with a [research] project is often the most difficult part. It involves a process that starts with very general and often vague ideas. Then by reading or listening to others discuss their ideas, you find a topic that not only interests you, but contains a problem or question that can be investigated through scientific inquiry." (WSSEF Handbook)

Topic selection is a critical step in your success in this program and life in general. Most importantly, you must select something that interests and engages your mind. If you have no interest in the topic, then it will be difficult for you to be motivated to complete this inquiry driven process.

While many of you will struggle with whether to lean toward a friendship-based team or one based on interests, the most successful students balance the two and find a happy medium. We will conduct activities and exercises to help you work through this process. If, after the first phase of the project, you absolutely cannot continue with either your team and/or your topic, we will help you resolve the issues and find a new focus.

Developing Norms of Collaboration

Since you will be working in teams to conduct your research, it is beneficial to establish some norms or guidelines by which the group will operate. You will perform an exercise in class to familiarize yourself with common norms and then develop a set of four to five of your own that each group member can agree to follow during your project.

Choosing a Mentor

To prepare you for your junior internship and senior project, you will be expected to recruit a mentor to advise you during your investigations. The mentor should be someone with experience in your topic area who is willing to offer about two hours a month to discussing your project with your group. It must be someone who is not a Camas High School teacher. You will submit the name and contact information of your mentor to your science and/or engineering magnet teacher.

Developing a Research Question

Once you have established norms for your team, you should develop an overarching research question based on your topic. A good research question is open ended, one that typically defies being answered with a simple "Yes" or "No" response. From this, you will develop specific subtopic questions that will be more narrowly defined and linked to our pre-determined categories – historical overview of topic, current trends and practices, controversies and debates, and any other subcategories you deem appropriate. The answers to these questions will form the basis of the literature review (see Writing the Literature Review).

Conducting Effective Searches

In order to more effectively research any topic using the Internet, you need to be able to conduct "smart searches" that draw on the multitude of digital resources at their fingertips, not just Google. A "smart search" makes use of Boolean operators, logic, and smart search strings. You will learn the basic Boolean operators and logic that can and should be applied to any database or Internet search you perform and how to develop "smart search" strings to maximize and/or narrow results.

Reading Scholarly Papers and Annotating References

Once you begin researching your topic, you'll need to make sense of the dense, scholarly works you'll encounter. While this may seem pointless and tedious, the time you invest now in sitting and simply reading through the research will pay handsome dividends later. The categories and questions you developed in previous steps will help immensely by providing a focus and framework to your research. You will participate in classroom activities and exercises that will help you acquire these skills.

Consider these guidelines as you wade through the research:

- Save copies of the articles by either downloading the PDF and/or cutting and pasting the text into a document. Be sure to record proper reference data as you cut and paste. You MUST cite your resources and give credit where credit is due.
- Print off some of the articles to allow for highlighting, labeling, and efficient note taking.
- Sort articles by categorizing them into the three broad literature review categories – historical overview, current trends and practices, controversies and debates.
  - If it's clearly an article that focuses primarily on the history of your topic, label it as "historical overview." More likely than not, you will find many of the categories in a single source. Label and highlight relevant sections as you read.
- As a guideline for the minimum bar requirement, consult at least eight to ten resources in your review of the literature, being sure to draw from multiple sources (ProQuest, Ebsco, etc).
- Be sure to consult the Annotated References assignment, and write a brief summary and critical description as to why this particular source helps answer your research question.

Making Note Cards

Once you've read, labeled, highlighted, and annotated your sources, you should have a pretty good idea what your topic is all about. Now it's time to go back through the articles and pull out specific information you can use in your literature review. You will record this information on note cards to make it easier to organize. There are two different types of note cards you will make.

QUOTE: The first type is one that includes a direct quote of a single idea. The only reason to include a direct quote is because the author's phrasing is so unique and critical to your purpose that you want their exact words. In sum, they are saying it better than you can say it in a paraphrase.

PARAPHRASE: The second type of note card is a paraphrase of a single idea. Some people call this "switching up the words" so it's your original phrasing of somebody else's idea. It takes practice to paraphrase correctly, so we'll work on this in class.

Consider the following guidelines when you make your note cards:

- Put only ONE piece of data/info/quote on each card.
- Mark each card as either a QUOTE or a PARAPHRASE card.
- Record ALL the proper reference page data on the note card. Regardless of your use as a quote or a paraphrase, each piece of information gets a parenthetical citation in the body of your literature review. Give credit where credit is due! When in doubt, ere on the side of caution.
- Only bits and pieces of information belong on the note cards. You are NOT writing your whole paper on the cards.
- You are required to have a total of 40 note cards. You may have more.
  - Strive to record about ten note cards per day of class time provided.
  - Ultimately, you will use only a fraction of the cards you make, but you'll have lots of information from which you can select the most critical parts to create a comprehensive overview of the literature you reviewed.

Sorting Note Cards

Once you've compiled your note cards, you will need to organize them. The overall purpose of this step is to group information from different sources that have a common idea. This will help you consider the relationships between the parts and help you weed out unnecessary information that doesn't fulfill your purpose. It will also help identify the gaps in your research.

You should sort your cards into the three predetermined categories of the literature review (historical overview, current trends and practices, and controversies and debates). You will complete an activity in class to help you accomplish this. While in some cases you might add categories beyond what we've mandated, most of you will find those three categories satisfactory for completing your literature review.

Writing the Literature Review

A literature review is nothing more than an overview of your topic. It serves two purposes, the first being to educate you on your topic and ensure your project is feasible. The second purpose is to demonstrate to those who review your work and oral presentation that you are well-versed in the relevant and germane ideas and research related to your topic. It lends credibility to you as a researcher and the process you go through as you develop your work.

Organizing and writing a literature review is not all that different from the academic writing you have done before. You will organize it with an introduction, a body of support, and a conclusion. The introduction will include the thesis. Your body paragraphs will start with topic sentences, followed by context, use of concrete details/evidence from your note cards, including commentary to support your thesis. Your conclusion will, hopefully, synthesize your findings and offer a conclusion about your topic connecting it to your overarching research question. You will receive models of literature reviews so you understand what is expected of you. You will also conduct peer review sessions in class to help you refine your final literature review.

What *is* different about the literature review process is the formatting guidelines you will use. In academia, different disciplines use different formatting guidelines. There are even disputes within disciplines about which guidelines to use. You will use the formatting guidelines laid out by the American Psychological Association, known simply as APA. These guidelines are also used in college for scientific writing.

While the formatting nuances and peccadilloes of APA will be maddening at times, you don't need to memorize them. You simply need to know where to go to find them. You will receive plenty of direction and resources for properly formatting items like title pages, running heads, section titles, source citations, creating tables, making reference pages, etc. A significant chunk of the rubric points for the literature review are tied to proper use and attention to APA formatting, so if you can adhere to these guidelines, you should do well.

Once your first draft of the literature review is completed, the MST Magnet teachers will review it and give you a chance to integrate their feedback for a revised grade. After making your revisions, the first half of your project paper is complete for the first phase. Upon finishing the first phase of your project, you will be required to update your literature review with some new and/or additional sources based on your findings and planned course of action for phase two. This step is mandatory.

Writing the Reference Page

The reference page you submit for your first literature review will only include the sources you actually use in the review. While you may have consulted many other sources while researching your topic and creating your annotated reference page, only the ones you quote in the review are required on the final reference page. There should be no annotations included on your final reference page. This should be a separate page at the end of your literature review that is included in the page number sequence of the document.

Writing an Investigation Proposal

Before you can begin any investigation, your plans must be submitted to and approved by your mentor AND science and/or engineering magnet teacher. As you plan your investigation, consider the following questions:

- Can the investigation be completed within the amount of time available? Have you considered the time needed for retrials or repeats? (For example, do you need a large number of plants ready to sample in two or three week intervals?)
- Are there environmental concerns? (For example, is it the right time of year to make your observations or collect samples?)
- Do you have adequate laboratory resources (time, materials, and equipment) or natural resources, or both, to carry out your investigation?
- What is the cost of completing the investigation? Is it within your budget? Do you need special equipment beyond what is available? How will you get it? Have you budgeted for retrials?
- Is the design of the investigation adequate? Are the effects measurable in an objective way?
- Does the investigation conform to **ALL** state or federal laws pertaining to scientific research?

Since there are three different types of investigations, your proposal may not look exactly the same as another group's proposal. You will need to decide what type of investigation your topic is best suited for and write the proposal following the appropriate guidelines.

The controlled experiment investigation (CEI) is what is most commonly done in science classes. It includes a question, hypothesis, materials list, detailed procedure with variables identified, safety considerations, data, and conclusion, which includes possible sources of error and recommendations for further investigations. All miniature investigations for ninth and tenth graders are required to be CEI. Most ninth grade symposium projects will be CEI, and about a quarter of the seniors' projects are CEI. The proposal for a CEI should include all the components up to the safety considerations. Be sure to identify the independent and dependent variables, the controlled variables, and a control group in the procedure. You should have at least five increments for your independent variable. Make sure you have indicated that you will conduct a minimum of three trials for each increment of the investigation in the procedure, as well. The data and conclusion sections are not included in the proposal since you haven't conducted the investigation yet; they will be added in to your investigation results paper.

The design process investigation (DPI) is where you attempt to solve a problem using a formal, thought-out process, which includes a question, problem statement including constraints, materials, variables, procedure (iterated through many changes in many of your variables, with a data table and results for each mini-experiment), data, graphs (if needed), statistics, conclusion (best combination of variables as your best solution with explanation), limitations of solution, and recommendations for further investigations.

Some ninth grade and about half of tenth grade symposium projects are DPI; about a quarter of the seniors' projects are DPI. The proposal for a DPI should include all the components up to the procedure, including the expected data tables that will be used for each mini-experiment. The actual data, graphs, statistics, conclusion, limitations of solution, and recommendations will be added in to your investigation results paper.

The field study with recommendation (FSR) is where you attempt to solve a problem but don't have the resources or time to test possible solutions. The format of an FSR paper includes a question, problem statement including constraints, survey of possible materials, survey of major variables, procedure (a prior-to-investigation course of action statement for gathering data on the variables you will study), data, graphs (as needed), statistics, recommendation (with explanation), limitations of recommendation, and recommendations for further investigations. Ninth and tenth graders are not allowed to conduct FSR for symposium projects since you should perform an actual investigation. About half of the seniors' projects are FSR since complex problems in the real world often take years to investigate and solve and cost more money than is available in the relatively short time you work with the companies who are asking you to conduct the research.

There are two other types of investigations which are precursors to the three types listed above. These are the generic field study which looks at what factors are present in the system being considered, and how many of each factor there are, and the basic system investigation which identifies all the variables in the system under investigation and the standard value of each. You will most likely use one or both of these during your research phase as you prepare and plan for your miniature and symposium investigations.

Conducting the Investigation

During the fall semester, you will perform a small-scale, miniature investigation that will prepare you for your larger investigation in the spring semester. You should focus this investigation on a narrow question that takes a short amount of time to conduct. Once you have turned in your miniature investigation results and conclusion, you will submit a proposal for your symposium investigation. You will need to allow time for at least three trials of this large-scale investigation.

Writing an Investigation Report

Once you have completed your investigation (either miniature or symposium), you will need to report on your results to your science and/or engineering teacher. You will include your original research question and hypothesis, exactly as they were stated in the proposal. You will **amend** your materials and procedure sections from your proposal to reflect any changes you might have implemented during your investigation. The data you collected will be presented in whatever format is appropriate, including tables, line and/or bar graphs, pie charts, etc. In your conclusion you will discuss the data collected, addressing whether it supported your hypothesis or not, the implications of your investigation to your topic, and any future recommendations you would make to anyone wanting to continue with your research.

Writing the Project Paper

Your project paper will synthesize your literature review and investigation paper into one document. The literature review will be the first section, demonstrating your thorough knowledge of the topic and validating your work. You will then include your materials and procedure, data, and conclusion sections from your investigation paper. The section headings for your project paper are as follows:

- Historical Overview
- Current Trends and Practices
- Controversies and Debates
- Methods and Materials
- Results
- Discussion and Conclusion

Writing the Project Abstract

The abstract will be used in a variety of ways. If you enter your project into competitions, it will be used on the application or presentation you give during the competition. It will be included in the program available during the CHS Research Symposium, which is held annually at the end of May. An abstract is generally between 100 to 500 words, depending on the purpose of the abstract. For the symposium program, it will need to be about 100 words, no more than one-half page. It includes your hypothesis and a brief summary of the results of your investigation. Your research paper abstract should be about 250 words. It is a brief overview of your entire project, not just your paper.

Creating the Project Poster

Once your project paper is complete, you are ready to create a poster that will summarize your project and present the information in a visually-appealing, easy-to-understand format for the general public. You will use these posters at most competitions into which you might enter your project, as well as at the CHS Research Symposium in May. You will use PowerPoint to make your poster, following the directions and guidelines given to you by your Research English teacher and the online examples. Many students try to create their posters by simply cutting and pasting their paper into text boxes in the PowerPoint slide that will become their poster. If you are doing this, you're missing the point; very few people will read your poster. Think of what you put on there as a road map for you, an interesting set of visuals, that will help you tell and illustrate the story of your project.in real time as you stand in front of it and present your work. Your poster should be a very condensed version of your work.
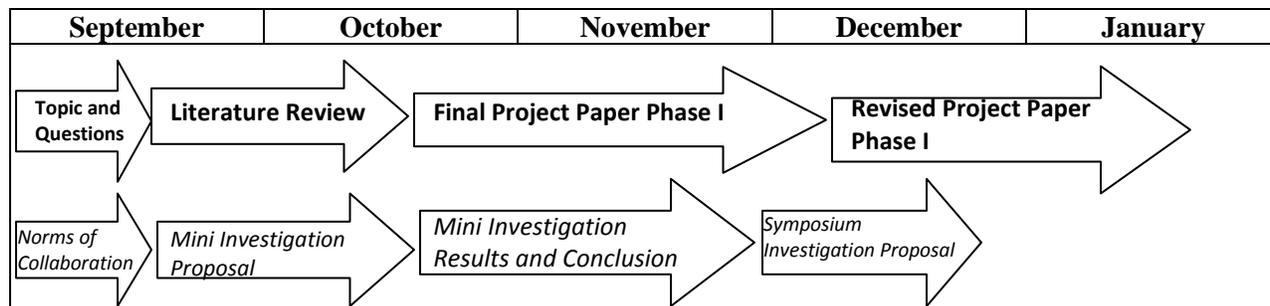
CHS Research Symposium

You will present your projects during the annual Symposium held at the end of May. CHS faculty members and the public are invited to come and see what you have accomplished throughout the year. Tables are set up throughout the entry hall and the commons for each group or individual to set up a display showcasing their project. Generally two groups are asked to present their projects to the whole group in the theater. You are expected to fulfill the following duties on the day of the Symposium:

- Set up presentation table with poster and other items that will effectively explain your project.
- Be present at your table during the whole event to answer any questions visitors might ask.
- Attend the project presentations held in the theater.
- Juniors who set up a table will assist with feedback to the groups presenting in the theater.
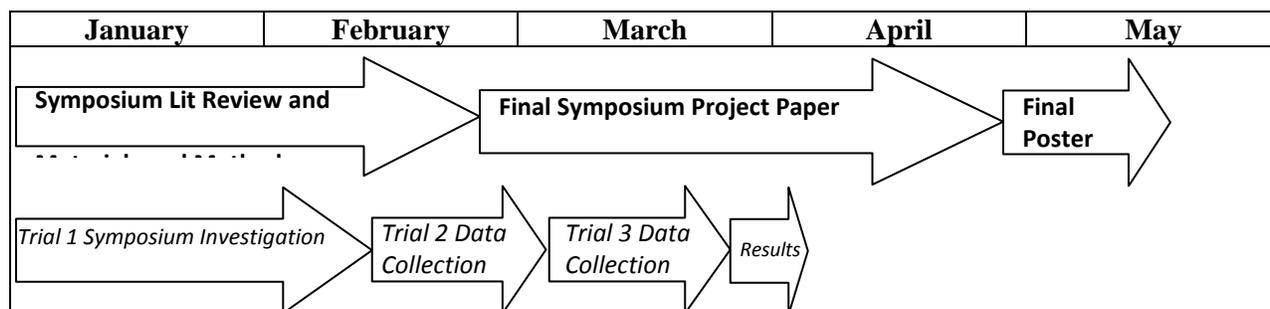- You will clean up your projects at the end of the night.

You will follow any directions given to you by magnet faculty during the event.

Research Project Timeline (9th and 10th Grade)

Fall Semester (English deliverables in bold, *Science deliverables in italics)*

September	October	November	December	January

Topic and Questions → **Literature Review** → **Final Project Paper Phase I** → **Revised Project Paper Phase I**

Norms of Collaboration → *Mini Investigation Proposal* → *Mini Investigation Results and Conclusion* → *Symposium Investigation Proposal*

Spring Semester (English deliverables in bold, *Science deliverables in italics)*

January	February	March	April	May

Symposium Lit Review and Materials and Methods → **Final Symposium Project Paper** → **Final Poster**

Trial 1 Symposium Investigation → *Trial 2 Data Collection* → *Trial 3 Data Collection* → *Results*

Outline Form of Timeline

- mid September: Topic, Question, and Norms of Collaboration due
- mid October: Literature Review and Investigation Proposal due
- late November: Investigation Results and Conclusion due
- early December: Final Project Paper Phase I due
- late December: Symposium Investigation Proposal due
- mid January: Revised Project Paper Phase I due
- mid February: Trial 1 Symposium Investigation Data Collection due
- late February: Symposium Literature Review and Materials and Methods due
- early March: Trial 2 Symposium Investigation Data Collection due
- late March: Trial 3 Symposium Investigation Data Collection due
- late March: Symposium Investigation Results due
- late April: Final Symposium Project Paper due
- late April: Symposium Poster due
- mid May: Final Symposium Poster due

Competitions Overview

MST Magnet students are strongly encouraged to enter their projects into competitions. The projects you complete for Symposium are uniquely qualified to do well in the competitions described below. By doing so, you gain recognition for the hard work and exciting investigations you have accomplished. It also spotlights MST Magnet program and increases Camas High School's visibility around the state.

Science Talent Search (STS)

Sponsored by Intel, this competition is for high school seniors and requires you to submit your complete paper in October. The top 40 finalists will compete at the week-long Intel Science Talent Institute in March in Washington D.C. There are substantial monetary prizes for all 40 finalists. Visit http://www.societyforscience.org/STS for complete information.

Junior Science and Humanities Symposium (JSHS)

Sponsored by the U.S. Military and Seattle Pacific University, this competition requires you to submit your complete paper in February. Selected papers will be presented to a panel of judges and an audience of high school students, teachers, parents, university faculty and students, and professional scientists during a two-day event in March at Seattle Pacific University. Awards include college scholarships and the opportunity to compete at the National Junior Science and Humanities Symposium in San Diego in late April. Visit http://www.jshs.org/regions/washington.html for complete information.

Southwest Washington Science and Engineering Fair (SWSEF)

Sponsored by Skyview High School and Bonneville Power Administration, you submit your project research plan during the summer, prior to collecting any data. Your completed paper is submitted in January with an arena-style presentation of your poster in February at Skyview High School.

Washington State Science and Engineering Fair (WSSEF)

Sponsored by Olympic College and several Puget Sound area companies (Boeing, Microsoft, etc), this is the state-wide "twin" of the SWSEF. You must submit a research plan prior to collecting any data. You submit your completed paper in February with an arena-style presentation of your poster in April in Bremerton. Visit http://www.wssef.org/ for complete information.

Imagine Tomorrow (IT)

Sponsored by WSU Pullman, you must submit your research plan to the MST Magnet teachers in January. Projects selected to represent Camas High School will be presented at WSU Pullman in May. Visit http://imagine.wsu.edu/ for complete information.

Appendix A

ACADEMY OF MATH, SCIENCE, AND TECHNOLOGY at CAMAS HIGH SCHOOL
ACADEMIC PROBATION CONTRACT

STUDENT: _____ **GRADE LEVEL:** _____ **DATE:**_____

GOAL: It is our desire that the student be successful in the Magnet Program at CHS by meeting its academic expectations. To assist the student in achieving that goal, this contract has been written.

SPECIFIC PROBLEM: _____

Grading Period: 1st 6 weeks   2nd 6 weeks   3rd 6 weeks

                              Semester 1   Semester 2

Class:	Grade:	Comments:

Cumulative GPA: _____

PLAN OF ACTION:
STUDENT:

TEACHERS:

PARENTS:

SIGNATURES:

Science: _____   Parent:_____

English: _____   Student:_____

Math: _____   Principal:_____

NEXT REVIEW DATE: _____