

Elizabethtown Area School District

Competition Science

Name of Course

Course Number: 345

Length of Course: 36 weeks

Grade Level: 9-12 Elective

Total Clock Hours: 120

Length of Period: 80 minutes

Date Written: 11/27/10

Periods per Week/Cycle: 2.5

Written By: Theresa Swenson

Credits (if app.): 1.0

Weighting: 1.2

Prerequisite: Honors English in past or current year recommended

Course Description:

This elective course will provide students with the opportunity to develop, conduct and present an original research project that will be entered into the Lancaster Science and Engineering Fair. In addition, students will compete in the Science Olympiad which requires participants to work cooperatively as a team to solve science related problems in a competitive atmosphere. Experimental design, measurement techniques, statistical analysis of data, literature research techniques, scientific writing and presentation will be covered. **Students are required to participate in the Regional Science Olympiad and the Lancaster County Science Fair. The Science Olympiad is held on a Saturday in the month of March, and the science fair will require time outside of school to participate.**

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I. Overall Course/Grade Level Standards: Science and Technology

Students will KNOW and be able TO DO the following as a result of taking this course.

- A. Apply concepts of systems, subsystems, feedback and control to solve complex technological problems. (3.1.12.A)(E)
- B. Apply concepts of models as a method to predict and understand science and technology. (3.1.12.B)(E)
- C. Assess and apply patterns in science and technology. (3.1.12.C)(E)
- D. Analyze scale as a way of relating concepts and ideas to one another by some measure. (3.1.12.D)(E)
- E. Evaluate the nature of scientific and technological knowledge. (3.1.12.E)(E)
- F. Evaluate experimental information for appropriateness and adherence to relevant science processes. (3.2.12.B)(E)
- G. Apply the elements of scientific inquiry to solve multi-step problems. (3.2.12.C)(E)
- H. Analyze and use the technological design process to solve problems. (3.2.12.D)(E)
- I. Analyze knowledge of information technologies of processes encoding, transmitting, receiving, storing, retrieving and decoding. (3.6.12.B)(I)
- J. Analyze physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems. (3.6.12.C)(I)
- K. Apply advanced tools, materials and techniques to answer complex questions. (3.7.12.A)(E)
- L. Evaluate appropriate instruments and apparatus to accurately measure materials and processes. (3.7.12.B)(E)
- M. Apply basic computer operations and concepts. (3.7.10.C)(E)
- N. Utilize computer software to solve specific problems. (3.7.10.D)(E)
- O. Apply basic computer communications systems. (3.7.10.E)(E)
- P. Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life. (3.8.12.B)(I)
- Q. Evaluate the consequences and impacts of scientific and technological solutions. (3.8.12.C)(E)

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II. Overall Course/Grade Level Standards: Reading, Writing, Speaking and Listening

Students will KNOW and be able TO DO the following as a result of taking this course.

- R. Write complex informational pieces. (1.4.11.B)(E)
- S. Edit writing using the conventions of language. (1.5.11.F)(E)
- T. Present and/or defend written work for publication when appropriate. (1.5.11.G)(E)
- U. Listen to others. (1.6.11.A)(I)
- V. Contribute to discussions. (1.6.11.D)(I)
- W. Select and refine a topic for research. (1.8.11.A)(E)
- X. Locate information using appropriate sources and strategies. (1.8.11.B)(E)
- Y. Organize, summarize and present the main ideas from research. (1.8.11.C)(E)

III. Overall Course/Grade Level Standards: Math

Students will KNOW and be able TO DO the following as a result of taking this course.

- Z. Make predictions using interpolation, extrapolation, regression and estimation using technology to verify them. (2.6.11.D)(E)
- AA. Describe questions of experimental design, control groups, treatment groups, cluster sampling and reliability. (2.6.11.G)(E)

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II. Content Major Areas of Study

List all units of study below:

<u>Unit</u>	<u>Estimated Time</u>	<u>Materials</u>
1. The Scientific Research Proposal	20 Blocks	Text, Computer with Internet access
2. Science Olympiad Events	19 Blocks	Science Olympiad handouts, Computer with Internet access
3. Research and Science Olympiad Materials	8 Blocks	Computer with Internet access
4. Independent Research	21 Blocks	Text, Lab equipment, Lab supplies, Computer with Internet access
5. Cooperative Research	24 Blocks	Text, Lab equipment, Lab supplies, Computer with Internet access

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Name of Course: Competition Science

Name of Unit: The Scientific Research Proposal

Essential Question for the Unit: How is an individual research project established?

Unit Objectives/Key Questions			
A. How is the scientific method used in the real world?	E .	A, G, W, AA	3.1.12.A, 3.2.12.C, 1.8.11.A, 2.6.11.G
B. What is the difference between a scientific question and a research hypothesis?	E	A, G	3.1.12.A, 3.2.12.C
C. How is a research proposal written?	E	A, K, L, M, O, R, S, X, Y	3.1.12.A, 3.7.12.A, 3.7.12.B, 3.7.10.C, 3.7.10.E, 1.4.11.B, 1.5.11.F 1.8.11.B, 1.8.11.C

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Name of Course: Competition Science

Name of Unit: Science Olympiad Events

Essential Question for the Unit: How are Science Olympiad events matched with students?

Unit Objectives/Key Questions			
A. What Science Olympiad events are scheduled for this year?	E	H	3.2.12.D
B. How are Science Olympiad events matched with individual students?	E	H	3.2.12.D
C. How does a student prepare for (a) Science Olympiad event(s)?	E	A, E, H, J, K, L, P, Q	3.1.12.A, 3.1.12.E, 3.2.12.D, 3.6.12.C, 3.7.12.A, 3.7.12.B, 3.8.12.B, 3.8.12.C

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Name of Course: Competition Science

Name of Unit: Research and Science Olympiad Materials

Essential Question for the Unit: How do you predict necessary research and event materials in a cost-effective way?

Unit Objectives/Key Questions			
A. How are the materials necessary for a project determined?	E	H	3.2.12.D
B. How is a cost analysis performed for research and event materials?	E	H, Q	3.2.12.D, 3.8.12.C

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Name of Course: Competition Science

Name of Unit: Independent Research

Essential Question for the Unit: How is an individual research project conducted and evaluated?

Unit Objectives/Key Questions			
A. How are research experiments selected and designed?	E	A, G, K, L, AA	3.1.12.A, 3.2.12.C, 3.7.12.A, 3.7.12.B, 2.6.11.G
B. How is research data displayed and analyzed?	E	B, C, D, F, N, Z	3.1.12.B, 3.1.12.C, 3.1.12.D, 3.7.10.D, 3.2.12.B, 2.6.11.D
C. How is the method of statistical analysis of data determined?	E	F	3.2.12.B
D. How is a research report written?	E	G, M, O, R, S, X, Y	3.2.12.C, 3.7.10.C, 3.7.10.E, 1.4.11.B, 1.5.11.F 1.8.11.B, 1.8.11.C
E. How is a research poster constructed?	E	M, N, T	3.7.10.C, 3.7.10.D, 1.5.11.G

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Name of Course: Competition Science

Name of Unit: Cooperative Research

Essential Question for the Unit: How is a complex research problem delineated within a group?

Unit Objectives/Key Questions			
A. How is a research problem solved in a cooperative group?	I	B, F, G, K, L, U, V, Z, AA	3.1.12.B, 3.2.12.B, 3.2.12.C, 3.7.12.A, 3.7.12.B, 1.6.11.A, 1.6.11.D 2.6.11.D, 2.6.11.G
B. How do members of a research team communicate?	I	O, U, V	3.7.10.E, 1.6.11.A, 1.6.11.D
C. How is a research report written cooperatively?	I	C, D, I, M, N, O, R, S, X, Y	3.1.12.C, 3.1.12.D, 3.6.12.B, 3.7.10.C, 3.7.10.D, 3.7.10.E, 1.4.11.B, 1.5.11.F, 1.8.11.B, 1.8.11.C

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III. Course Assessments

Check types of assessments to be used in the teaching of the course.

(Provide examples of each type.)

- | | |
|---|--|
| <input type="checkbox"/> Objective Tests/Quizzes
<input type="checkbox"/> Constructed Responses
<input type="checkbox"/> Essays
<input checked="" type="checkbox"/> Reports
<input checked="" type="checkbox"/> Projects
<input type="checkbox"/> Portfolios
<input checked="" type="checkbox"/> Presentations
<input checked="" type="checkbox"/> Performance tasks

<input type="checkbox"/> _____
<input type="checkbox"/> _____ | <input type="checkbox"/> Response Journals
<input type="checkbox"/> Logs
<input type="checkbox"/> Computer Simulations
<input checked="" type="checkbox"/> Research Papers
<input type="checkbox"/> Class Participation
<input type="checkbox"/> Notetaking
<input type="checkbox"/> Daily Assignments
<input type="checkbox"/> Writing Samples

<input type="checkbox"/> _____
<input type="checkbox"/> _____ |
|---|--|

Provide copies of common assessments that will be utilized for all students taking this course. Overall course/grade level standards will be measured by a common course assessment. Unit objectives will be measured on an ongoing basis as needed by the classroom teacher to assess learning and plan for instruction. List common assessments below and recommended date/time frame for administration (at least quarterly).

Name of Common Assessment	When given?
1. Research Proposal	End of 1 st Quarter
2. Research Poster	End of 3 rd Quarter
3. Final Report	At the end of the course
4.	
5.	
6.	

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IV. Expected levels of achievement

Current grading scale:

“A” 92% - 100%

“B” 83% - 91%

“C” 74% - 82%

“D” 65% - 73%

“F” Below 65%

PA Proficiency Levels
Advanced Proficient
Basic Below Basic

Attach rubrics, checklists, or other documentation noting how levels of proficiency will be determined for common assessments. The following scoring documents have been developed for this course:

Research Proposal Grading Rubric

Forms:	Maximum Points	Earned Points
A. Checklist for Adult Sponsor (1).....	1	_____
B. Student Checklist (1A).....	1	_____
C. Approval Form (1B).....	1	_____
D. Risk Assessment Form (3).....	1	_____
 Research Plan		
A. Cover page.....	2	_____
Name		
School		
Advisor: Dr. Theresa Swenson		
Title of Project		
Category		
B. Project Title.....	1	_____
C. Question(s) or Problem(s) being addressed.....	2	_____
D. Hypothesis/Engineering Goals.....	2	_____
E. Procedures.....	15	_____
F. Data Analysis		
1. Types of numbers obtained (if applicable).....	5	_____
For example: distance traveled (km) vs time (s)		
2. Type of graphical display(s) (if applicable).....	5	_____
3. Statistical analysis (if applicable).....	5	_____
Examples: t-test, standard deviation, standard error, chi-square		
G. Bibliography (APA Style).....	10	_____
Five references from science journal articles, books or reliable internet sites		
 National Registration by 10/30/10	 2	 _____
Total		_____

Your point totals will be normalized to 100 points for your Q1 Grade. If you have more or fewer points than someone else due the requirement for additional forms by INTEL Science Fair, the normalization process makes everyone’s proposal worth the same number of points (100).

Rubric for Research Poster – Science Fair

	Maximum Points	Earned Points
A. Title.....	5	_____
B. Abstract.....	10	_____
C. Introduction.....	10	_____
D. Hypthosis/Engineering Goals.....	5	_____
E. Materials.....	10	_____
F. Procedures.....	30	_____
G. Results.....	30	_____
H. Data: Statistical Analysis.....	20	_____
I. Data: Display.....	20	_____
J. Conclusions.....	30	_____
K. Hypothesis/Engineering Goals Analysis.....	10	_____
L. Bibliography (APA Style)	20	_____
At least five references from science journal articles, books or reliable internet sites		
Total		_____

Note: If a line item does not apply to your project, your point total will be normalized so that all projects equal the same number of points (200).