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CSP's Science & Engineering Fair



Students in **Course Name** will be required to complete an independent science project during the first semester. The project will count for a significant portion of the student's grade, as laid out below. The project involves following the scientific processes and teaches students how scientists approach problems. The project will include a research paper and a project display that will be presented to other students, faculty, and community members.

Our Science Fair follows the rules designed by the Intel National Science and Engineering Fair (ISEF). Students may choose a topic from any of the eighteen categories recognized by ISEF. Students will have the opportunity to enter their project in the county and regional science fairs if they score well at the school level. There are prizes, awards, and scholarships available to students who do well at the school, county, and regional fairs. All county science fair information and forms can be found at: <http://www.aacps.org/science/secondscifair.asp>

Please refer to the next page for the rubrics and how the grades will be entered into the grade book. Here is a timeline for the project:

Task	Documents to Hand In	Due Date		Points (grading category)
		A Day	B Day	
Choose topic & research question	<ul style="list-style-type: none"> Think Sheet 1 	09/14	09/15	10 (homework)
Define hypothesis & variables	<ul style="list-style-type: none"> Think Sheet 2 	09/28	09/29	10 (homework)
Plan & design experiment	<ol style="list-style-type: none"> Think Sheet 3 Checklist for Adult Sponsor (1) Student Checklist (1A) Approval Form (1B) And any addition safety forms specific to your project (identified on <i>Think Sheet 1</i>) 	10/17	10/18	10 (homework)
Conduct experiment & collect data check	<ul style="list-style-type: none"> Proof of progress (data table, journal, or photo of apparatus set-up with student visible) 	11/02	11/03	10 (homework)
Finish paper & construct display board	<ul style="list-style-type: none"> Project paper Project display 	12/12	12/13	40 (Assessment)
Fair Participation & Guest Judges Score (voluntary)	N/A – Students may elect to stay after school and present their projects to the guest judges, which will include engineers and scientists from our community. This is not a requirement.	12/17		N/A

Please sign and return the form below to acknowledge that you will support the efforts of your student to do well on this project. Thank you.



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SCIENCE FAIR ACKNOWLEDGEMENT

I understand that my student _____ has been assigned a Science project to complete, and that this project is to be done independently. I understand the importance of completion of all parts of the project as outlined and I will work with my student to meet the deadlines.

Parent/Guardian _____

Date _____

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Science Criterion Rubric

Inquiring and Designing Rubric				
	i. explain a problem or question to be tested by a scientific investigation	ii. formulate a testable hypothesis and explain it using scientific reasoning	iii. explain how to manipulate the variables, and explain how data will be collected	iv. design scientific investigations
0	Does not reach a standard identified by any of the descriptors below	Does not reach a standard identified by any of the descriptors below	Does not reach a standard identified by any of the descriptors below	Does not reach a standard identified by any of the descriptors below
1-2	State a problem or question to be tested by a scientific investigation	Outline a testable hypothesis	Outline the variables	Design a method, with limited success
3-4	Outline a problem or question to be tested by a scientific investigation	Formulate a testable hypothesis using scientific reasoning	Outline how to manipulate the variables, and outline how relevant data will be collected	Design a safe method in which he or she selects materials and equipment
5-6	Describe a problem or question to be tested by a scientific investigation	Formulate and explain a testable hypothesis using scientific reasoning	Describe how to manipulate the variables, and describe how sufficient, relevant data will be collected	Design a complete and safe method in which he or she selects appropriate materials and equipment
7-8	Explain a problem or question to be tested by a scientific investigation	Formulate and explain a testable hypothesis using correct scientific reasoning	Explain how to manipulate the variables, and explain how sufficient, relevant data will be collected	Design a logical, complete, and safe method in which he or she selects appropriate materials and equipment

Total Score on Project	
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Credit: Much of rubric taken from IB curriculum



The Point of Success

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Rubric Mark conversion to AACPS Percentages



Criterion achievement level	Letter Equivalent	AACPS score out of 100%
8	A+	100
7	A	95
6	B+	89
5	B	85
4	C+	79
3	C	75
2	D+	69
1	D	65
0	E	50
Not handed in	E	0

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Purpose/Research Question

Science Fair Think Sheet 1



*The universe is full of magical things
patiently waiting for our wits to grow sharper.*

- Eden Phillpots

Selecting a topic for your science fair project is probably the most difficult step. However, if you begin your research with a field of science in which you are already interested, this first step will be greatly simplified. The kind of project you need is one that produces measurable data; your project must deal with an effect that can be measured with numbers and units. The best projects pose a question and use scientific techniques to answer it.

Newspapers, science magazines, and science television programs offer many ideas for science fair projects. Adults in your life may also have some ideas for you. Topics may be found in the many books and magazines in your school library and in your science class room.

The following list shows the kind of ideas you can develop from a topic of interest. General topic: algae. Possible projects:

- The Responses of Algae to Ultraviolet Light
- The Effect of Metals on Transport Within Algae
- The Effect of Water Pollution on Algae
- The Sulfur Requirements of Algae Used for Human Food
- Factors Influencing the Development of Colonies of Algae
- A Study of Intracellular Algae in Hydras
- How Uniform is the Thallus of *Ulva*, a Green Alga?

Keep in mind that your project will have to be limited in scope. You cannot do a project on all there is to know about algae as a food source. You would have to limit the range of your projects, as shown in the list of projects on algae.

Using vertebrate animals requires the completion of multi-paged protocols that describe your entire experiment in great detail. You will also need to complete numerous forms and certifications in order to use human subjects. The use of either vertebrate animals or humans will require the approval of the district science fair before you may begin your experimentation. There are many other organisms that would be just as interesting to work with, such as algae, ants, bacteria, beetles, crabs, crayfish, crickets, protists (*Daphnia*, or water fleas, Cyclops, brine shrimp, hydra, etc.), fruit flies, houseflies, sowbugs, lichen, yeast, vinegar eels, slugs, earthworms, planaria, and mealworms.



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Explain the idea you would like to investigate for your science fair project. Include a statement of your scientific **research question** (RQ) along with your **purpose** for doing the project.

To be filled out by your teacher:

Teacher comments:

extra Safety Forms needed (obtained from <http://www.aacps.org/science/secondscifair.asp>) or see your teacher:

- Qualified Scientist form (2)
- Risk Assessment form (3)
- Human Subjects form and Informed Consent form (4)
- Vertebrate Animal form (5A and 5B)
- Potentially Hazardous Biological Agents form (6A)
- Human and Vertebrate Animal Tissue form (6B)

Project Approved: _____

Date: _____

Criterion	Achievement Levels				
	0	1-2	3-4	5-6	7-8
Inquiring and designing					
i. explain a problem or question to be test by a scientific investigation	The student does not reach a standard identified by any descriptors to the right.	The student states a problem or question to be tested by a scientific investigation.	The student outlines a problem of question to be tested by a scientific investigation.	The student describes a problem or question to be tested by a scientific investigation.	The student explains a problem or question to be tested by a scientific investigation.

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Excerpt from Intel International Science and Engineering Fair International Rules and Guidelines 2015:

Intel ISEF Categories and Subcategories

The categories have been established with the goal of better aligning judges and student projects for the judging at the Intel ISEF. Local, regional, state and country fairs may or may not choose to use these categories, dependent on the needs of their area. Please check with your affiliated fair(s) for the appropriate category listings at that level of competition.

Please visit our website at student.societyforscience.org/intel-isef-categories-and-subcategories for a full description and definition of the Intel ISEF categories:

ANIMAL SCIENCES

Animal Husbandry
Development
Ecology
Pathology
Physiology
Populations Genetics
Systematics
Other

BEHAVIORAL & SOCIAL SCIENCES

Clinical & Developmental Psychology
Cognitive Psychology
Physiological Psychology
Sociology
Other

BIOCHEMISTRY

General Biochemistry
Metabolism
Structural Biochemistry
Other

CELLULAR & MOLECULAR BIOLOGY

Cellular Biology
Cellular and Molecular Genetics
Immunology
Molecular Biology
Other

CHEMISTRY

Analytical Chemistry
General Chemistry
Inorganic Chemistry
Organic Chemistry
Physical Chemistry
Other

COMPUTER SCIENCE

Algorithms, Data Bases
Artificial Intelligence
Networking and Communications
Computational Science, Computer Graphics
Computer System, Operating System
Software Engineering, Programming Languages
Other

EARTH & PLANETARY SCIENCE

Climatology, Weather
Geochemistry, Mineralogy
Paleontology
Geophysics
Planetary Science
Tectonics
Other

ENGINEERING: Electrical & Mechanical

Electrical Engineering, Computer Engineering, Controls
Mechanical Engineering, Robotics
Thermodynamics, Solar
Other

ENGINEERING: Materials & Bioengineering

Bioengineering
Chemical Engineering
Civil Engineering, Construction Eng.
Industrial Engineering, Processing
Material Science
Other

ENERGY & TRANSPORTATION

Aerospace and Aeronautical Engineering, Aerodynamics
Alternative Fuels
Fossil Fuel Energy
Vehicle Development
Renewable Energies
Other

ENVIRONMENTAL MANAGEMENT

Bioremediation
Ecosystems Management
Environmental Engineering
Land Resource Management, Forestry
Recycling, Waste Management
Other

ENVIRONMENTAL SCIENCES

Air Pollution and Air Quality
Soil Contamination and Soil Quality
Water Pollution and Water Quality
Other

MATHEMATICAL SCIENCES

Algebra
Analysis
Applied Mathematics
Geometry
Probability and Statistics
Other

MEDICINE & HEALTH SCIENCES

Disease Diagnosis and Treatment
Epidemiology
Genetics
Molecular Biology of Diseases
Physiology and Pathophysiology
Other

MICROBIOLOGY

Antibiotics, Antimicrobials
Bacteriology
Microbial Genetics
Virology
Other

PHYSICS & ASTRONOMY

Astronomy
Atoms, Molecules, Solids
Biological Physics
Instrumentation and Electronics
Magnetics and Electromagnetics
Nuclear and Particle Physics
Optics, Lasers, Masers
Theoretical Physics, Theoretical or Computational Astronomy
Other

PLANT SCIENCES

Agriculture/Agronomy
Development
Ecology
Genetics
Photosynthesis
Plant Physiology (Molecular, Cellular, Organismal)
Plant Systematics, Evolution
Other



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Hypothesis and Variables

Science Fair Think Sheet 2



Question

With the teacher feedback from *Think Sheet 1*, restate your scientific research question:

Hypothesis

Write a hypothesis for your scientific research question.

Variables

Independent variable (what you will change each time you experiment):

Dependent variable (what you will monitor or measure each time you experiment):

Constants (items that need to be kept the same each time you experiment)

Control group: (group in your experiment where the experimental treatment is NOT applied)

To be filled out by your teacher:

Criterion :	Achievement Levels				
	0	1-2	3-4	5-6	7-8
ii. formulate a testable hypothesis and explain it using scientific reasoning	The student does not reach a standard described by any of the descriptors to the right.	The student outlines a testable hypothesis.	The student formulates a testable hypothesis using scientific reasoning .	The student formulates and explains a testable hypothesis using scientific reasoning .	The student formulates and explains a testable hypothesis using correct scientific reasoning .
iii. explain how to manipulate the variables, and explain how data will be collected	The student does not reach a standard described by any of the descriptors to the right.	The student outlines the variables.	The student outlines how to manipulate the variables, and outlines how relevant data will be collected.	The student describes how to manipulate the variables, and describes how sufficient, relevant data will be collected.	The student explains how to manipulate the variables, and explains how sufficient, relevant data will be collected.

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Design

Science Fair Think Sheet 3



You may attach extra pages if you need more room.

Question:

Hypothesis:

Complete Materials List:

Include all materials with exact amounts (ie. "10 g of salt" as opposed to "salt").

Procedure:

This needs to be in a list-form and must be detailed (ie. "Pour 50 mL of water into the 250 mL beaker" as opposed to "pour the water into the beaker")

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Safety

Identify materials or procedures that may contain risks or safety concerns. Explain the steps you will take to alleviate these risks to you or others involved in the project. (Be sure all forms are completed prior to beginning the project)

Data Collection and Processing

Construct a data table for which you will record your collected data in. You do not need to fill in the data table with made-up numbers; we just want the skeleton of your table! What will you do with this data (find the average, etc.)

Bibliography:

What resources have you utilized? Are your resources varied (ie. Internet, book, journals, etc.)? Are your resources reliable (ie. do not cite Wikipedia as a source of information)?

To be filled out by your teacher:

Criterion Inquiring and designing	Achievement Levels				
	0	1-2	3-4	5-6	7-8
iv. design scientific investigations	The student does not reach a standard described by any of the descriptors to the right.	The student designs a method with limited success .	The student designs a safe method in which he or she selects materials and equipment .	The student designs a complete and safe method in which he or she selects appropriate materials and equipment .	The student designs a logical, complete, and safe method in which he or she selects appropriate materials and equipment .

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<Insert Student Checklist (1A)>

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<Insert Checklist for Adult Sponsors (1)>

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<Insert Approval Form (1B)>

NAME: _____

Course Name

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