2007 Mississippi Curriculum Framework

Secondary Agriculture Power and Machinery

(Program CIP: 01.0204 – Agricultural Power Machinery Operation)

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Standards in this document are based on information from the following organizations:

Agriculture, Food, and Natural Resources Standards	Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources* as published by the National Association. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.
Academic Standards	Mississippi Department of Education Subject Area Testing Program
21st Century Skills	Reproduced with permission of the Partnership for 21st Century Skills. Further information may be found at www.21stcenturyskills.org

Preface

Secondary Agriculture Power and Machinery Research Synopsis

Articles, books, Web sites, and other materials listed at the end of each instructional unit were considered during the revision process. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from other secondary and postsecondary agricultural power and machinery programs throughout the state were asked to give input related to changes to be made to the curriculum framework. Instructors from secondary and postsecondary agriculture power and machinery programs throughout the state were also asked to give input on changes to be made to the curriculum framework.

Curriculum
The following state/national standards were referenced in each course of the curriculum:

- *Mississippi Department of Education Subject Area Testing Program Academic Standards*
- *21st Century Skills*
- *Career Cluster Resources for Agriculture, Food, and Natural Resources* as published by the National Association of State Directors of Career and Technical Education

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process; and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the curriculum revision meeting included:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness and that they were aligned to the Career Clusters skills and knowledge statements.
- Information from the "Special Topics" units in both courses was integrated into other units and the "Special Topics" units were removed from the curriculum.
- Competencies on Supervised Agricultural Experience programs and recordkeeping were added to the Introduction units in both courses.
- All Suggested Strategies were updated to reflect differentiated instruction and other proven instructional practices.
- Rubrics and other suggested assessment instruments were added.
- The Recommended Tools and Equipment list was updated.

Assessment
Students will be assessed using the Mississippi Career Planning and Assessment test for *Secondary Agriculture Power and Machinery MS-CPAS2 Test*.

Professional Learning
It is suggested that instructors participate in professional learning related to the following concepts:

- Integrating academics into Agriculture Power and Machinery
- Use of the Mississippi Agriculture Education BRIDGE site on Blackboard®

- Use of precision agriculture technology
- Implementation of Supervised Agricultural Experience programs for Agricultural Power and Machinery
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html and click on Differentiated Instruction. Work through this online course and review the additional resources.

Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Career and Technical Education Improvement Act of 2006; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
    - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
    - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills has been recognized for some time and the 21st Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and the International Society for Technology in Education, developers of the National Educational Technology Standards (NETS), were strategic partners in the Partnership for 21st Century Skills.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

Agriculture Power and Machinery is an instructional program designed to provide basic skills for students to become employed in the industry of agricultural power mechanics or to continue their education in postsecondary institutions. Skills taught in the program relate to selection, operation, service, maintenance, and repair of a variety of agricultural power units and agricultural machinery and equipment. The program includes instruction in gasoline and diesel engines, welding, hydraulics, and other power systems. This program makes use of the FFA Leadership, Professional Development Activities, and Supervised Agricultural Experience Program as integral learning laboratories.

General equipment maintenance and operation are covered in this course. Specific equipment, such as tillage, turf/lawn care, irrigation, harvesting, and forage equipment, is covered in the postsecondary course.

Industry standards referenced are from the *Career Cluster Resources for Agriculture, Food, and Natural Resources* as published by the National Association. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

Course Outline

Agriculture Power and Equipment I

Course CIP Code: 01.0201

Course Description: Agriculture Power and Equipment I is the entry-level course of the secondary Agriculture Power and Machinery program. Students in this course will gain basic skills and knowledge related to safety, measurement, fasteners, welding and cutting, mechanics, equipment maintenance, and agricultural equipment. (2-2½ Carnegie units, depending upon time spent in the course)

Unit	Title	Hours
1	Introduction	10
2	Safety	15
3	Measurement	20
4	Fasteners	10
5	Oxyfuel Cutting	15
6	Arc Welding (SMAW)	28
7	Mechanics and Power Transmission	20
8	Compact Engines Service and Repair	45
9	Equipment/Systems Maintenance	22
10	Repairing and Refinishing Agricultural Equipment	25

Agriculture Power and Equipment II

Course CIP Code: 01.0290

Course Description: Agriculture Power and Equipment II is the completion level course of the secondary Agriculture Power and Machinery program. Students in this course will gain additional skills related to safety, advanced welding and cutting, diesel engines, equipment operation and maintenance, and advanced topics in agriculture. (2-2½ Carnegie units, depending upon time spent in this course)

Unit	Title	Hours
1	Orientation and Safety (Review and Reinforcement)	20
2	Advanced Cutting and Welding	40
3	Hydraulic Systems	20
4	Diesel Engines	40
5	Electrical/Electronics Systems	30
6	Agricultural Equipment Operation	20
7	Periodic and Seasonal Maintenance	10
8	Applying Principles of Diagnostics	15
9	Advanced Technology in Agriculture	15

Agriculture Power and Machinery I
Unit 1: Introduction **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the requirements and working conditions for employment in the Agriculture Power and Machinery industry. a. Describe employment opportunities in the Agriculture Power and Machinery industry. b. Describe education and experience requirements for employment in the Agriculture Power and Machinery industry. c. Describe earning and working conditions in the Agriculture Power and Machinery industry. d. Describe employability skills necessary for employment in the Agriculture Power and Machinery industry. e. Complete a job application. f. Complete a personal resume. g. Conduct a job interview.	**Teaching:** • Display the classroom discipline plan, procedures, calendar, and emergency information, etc. in a prominent place. Review these important documents with students. Make sure students understand the proper emergency procedures. • Administer a learning styles inventory to students. Use results from this inventory to differentiate instruction throughout the course. • Post examples of tests students will complete; assignments they will turn in; and projects students will complete throughout the year. Allow students to review these samples and ask questions. • Designate one area of the classroom to list daily objectives and weekly assignments and/or expectations of students. Encourage students to write the weekly assignments in their Agriculture Power and Machinery notebook. • Using guided prompts, have students participate in a classroom discussion describing their history, experiences, and feelings about agriculture, and 21st Century skills. o What do you already know about agriculture and machinery? o What would our nation and world be like without agriculture? o What are the major agriculture industries in your area? o What is the FFA? o What is technology? o When was the first time you used a computer? Do you use the Internet? If so, how do you use it? o What skills or behavioral characteristics does this

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	school/classroom expect from you? What skills or behavioral characteristics do employers and/or industries expect from you? How are they different? How are they the same? • Show students the video, *US Geography: From Sea to Shining Sea: Southeast Region*, from the United Streaming video collection (http://www.unitedstreaming.com). To get a user name and password, contact your local media science technician or administrator. Use the following prompts to facilitate discussion after the video: o What are the main crops grown in the southeast? o How has the agriculture industry changed from the time of early settlers to present day? o What cultural and ethical issues impacted the agriculture industry? • Have students select one of the following projects: o Develop a 3-dimential timeline that shows the growth, changes of the agriculture industry. Be sure to include ethical and cultural issues that impacted the industry. o Develop a 3-dimential map of the southeastern United States. Indicate the different types of agriculture industries and crops throughout the region. • Have students interview three industry members from Agriculture Power and Machinery or other professionals related to the course and determine how science, math, writing, technology, and industry specific knowledge work together in their daily careers. Using bulletin board paper, construction papers, and tape, have students work in collaborative groups to create a classroom chart and summaries of

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	the quantitative data they received for their industry member interviews. Allow students to discuss their findings and expectations for the course. • As an extension, have students input information into a word processing and spreadsheet application program. Have students use the writing process to summarize their information. • Explain the requirements and working conditions for employment in the Agriculture Power and Machinery industry, using a PowerPoint presentation. • Have students use the Internet and other classroom resources to research employment opportunities, educational opportunities, and working conditions in the Agriculture Power and Machinery industry. Have students use the writing process to develop a summary report of their research. • Invite a representative of a local human resources department to speak to the class regarding the job application process. • Have students complete a job application, letter of application, and resume. Have students participate in a mock job interview. • Cover one or more bulletin boards with paper and trim. Leave it bare and tell students that this is where their high-quality work will be displayed. Select exemplary samples of the letter of the job application, letter of application, and resume to display to the class. **Assessment:** • Give a written test on working conditions and employment opportunities in Agriculture Power and Machinery occupations. • Have students use the Written Report Rubric found in Appendix D to peer evaluate summary reports. Next, have students make corrections and submit. Use the Written Report Rubric found in

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	Appendix D to assess the report on employment and educational opportunities and working conditions. • Use the Employability Skills rubric found in Appendix D to evaluate the job application, letter of application, and resume, and participating in a job interview. • Explain to students that portfolios are a collection of works gathered over time that demonstrate students' progress in learning and writing. Explain to students that they will build a portfolio throughout the two-year program. Have students correct any errors to assignments and include them in their Agriculture Power and Machinery portfolio.
2. Explain the local school rules and regulations. a. Describe local school rules found in the student handbook. b. Describe attendance policies. c. Describe laboratory and facilities associated with the program d. Compare and contrast school and industry expectations.	**Teaching:** • Divide students into two groups. Assign one of the following scenarios to each group. Have groups present a role play for their assigned scenario: o Imagine a school without rules. What would a normal day be like? What would a normal class be like? How productive would your day be? o Imagine a school that has created a rule and a procedure for everything. What would a normal day be like? What would a normal class be like? How productive would your day be? • Have students interview family and community members who are employed at local industries to determine employee expectations for behavior and work ethic. Have students read local student handbook and complete a Venn Diagram (see example in Appendix D) that compares and contrasts the student handbook requirements to those in the workplace. Have students use technology productivity tools and the writing process to write a description of their Venn Diagram. • Have students read and discuss local

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	school rules and policies associated with the Agriculture and Power Machinery program. • Tour laboratory and other facilities associated with program, noting equipment and resources available to the students. Discuss safety procedures related to the facility (e.g., fire drills, tornado drills, school crisis response plan, etc.). **Assessment:** • Give a written test on local school rules and regulations. • Have students complete a form verifying that they have received instruction on local school rules and policies. • Evaluate Venn Diagrams for accuracy. • Have students insert artifacts from this competency into their portfolio.
3. Identify FFA activities pertaining to Agriculture Power and Machinery. a. Describe the purposes of the FFA organization. b. Participate in the leadership and personal development activities and competitive events of FFA.	**Teaching:** • Use a PowerPoint presentation to describe the purposes of the FFA organization and the activities and programs that support these purposes. • Have students visit the FFA website (http://www.ffa.org/) to explore the FFA mission, goals, and history. • Have students research and select FFA activities that they will participate in during the coming year. Have students set a goal related to FFA that they would like to accomplish throughout the year. Have students develop a timeline to help them accomplish their goal. **Assessment:** • Give a written test on the purposes and programs of the FFA. • Evaluate student participation in FFA activities on an ongoing basis. • Have students insert artifacts from this competency into their portfolio.
4. Identify the purposes, requirements, and types of the Supervised Agricultural Experience (SAE) programs. a. Explain the purposes of the SAE	**Teaching:** • Provide examples of sound SAE's using PowerPoint presentation, the SAE's website, and other graphic presentations.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
program. b. Identify the requirements of the SAE. c. Compare the types of SAE programs. d. Plan SAE activities for the coming year.	• Discuss the purposes and requirements for having an SAE. • Discuss benefits and objectives of the SAE. • Have students conduct research to determine suitable SAE programs. • Have students complete a plan of activities for their SAE over the coming year. **Assessment:** • Give a written test on SAE planning. • Use the SAE Plan Rubric found in Appendix D to evaluate the SAE plan. • Have students insert artifacts from this competency into their portfolio.
5. Maintain agriculture record keeping for the SAE. a. Maintain income and expense records. b. Prepare inventory records. c. Compute a net worth statement. d. Maintain records of supplementary and improvement activities and leadership development activities.	**Teaching:** • Discuss the income and expense records, inventory and depreciation methods, how to figure net worth, and maintaining records of supplementary and improvement activities, and leadership activities. • Have students start filling in their record books with their information. **Assessment:** • Give a written test on maintaining records. • Make monthly checks on progress in keeping accurate records of SAE experiences. • Have students insert artifacts from this competency into their portfolio. • Evaluate portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives

LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives

TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.
H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

SUGGESTED REFERENCES

Books

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National Association of the FFA. (2006). *FFA student handbook*. Indianapolis, IN: Author.

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Agriculture Power and Machinery I
Unit 2: Safety **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the general laboratory safety requirements for Agriculture Power and Machinery. a. Describe personal safety rules for working in the laboratory and/or Agriculture Power and Machinery industry, including the eye safety law. b. Describe general workplace safety rules. c. Describe the proper use of fire extinguishers and classes of fires. d. Identify standard industry Safety Color Code. e. Describe procedures for safely handling heavy objects. f. Identify safety precautions and devices associated with the use of electricity. g. Describe accident reporting procedures.	**Teaching:** • Use a PowerPoint presentation to identify and describe safety rules and precautions associated with working in Agriculture Power and Machinery laboratories and shops. • Show a video on procedures for the proper use of fire extinguishers and classes of fires. A sample video, *Fire Extinguishers, Alarms, and Planning for Emergencies,* can be found at www.unitedstreaming.com • Use a PowerPoint presentation to identify the safety colors and their meanings. • Demonstrate procedures for safely handling heavy objects. • Discuss the general safety rules associated with electricity and the risks associated with receiving an electrical shock. Show students the different devices that are used to protect against shock and stress and the importance of care in using electrical equipment. • Have students draw a floor plan of the laboratory/shop area showing safety features such as exits, fire extinguishers, safety equipment locations, and first aid equipment; and potential hazards such as compressed air and gas lines. • Stage a mock accident and have students follow procedures and complete an accident report. **Assessment:** • Give a written test on safety rules, procedures, and devices. Students must correctly answer 100% of the questions to participate in shop and laboratory activities. NOTE: Safety practices and procedures will be monitored and evaluated on an ongoing basis throughout the year. • Grade student assignment to draw and label a floor plan showing safety equipment, exits, and hazardous areas.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Grade student assignment to complete an accident reporting procedure. • Have students insert artifacts from this competency into their portfolio.

2. Identify hazardous materials that may be found in the laboratory or on a job site and describe procedures for handling/avoidance or removal of materials.
a. Review MSDS sheet to identify hazardous materials.
b. Describe the approved storage procedures for flammable materials found in the Agriculture Power and Machinery laboratory.
c. Describe approved procedures for disposal of hazardous materials.
d. Demonstrate safe procedures for the use of storage batteries.
	Teaching:
	• Show the video, *Simple Science: Safety Matters,* from the United Streaming video Collection (http://www.unitedstreaming.com). Use the following prompts to facilitate a classroom discussion:
	  • What are chemical reactions and energy changes? Why do we need to know about them?
	  • What is the Workplace Hazardous Materials Information System (WHMIS)?
	  • What are examples of proper techniques for handling hazardous materials?
	• Provide students with an example of a MSDS sheet and have them complete an activity interpreting its content.
	• Demonstrate approved procedures for the storage for flammable materials found in the Agriculture Power and Machinery laboratory.
	• Demonstrate procedures for disposal of hazardous materials.
	• Demonstrate safe procedures for the use of storage batteries.
	Assessment:
	• Grade activity on interpreting a MSDS sheet.
	• Monitor student activities throughout the year related to storage and disposal of hazardous materials including flammable materials and storage batteries.
	• Have students insert artifacts from this competency into their portfolio.

3. Demonstrate use of hand tools used in Agriculture Power and Machinery. a. Identify basic hand tools used in Agriculture Power and Machinery (wrenches, sockets and accessories,	**Teaching:** • Show the video, *Home Appliances and Power Tool Repairers,* from the United Streaming video Collection. (http://www.unitedstreaming.com). Have

Competencies and Suggested Objectives	Suggested Strategies for Competencies
screwdrivers, pliers, hammers, punches and chisels, etc.) b. Demonstrate use of hand tools used in Agriculture Power and Machinery.	students develop one discussion question from the video. Have students share their discussion questions to facilitate discussion. • Show each tool to the students and describe and demonstrate its safe and proper use. **Assessment:** • Conduct a Tool Identification Contest. Have students identify the tool and complete statements or questions related to its safe and proper use. • Have students insert artifacts from this competency into their portfolio.
4. Demonstrate use of portable power tools found in the Agriculture Power and Machinery laboratory. a. Identify types of portable power tools used in Agriculture Power and Machinery (grinders, drills/drivers, impact wrenches, saws, and presses, etc). b. Demonstrate safety procedures for use of portable power tools used in Agriculture Power and Machinery. c. Demonstrate the use of portable power tools used in the Agriculture Power and Machinery laboratory.	**Teaching:** • Identify the different portable power tools used in Agriculture Power and Machinery and describe their use. • Demonstrate the safe and proper use of each tool to the students. Have students perform simple exercises to make sure they can safely and properly use the tool. (NOTE: Power tool safety will be assessed on an ongoing basis throughout the year.) **Assessment:** • Give a written test on power tool identification and usage. • Use a checklist to evaluate student use of specific power tools. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.
5. Demonstrate the use of stationary tools used in Agriculture Power and Machinery. a. Identify stationary tools used in the Agriculture Power and Machinery laboratory (band saws, drill presses, hydraulic shears, pedestal/bench grinders, abrasive cut-off saws, etc. b. Describe the functions of stationary power tools used in Agriculture Power and Machinery. c. Describe safety rules of stationary power tools used in Agriculture Power	**Teaching:** • Identify the different stationary power tools used in the lab, describe their functions and their safe and proper operation and use. • Demonstrate the use of each tool and have students perform simple exercises to show their familiarity with safe and proper operations. (NOTE: Safety in using power tools will be assessed throughout the year.) • Give students an imaginary budget. Have students determine what tools they would need to run a successful Agriculture Power and Machinery Technician Shop. Have

Competencies and Suggested Objectives	Suggested Strategies for Competencies
and Machinery. d. Demonstrate use of each stationary power tool used in Agriculture Power and Machinery. e. Perform maintenance procedures on each stationary power tool used in Agriculture Power and Machinery.	students use a spreadsheet application program to determine which tools they would purchase with their allotted budget. Have students use technology productivity tools and the writing process to create a summary of their budget. The summary should include a table of their budget and graphs. **Assessment:** • Give a written test on stationary power tools usage. • Use a checklist for each tool to document student familiarity with the tool. • Use the Written Report Rubric found in Appendix D to evaluate student budget summaries. • Have students insert artifacts from this competency into their portfolio.
6. Demonstrate use of lifting, hoisting, and supporting equipment used in Agriculture Power and Machinery. a. Identify lifting, hoisting, and supporting equipment used in Agriculture Power and Machinery (jacks, jack stands, hoists, floor cranes, overhead cranes, chains and slings, etc.) b. Demonstrate safety rules for using lifting, hoisting, and supporting equipment in Agriculture Power and Machinery. c. Demonstrate use of lifting, hoisting, and supporting equipment in Agriculture Power and Machinery.	**Teaching:** • Identify the different lifting and hoisting equipment used in the Agriculture Power and Machinery lab and discuss its safe and proper use. • Have students perform simple exercises to demonstrate their familiarity with each piece of equipment. **Assessment:** • Give a written test on safe and proper use of lifting and hoisting equipment. • Use a checklist to evaluate student familiarity with each piece of equipment. (NOTE: Safety in using equipment will be assessed throughout the year.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
TEC 2 Use available power sources to plan and apply control systems.
TEC 3 Explain geospatial technology to demonstrate its applications.
ENV 4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A5 Utilize various formulas in problem-solving situations.
A8 Analyze data and apply concepts of probability.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

American Association for Vocational Instructional Materials. (2002). *Developing safety skills for the home and shop*. Winterville, GA: Author.

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Agriculture Power and Machinery I
Unit 3: Measurement **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies

1. Identify types of measuring devices used in Agriculture Power and Machinery.
a. Identify types of measuring devices used in Agriculture Power and Machinery, including tape measure, rules, micrometers, calipers, dial indicators, and thickness gauges.
b. Demonstrate ability to use types of measuring devices used in Agriculture Power and Machinery, including tape measures, rules, micrometers, calipers, dial indicators, and thickness gauges.
	Teaching:
	• Discuss the importance of accurate measurement. Have students work in groups to determine the following measurements (Note: Students may need to use Map Quest (http://www.mapquest.com/directions/) for those in the U.S. and the Distance Calculator (http://www.indo.com/cgi-bin/dist) for international distances.):
	  • Distance from your classroom to the principal's office.
	  • Distance from your school to the nearest grocery store.
	  • Distance from your town to another town in Mississippi.
	  • Distance from your town to another town in the US.
	  • Distance from your town to another town in another country (e.g., Paris, France, etc.).
	• Have students watch *Measure for Measure: Lengths and Heights* from the united Streaming video library, and point out that the narrator says, "Measurement rules our lives. It has sliced up our world and helped us impose order and logic on our restless universe." Ask students: What do you think the narrator means? What would a world with no measurements be like?
	• Ask students the following:
	  • How have units of length been determined? (People used the length of their own foot, hand, fingertip, pace, or the distance from the elbow and fingertip. In England, the distance from the ruling monarch's nose to fingertip was one yard and three barleycorns made up one inch.)
	  • What was the problem with using the human body or natural products as a

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	standard of measurement? (They always differ.) • Who first called for standard measurements, and why? (Traders needed to know how much they were buying or selling.) • How have units of length been determined? (People used the length of their own foot, hand, fingertip, pace, or the distance from the elbow and fingertip. In England, the distance from the ruling monarch's nose to fingertip was one yard and three barleycorns made up one inch.) • What was the problem with using the human body or natural products as a standard of measurement? (They always differ.) • Who first called for standard measurements, and why? (Traders needed to know how much they were buying or selling.) • Have students work with a partner to measure the length of their feet without shoes. Have them record this measurement in standard inches. • Using their personal unit measurement, have students determine the length of a personal non-standard inch. They should divide the length of their foot by 12. (Example: If a student's foot measures 8 inches, a non-standard inch would be 8 divided by 12 = .6.) Students may round their answer to the nearest eighth. • Have students draw two squares with four inch sides, one using standard inches, the other using personal inches. (Using the personal non-standard inch example above, the second square would have 2.5-inch sides.) • Have students attach their personal squares to the board. Discuss the consequences of countries using nonstandard measurements. For example, what if one country supplied parts for a machine produced in another

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	country? • Identify types of measuring devices used in Agriculture Power and Machinery and demonstrate their use. • Have students complete practical exercises involving the use of each device. **Assessment:** • Give a written test on the identification and use of measuring devices. • Use a checklist to evaluate student familiarity with each device. • Have students insert artifacts from this competency into their portfolio.
2. Apply English and metric systems of measurement. a. Describe English and metric units for measuring distance, area, weight, and volume. b. Convert measurements from metric to English units and vice versa.	**Teaching:** • Have students read the articles titled *Metric System* and *The International System of Units* from the United Streaming Web site. Have students use a table in a word processing document to compare and contrast the two systems. • Describe the different English and metric units for measuring distance, area, weight, and volume. • Have students apply the use of English and metric measures of distance or length, area, and volume. • Use an assignment sheet to have students convert metric weight and distance measurements to English and vice versa. **Assessment:** • Give a written test on the use of metric and English measurement. • Grade student assignment sheet on converting weight and distance measurements. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

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PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
TEC 2 Use available power sources to plan and apply control systems.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A5 Utilize various formulas in problem-solving situations.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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Articles

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Agriculture Power and Machinery I
Unit 4: Fasteners **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Select typical fasteners used in agriculture power and machinery including bolts, nuts, washers, keys, snap rings, screws, pins, and studs. a. Identify common fasteners used in Agriculture Power and Machinery including screws, bolts, nuts, washers, keys, snap rings, pins, and studs. b. Identify bolt types, grades, and thread measuring terms. c. Measure bolt and nut length, diameter, and thread type. d. Discuss tools and procedures for extracting broken bolts and restoring internal and external threads. e. Identify tools and equipment used to create internal and external threads.	**Teaching:** • Present students with a brief explanation or description of new terms related to agriculture power and machinery. Next, present students with a nonlinguistic representation of the new term (e.g., picture, cartoon, etc.). Ask students to generate their own explanation or description of the term or phrase in their vocabulary notebook. Finally, ask students to create their own nonlinguistic representation of the term. Throughout the unit, periodically ask students to review the accuracy of their explanations and representations. • Display common fasteners used in agricultural power machinery to the students. Discuss each fastener's application. Discuss the meaning of bolt grade and the measurement of length, diameter, and thread count. • Display tools used to extract broken bolts and demonstrate the process to the students. Have students use technology productivity tools to develop a flow chart that describes the process of extracting broken bolts. Have students use the writing process to develop a descriptive paragraph describing the chart/process. • Identify taps and dies used to create internal and external threads and demonstrate their use. Students will have the opportunity to apply these skills in exercises throughout the course. **Assessment:** • Give a written test on the different types of fasteners and their use. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 4 Develop skills required to use construction/fabrication equipment and tools.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E1 Provide writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

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Agriculture Power and Machinery I
Unit 5: Oxyfuel Cutting **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Assemble and handle oxyfuel cutting equipment. a. Discuss safety procedures for set up of oxyfuel cutting equipment. b. Identify parts of the oxyfuel cutting equipment including regulators, hoses, fittings, torch body, cutting tips, and accessories. c. Assemble oxyfuel cutting equipment including purging of lines and testing for leaks. d. Demonstrate procedures for handling and storing oxyfuel cylinders and equipment.	**Teaching:** • Have students read the article *Practicing Safe Oxyfuel Cutting: Tips for Proper Equipment Use*. Use the Text Based Seminar Rubric found in Appendix D to facilitate discussion from the article. • Discuss and demonstrate safety procedures and precautions to be followed in setting up and using oxyfuel equipment. Identify each part of an oxyfuel cutting torch and describe its safe and proper installation and operation. • Demonstrate the safe and proper assembly of oxyfuel cutting equipment. Continue to allow students to take notes and ask questions. • Identify, discuss, and demonstrate safe and proper procedures for transporting, handling, and storing oxyfuel tanks and equipment. • Throughout the demonstration, allow students to take notes and ask questions. Have students organize their notes and ask follow-up questions prior to the assessment. **Assessment:** • Give a written test on setup of oxyfuel equipment. • Use the Oxyacetylene Welding and Cutting Operations Rubric found in Appendix D. (NOTE: Students will be evaluated on the safe and proper set up of oxyfuel equipment throughout the year.) • Have students insert artifacts from this competency into their portfolio.
2. Operate oxyfuel cutting equipment. a. Demonstrate safety procedures for operating oxyfuel cutting equipment. b. Demonstrate procedures for lighting oxyfuel torch and adjusting an oxyfuel cutting torch. c. Adjust the flame to produce oxidizing,	**Teaching:** • Have students watch *Junkyard Wars: Wind Machines* from the United Streaming video library (http://www.unitedstreaming.com). Facilitate a classroom discussion regarding the strengthening with welding and the quality control component of the video.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
carburizing, and neutral flames. d. Demonstrate procedures to make a cut in mild steel.	• Demonstrate the safe and proper procedure for setting up the regulators and torch body prior to lighting the torch. • Demonstrate the safe and proper procedure for lighting the torch and adjusting to a neutral flame. • Demonstrate the safe and proper procedure for adjusting to a carbonizing and oxidizing flame. • Demonstrate the procedure for making a cut in mild steel. • Throughout the demonstrations, have students record step-by-step procedures for each demonstration. • Have students work in pairs to practice the procedures for setting up the torch, lighting and adjusting, and making a cut in mild steel. Have one student review the step-by-step procedure while the other student completes the task. Next, have students switch roles. • Have students work individually to setup the torch, light and adjust it, and make a cut in mild steel. **Assessment:** • Give a written test on the safe and proper setup and adjustment of an oxyfuel torch. • Use the Oxyacetylene Cutting Operations found in Appendix D to evaluate each student's ability to set up and adjust the oxyfuel torch and cut mild steel. (NOTE: Students will be evaluated on the use of the oxyfuel torch throughout the year.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 4 Develop skills required to use construction/fabrication equipment and tools.
STR 5 Plan implement manage, and/or provide support services for facility design and construction, equipment design, manufacture, repair, and service; and agricultural technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
ENV 2 Identify public policies and regulations impacting environmental services to determine their effect on facility operation.

Academic Standards

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

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Videos

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Agriculture Power and Machinery I
Unit 6: Arc Welding (SMAW) **(28 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Set up SMAW welding equipment. a. Identify equipment and tools used in arc welding. b. Describe safety procedures used in arc welding. c. Identify different electrodes and the meanings of the numbers in the electrode classification system. d. Identify the types of weld joints and weld positions.	**Teaching:** • Identify equipment and tools used in arc welding including the different types of welding machines and their characteristics and application. Using a word processing program and graphics, create a pictorial dictionary of different tools and equipment related to SMAW welding equipment. • Use a videotape or PowerPoint presentation to identify and describe safety procedures to be followed in arc welding. Have students take notes from the video or presentation. Have students use the writing process and technology tools to summarize or organize their notes related to safety and SMAW welding equipment. • Invite a representative of a local welding supply company to come to the class and discuss the different types of electrodes and their identification. • Use a PowerPoint presentation to identify the different welding positions and weld joints. **Assessment:** • Give a written test on the different types of welders and welding equipment, electrodes, and weld joints and positions. • Students will be continuously evaluated for safety practices throughout the year. • Use the Written Report Rubric found in Appendix D to evaluate student summaries. • Have students insert artifacts from this competency into their portfolio.
2. Demonstrate procedures for SMAW arc welding. a. Demonstrate safety procedures for arc welding. b. Demonstrate the process for initiating an arc weld (striking an arc). c. Demonstrate procedures to lay a stringer bead and develop a pad. d. Demonstrate procedures to construct a	**Teaching:** • Demonstrate safety procedures for arc welding. Have students refer to their notes throughout the demonstration. • Have students demonstrate procedures to initiate an arc weld. • Have students demonstrate procedures to lay a stringer bead and develop a pad. • Have students demonstrate procedures to

Competencies and Suggested Objectives	Suggested Strategies for Competencies
butt weld in the flat position. e. Demonstrate procedures to construct a fillet weld in the flat position.	construct a butt weld in the flat position. • Have students demonstrate procedures to construct a fillet weld in the flat position. • Have students use a Venn Diagram (see example in Appendix D) to compare and contrast the butt weld and the fillet weld. Have students summarize their Venn Diagram. • Have students use technical writing skills to list the steps and important things to remember when working with a stringer bead, a butt weld, and a fillet weld. **Assessment:** • Written test on procedures for arc welding. • Rubric on striking an arc, laying a stringer bead and building a pad, constructing a butt weld, and constructing a fillet weld. See Rubric on Welding Techniques in Appendix D. • Use the Written Report Rubric found in Appendix D to evaluate students' written steps. • Have students insert artifacts from this competency into their portfolio.

STANDARDS

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
STR 4 Develop skills required to use construction/fabrication equipment and tools.

STR 5 Plan implement manage, and/or provide support services for facility design and construction, equipment design, manufacture, repair, and service; and agricultural technology.

Academic Standards

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

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Videos

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Web Sites

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Agriculture Power and Machinery I
Unit 7: Mechanics and Power Transmission **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the concepts of power including work, force, and torque, and the elements of power including PTO (power take off) horsepower, drawbar horsepower, and brake horsepower. a. Explain concepts of Newton's Laws. b. Describe the terms of power including work, force, and torque. c. Explain the differences in PTO, drawbar, and brake horsepower.	**Teaching:** • Pose the following question students: o Two physics students, Will N. Andable and Ben Pumpiniron, are in the weightlifting room. Will lifts the 100-pound barbell over his head 10 times in one minute; Ben lifts the 100-pound barbell over his head 10 times in 10 seconds. Which student does the most work? Which student delivers the most power? Explain your answers. (Answer: Ben and Will do the same amount of work; they apply the same force to lift the same barbell the same distance above their heads. Yet, Ben is the most "power-full" since he does the same work in less time. Power and time are inversely proportional.) • Use a PowerPoint presentation and Internet resources to explain the concept of Newton's Law and power. • Define and describe terms associated with power including work, force, and torque. • Have students define and illustrate terminology related to Newton's Laws of Motion. Terms can include, but are not limited to motion, inertia, force, mass acceleration, friction, gravity, speed, velocity, work, force, and torque. • Write this law on the board and read it to students: o *1st Law of Motion: Objects in motion stay in motion, objects at rest stay at rest, until a force changes their speed or direction.* • Explain that this law can be demonstrated by a top. Distribute tops to all students. Have each student lay their tops on the table. Ask if the tops are at rest or in motion? (Answer: at rest) • Ask what is needed to make the tops move? (Answer: A force)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Ask students to apply a force to the top. Restate the 1st Law of Motion, and then ask what should happen according to the law. (Answer: Tops should continue to move forever.) • As the tops begin to slow, ask the students what force is acting on the top? (Answer: Friction) • Ask students to predict what would happen if they could spin the tops in outer space? (Answer: The tops do not stop because friction is eliminated in space.) • Write this law on the board and read it to the students: o *2nd Law of Motion: Charges in motion are equal to the applied force and in the direction of the applied force. Mathematically described as Force = Mass x Acceleration.* • Have one student help with the Swinging Wonder Demonstrator. Have the student pull one steel marble back and hold it while you ask, "If one marble is dropped, predict what will happen to the other four marbles?" (Answer: Only one marble will move in the direction of the applied force. Continue predictions with 2, 3, and 4 marbles pulled back. • Write this law on the board and read it to students: o *3rd Law of Motion: For every action there is an equal and opposite reaction.* • Have one student drop a basketball and another drop a tennis ball. Ask why the ball bounces back? As the ball hits the floor with force, the floor pushes back with the same force in the opposite direction. Therefore, the ball bounces up. • Now, place the tennis ball on top of the basketball. Ask the students to predict, then observe and explain what happens in terms of Newton's Laws of Motion. Drop the combination. (Answer: The tennis ball is launched to the ceiling because it

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	absorbs both the force of the floor pushing up on the basketball and the floor pushing up on the tennis ball.) • Divide students into groups of four or five. Assign a project manager for each group. Give each group a box containing the following: one toy tractor, two washers, two rubber bands, one balloon, and a PVC pipe elbow. • Ask students, "How can you make the tractor move with these materials?" Have them discuss the question within their groups. • Have students use problem solving strategies and information learned from Newton's Laws of Motion to achieve the following: o Design a tractor that can carry the greatest amount of weight the entire length of the track. Use a Hot Wheels Track for the tractors to travel on and use washers to add weight. • Allow 15 – 20 minutes for the students to experiment with their tractor designs. After all groups have their tractors running, as a review, discuss and demonstrate Newton's Laws of Motion. • Use a PowerPoint presentation to explain why there is a difference in the brake horsepower, drawbar horsepower, and PTO horsepower ratings of a tractor. Have students take notes during the presentation. • Ask students to summarize how Newton's Laws apply to brake horsepower, drawbar horsepower, and PTO horsepower ratings on a tractor. **Assessment:** • Term definitions and illustrations project as a grade. • Give a written test on Newton's Laws, power, and horsepower ratings. • Have students insert artifacts from this competency into their portfolio.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
2. Explain methods of power transmission and braking. a. Describe the transmission of power through direct drive. b. Describe the transmission of power through pulleys and belts. c. Describe the transmission of power through chains and sprockets. d. Describe the transmission of power through gears and shafts. e. Describe the transmission of power through hydraulic and pneumatic applications.	**Teaching:** • Using cut-away components and working models, describe the principles and processes involved in transmitting power from the engine throughout the machine, including the use of direct drives, pulleys and belts, chains and sprockets, gears and shafts, and hydraulic and pneumatic applications, including how speed and power may be increased or reduced in transmission. • Have students use technology tools or classroom resources to develop a flow chart explaining the methods of power transmission and breaking. Have students summarize their flowcharts. **Assessment:** • Evaluate flowcharts for correct information and presentation. • Give a written test on power transmission. • Have students insert artifacts from this competency into their portfolio.
3. Identify the different types and discuss their operation and use of clutches. a. Describe types of clutches and their operation (centrifugal, mechanical, and hydraulic). b. Identify uses of the different types of clutches.	**Teaching:** • Discuss and show examples of different types of clutches including their operating principles and common uses. Have students search the MAGNOLIA database for an article for each of the three types of clutches (centrifugal, mechanical, and hydraulic). • Have students use information from their search to and a Venn Diagram to compare and contrast the different types of clutches. Have students summarize their Venn Diagram and important components from the articles. **Assessment:** • Give a written test on the types of clutches, their operation and use. • Use the Written Report Rubric found in Appendix D to evaluate student summaries of the Venn Diagram and the articles. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	Portfolio Rubric found in Appendix D.

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 2 Use available power sources to plan and apply control systems.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A5 Utilize various formulas in problem-solving situations.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

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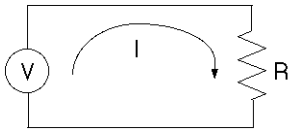
Agriculture Power and Machinery I
Unit 8: Compact Engines Service and Repair **(45 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe the operation of the four-stroke cycle engine. a. Identify the major components (intake, compression, power, and exhaust) of a four-stroke cycle engine. b. Describe the events occurring in one cycle of a four-stroke engine.	**Teaching:** • Using a video, PowerPoint presentation, or web resources such as http://www.keveney.com/otto.html to identify and explain the major components of a four-stroke cycle engine and the cycle of events that occurs in one cycle. • Divide students into four groups. Assign each group a component of the four-stroke cycle engine. Have groups become experts in their assigned area. Have groups create a presentation "teach" members of the class about their assigned component. • Have students use technology tools to create a technical document that explains how a four-stroke cycle engine works. • Have students create a flowchart that illustrates how a four-stroke cycle engine works. **Assessment:** • Give a written test on the operation of a four-stroke cycle engine. • Have students insert artifacts from this competency into their portfolio.
2. Describe the operation of the two-stroke cycle engine. a. Identify the components of a two-stroke cycle engine. b. Describe the events occurring in one cycle of a two-stroke engine. c. Calculate ratios of oil and gasoline and mix fuel for a two-stroke cycle engine.	**Teaching:** • Using a video, PowerPoint presentation, or web resources such as http://www.keveney.com/twostroke.html to identify and explain the major components of a two-stroke cycle engine and the cycle of events that occurs in one cycle. • Divide students into four groups. Assign each group a component of the two-stroke cycle engine (intake, transfer/exhaust, compression, and power). Have groups become experts in their assigned area. Have groups create a presentation "teach" members of the class about their assigned component. Have each group compare and contrast their assigned topic to the related topic of a four-stroke cycle engine. • Have students use technology tools to

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	create a technical document that explains how a two-stroke cycle engine works. • Have students create a flowchart that illustrates how a two-stroke cycle engine works. • Explain to students how to calculate the oil and gasoline mixture for a two-stroke cycle engine. Have students complete a homework assignment to calculate the oil and gasoline mixture for a two-stroke cycle engine. **Assessment:** • Give a written test on the components of a two-stroke cycle engine and its cycle of events. • Evaluate the homework assignment to calculate oil and gasoline mixtures. • Have students insert artifacts from this competency into their portfolio.
3. Describe the basic operation and service of electrical systems. a. Understand the basic concept of Ohm's Law. b. Define common terms used in the electrical system (AC, DC, volts, watts, amps, ohms, etc.) c. Identify the common sources of electricity (battery, magneto, generator, alternator). d. Identify the parts of a basic circuit. e. Identify the instruments used in checking electrical circuits. f. Measure voltage, amperage, and resistance of the electrical circuits. g. Service the ignition circuit on a compact gas engine.	**Teaching:** • Show students the video "Resistance in Electrical Systems" or a video related to electrical systems technology from United Streaming (http://www.unitedstreaming.com). Before the video, ask students: o Why does a wire get hot when current flows through it? • After the video, use the following probes to facilitate discussion. o In what ways is resistance useful in an electrical system? o What is the formula for calculating resistance in an electrical system? o What causes resistance in an electrical system? • Compose four to five charts that represent how resistance affects electrical systems with content material, pictorially, or verbally. Charts can include photographs and explanations, direct quotes from classroom resources, or other means to convey one idea per chart. Post the charts around the classroom and number each chart. Divide students into groups of three

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	– four. Assign one group per chart as a starting point. Allow groups to spend two to five minutes at each assigned chart. Encourage students to take notes and discuss the ideas presented on each chart. When time is up, rotate the groups until all groups have taken notes and discussed information from each chart. When students return to their seats, lead a whole group discussion about the content learned from each chart. • Use classroom tools or a graphing calculator and presentation equipment to enter data related to various voltages and currents. Graph the resulting resistances to demonstrate the relationship between them (Ohm's Law). • Have students use the Internet or classroom resources to gain a basic understanding of Ohm's Law. Have students write the formula and sketch the drawing that represents the formula in their notebooks. o *Ohm's Law: V = I x R* *V = Voltage* *I = Current* *R = Resistance*  • Allow students to work in small groups to solve the following problem. o Problem: A nine volt battery supplies power to a cordless curling iron with a resistance of 18 ohms. How much current is flowing through the curling iron? o Solution: Visit http://www.grc.nasa.gov/WWW/K-12/Sample_Projects/Ohms_Law/ohmslaw.html for the solution and more problems for students to solve. • Discuss "resistivity" and demonstrate the relationship of electrical resistance to Ohm's law. Use four wires and a

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	multimeter. One wire should be your "standard" with a specific length, diameter and material. Each of the other three wires has ONE parameter changed. Use this strategy to show the change in resistance of path of the three wires with respect to the "standard" wire. • Have students use technology application tools to define and illustrate what they discovered by watching the demonstration explaining Ohm's Law. • Have students use the electrical trainer or other devices to setup electrical experiments demonstrating resistance in Ohm's Law. • Using technology application tools, groups of three to four students will use the Internet to research the differences between conductors, semiconductors, and insulators. Have students create a product such as a Web page, brochure, news paper, technical report, etc. to explain and illustrate conductors, semiconductors, and insulators. • Using a video, PowerPoint presentation, or Internet resources to define terms associated with the electrical system and common sources of electricity. • Using a model, identify parts of a basic circuit including conductors, insulators, controllers, load, and source. Discuss the relationships between load and conductor size. • Demonstrate the use of the multimeter and test light to measure continuity, voltage, amperage, and resistance. Have students practice making these measurements and recording their findings. • Provide students with an information sheet on servicing a compact gas engine magneto ignition system to include adjusting sparkplug gap and magneto air gap. Have students service a system. **Assessment:** • Give a written test on basic operation and

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	service of electrical systems. • Grade student activity to measure and calculate voltage, amperage, and resistance. • Use a checklist to evaluate student performance in servicing a magneto-type ignition system. • Have students insert artifacts from this competency into their portfolio.
4. Perform compact gasoline engine service. a. Demonstrate how to find and use information in operator's manuals and manufacturer's specifications. b. Describe the functions of engine oil. c. Describe the Society of Automotive Engineers (SAE) viscosity rating system. d. Describe the American Petroleum Institute (API) classifications. e. Select compact engine oil viscosity according to seasonal temperature. f. Identify the components of the cooling system of an air cooled engine. g. Identify the components of a gasoline fuel system on a compact engine. h. Identify the types of carburetors and fuel systems on a compact engine. i. Identify the types of air filters on compact engines. j. Identify the types of governor systems used on compact engines. k. Perform preventative maintenance on compact engines.	**Teaching:** • Provide students with operator's manuals and an assignment sheet with a set of specifications or other information to be located. • Using a video, PowerPoint presentations, or Internet resources, describe the functions of engine oil and the SAE and API classification system. Have students use operators manuals to select proper viscosity and classification for a given engine. • Using a cut-away or working model, identify the components of the air-cooled compact engine and their inspection and service. • Using a cut-way or working model, identify the components of a fuel supply system on a compact gasoline engine. • Using a cut-way or working model, identify the types of carburetors on a compact gasoline engine. • Using a cut-way or working model, identify the types of air filters on compact engines. • Using a cut-way or working model, identify the types of governor systems used on compact engines. • Provide students with an operator's manual and service schedule for an engine and have them service the engine and its component systems. • Have students use technology tools and the writing process to summarize information related to compact gasoline engine service. **Assessment:** • Give a written test on compact gasoline engine systems and service.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Grade the student assignment to locate information and specifications in owner's manuals. • Grade the student assignment to service a compact gasoline engine and its component systems. • Use the Written Report Rubric found in Appendix D to evaluate student summary reports. • Have students insert artifacts from this competency into their portfolio.
5. Disassemble, inspect, and reassemble a compact gasoline engine a. Disassemble, clean, and inspect the parts of a compact engine for wear or damage. b. Assemble a compact engine to manufacturer's specifications. c. Performance test and adjust a compact engine.	**Teaching:** • Provide the students with specific instructions and steps and have them disassemble and inspect a compact gasoline engine for wear and damage. See the Engine Dissection Project Web site in the Suggested References section of this unit. Have students record their findings and make recommendations on parts to be replaced. Have students compile a work order to estimate the cost of rebuilding the engine to include parts and labor. Have students create a checklist or flowchart explaining the steps to disassembling and inspecting a compact gasoline engine. • Have students reassemble the engine and test for proper operation. **Assessment:** • Give a written test on compact gasoline engine disassembly, inspection, and reassembly. • Evaluate student's findings from inspecting the engine. • Use the Disassembling and Assembling a Small Gasoline Engine Rubric found in Appendix D when evaluating student's disassembled and reassembled engines. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
ENV 5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS2 Financial, Economic, and Business Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Briggs and Stratton. (1997). *Repair manual for single cylinder 4-cycle engines*. Milwaukee, WI: Author.

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Agriculture Power and Machinery I
Unit 9: Equipment/Systems Maintenance **(22 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Read and interpret operator's manual to determine daily maintenance on equipment. a. Select correct manuals to determine daily maintenance required on equipment. b. Obtain manufacturer's specifications for daily maintenance requirements on equipment.	**Teaching:** • Have students use the Internet to locate owner/operator manuals for a given piece of equipment. • Have students use the manual from the Internet to locate and record information on daily maintenance for the given piece of equipment. **Assessment:** • Give a written test on reading and interpreting the operator's manual. • Grade student assignment on locating and recording information for daily maintenance. • Have students insert artifacts from this competency into their portfolio.
2. Perform daily maintenance on tractors and equipment. a. Check tires for air pressure. b. Check fluid levels (engine oil, coolant, and hydraulic system). c. Lubricate the chassis and steering linkage. d. Inspect brakes for correct adjustment. e. Check safety equipment and gauges.	**Teaching:** • Take students on a field trip to see a tractor shop or dealership. If this is not possible, invite a guest speaker to discuss the daily operations of a tractor shop or dealership. • Using the owner's manual and a checklist, have students perform daily maintenance on a given piece of equipment to include checking fluid levels, tire pressure, brakes, and safety equipment. **Assessment:** • Use a rubric on performing daily maintenance on a given piece of equipment. (See Performing Routine Equipment Maintenance and Repair Tasks Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio.
3. Identify the different types of equipment used in agricultural operations and describe their operation and key maintenance procedures. a. Identify types of planting and tillage equipment and describe their operation and key maintenance procedures.	**Teaching:** • Using a combination of methods including the Internet, videos, PowerPoint presentations, operator's manuals, manufacturer's brochures and literature, and field trips to local equipment dealers and producers to familiarize students with the different types of agricultural

Competencies and Suggested Objectives	Suggested Strategies for Competencies
b. Identify types of lawn turf equipment and describe their operation and key maintenance procedures. c. Identify types of harvesting equipment and describe their operation and key maintenance procedures. d. Identify types of forage equipment and describe their operation and key maintenance procedures. e. Identify types of irrigation equipment and describe their operation and key maintenance procedures. f. Identify types of poultry equipment and describe their operation and key maintenance procedures. g. Identify types of forestry equipment and describe their operation and key maintenance procedures.	equipment. Assign each student a specific piece of equipment to prepare a report that includes major manufacturers and models, operating principles, and major maintenance operations. Have students present their findings to the class. • Have students create a pictorial dictionary of the different types of equipment used in agricultural operations. **Assessment:** • Use a rubric to evaluate student performance on compiling and delivering a report on a specific piece of agricultural equipment. (See Diesel Engine Disassembly, Inspection, and Reassembly Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

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TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

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Agriculture Power and Machinery I
Unit 10: Repairing and Refinishing Agricultural Equipment (25 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe procedures for preparing agricultural equipment for refinishing. a. Perform procedures for cleaning equipment for refinishing. b. Repair and/or replace damaged parts. c. Prepare surface for repainting.	**Teaching:** • Using a PowerPoint presentation or video from United Streaming to discuss and describe the procedures for cleaning equipment for refinishing including pressure washers, steam cleaners, brushing and sanding, chemical cleaners, and degreasers. • Describe and discuss procedures for identifying and repairing/replacing damaged parts and preparing a surface for painting. • Have students work in teams to prepare a piece of equipment for refinishing using the procedures described and discussed above. **Assessment:** • Give a written test on preparing equipment for refinishing. • Use a checklist to evaluate student performance as a team member in preparing equipment for refinishing. (See Refinishing Equipment Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio.
2. Demonstrate procedures for repainting agricultural equipment. a. Demonstrate procedures to mix and prepare paint for spraying. b. Set up and adjust paint gun. c. Apply paint coats according to manufacturer's specifications. d. Clean and prepare paint gun for storage.	**Teaching:** • Have students use the Internet and classroom resources to find different safety procedures related to repainting equipment. • Demonstrate procedures to mix and prepare paint for spraying. • Demonstrate setup and adjustment of a paint gun. • Demonstrate application of paint coats according to manufacturer’s specifications. • Demonstrate procedure for cleaning and preparing paint gun for storage. • Have students work in teams to repaint a piece of agricultural equipment. **Assessment:**

	• Give a written test on repainting agricultural equipment. • Use a checklist to evaluate student performance as a team member in refinishing agricultural equipment. (See Refinishing Equipment Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

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LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

Jacobs, D. (1991). *How to repair and restore body work*. St. Paul, MN: MBI.

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Web Sites

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Agriculture Power and Machinery II
Unit 1: Orientation and Safety (Review and Reinforcement) (20 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review the local school rules and regulations. a. Describe local school rules found in the student handbook. b. Describe attendance policies. c. Describe laboratory and facilities associated with the program.	**Teaching:** • Provide students with local student handbook. Have students read and discuss local school rules and policies associated with the Agriculture and Power Machinery program. • Tour laboratory and other facilities associated with program, noting equipment and resources available to the students. • Have students use technology tools and a Venn Diagram (see example in Appendix D) to compare and contrast school and classroom expectations to expectations from employers in the workforce. Have students summarize and illustrate the Venn Diagram. **Assessment:** • Give a written test on local school rules and regulations. • Have students complete a form verifying that they have received instruction on local school rules and policies. • Use the Written Report Rubric found in Appendix D to evaluate student's summary and Venn Diagram. • Have students insert artifacts from this competency into their portfolio.
2. Identify FFA activities pertaining to Agriculture Power and Machinery. a. Describe the purposes of the FFA organization. b. Participate in the leadership and personal development activities and competitive events of FFA.	**Teaching:** • Use a PowerPoint presentation to describe the purposes of the FFA organization and the activities and programs that support these purposes. • Have students select FFA activities that they will participate in during the coming year. **Assessment:** • Give a written test on the purposes and programs of the FFA. • Evaluate student participation in FFA activities on an ongoing basis. • Have students insert artifacts from this competency into their portfolio.

3. Update SAE plan of activities for the coming year.	**Teaching:** • Have students update their plan of activities for their SAE over the coming year. **Assessment:** • Use a rubric to evaluate the SAE Plan. (See SAE Plan Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio.
4. Maintain agriculture recordkeeping for the SAE. a. Maintain income and expense records. b. Prepare inventory records. c. Compute a net worth statement. d. Maintain records of supplementary and improvement activities and leadership development activities.	**Teaching:** • Review the income and expense records, inventory and depreciation methods, how to figure net worth, and maintaining records of supplementary and improvement activities, and leadership activities. • Introduce students to a spreadsheet application program, such as Microsoft Excel. • Have students use a spreadsheet application program or other electronic recordkeeping program to continue maintaining their record books throughout the year. **Assessment:** • Make monthly checks on progress in keeping accurate records of SAE experiences. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

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LEA 1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives
LEA 2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives
ABS 1 Employ leadership skills to accomplish goals and objectives in the Agriculture, Food, and Natural Resources business environment.
ABS 2 Practice good recordkeeping to accomplish AFNR business objectives.

ABS 3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
A8 Analyze data and apply concepts of probability.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

21st Century Skills

CS2 Financial, Economic, and Business Literacy
CS3 Civic Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

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Agriculture Power and Machinery II
Unit 2: Advanced Cutting and Welding **(40 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Perform Plasma Arc Cutting (PAC). a. Demonstrate safety procedures for PAC. b. Set up PAC equipment. c. Cut mild steel with PAC equipment.	**Teaching:** • Show videos found on Unitedstreaming Web site related to PAC. Have students perform an Internet search to find information on PAC. Have students summarize findings and share with the class. • Demonstrate safety procedures for PAC. • Set up PAC equipment. Have students take notes while they watch the set up. • Cut mild steel with PAC equipment. Have students develop a "tip sheet" to use when cutting mild steal with PAC equipment. **Assessment:** • Have students perform Plasma Arc Cutting (PAC). • Have students demonstrate safety procedures for PAC. • Have students set up PAC equipment. • Have students cut mild steel with PAC equipment. • Have students insert artifacts from this competency into their portfolio.
2. Perform advanced arc welding. a. Perform vertical and horizontal butt welds in mild steel. b. Perform fillet and lap welds in vertical and horizontal positions.	**Teaching:** • Using a video, PowerPoint presentation, or Internet resources to describe processes and procedures for welding in the vertical and horizontal welds. • Have students create a Venn Diagram (see example in Appendix D) to compare and contrast vertical and horizontal welds. Have students summarize their Venn Diagram. • Have students fabricate vertical and horizontal butt welds in mild steel. Have students peer evaluate work and provide tips for improvement. • Have students fabricate fillet and lap welds in vertical and horizontal positions. Have students peer evaluate work and provide tips for improvement. **Assessment:**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Use a rubric to evaluate the student's ability to fabricate vertical and horizontal fillet and butt welds. • Have students insert artifacts from this competency into their portfolio.
3. Perform Metal Inert Gas (MIG) welding. a. Demonstrate safety procedures for MIG welding. b. Identify and describe the use of different supplies and accessories associated with MIG welding. c. Set up MIG welding equipment. d. Weld mild steel with MIG welding equipment in the flat, vertical, horizontal, and overhead positions.	**Teaching:** • Have students use Internet resources, such as http://en.wikipedia.org/wiki/Gas_metal_arc_welding, to learn about Metal Inert Gas welding. Have students use illustrations and write summary about Metal Inert Gas (MIG) welding. • Demonstrate Metal Inert Gas (MIG) welding. • Demonstrate safety procedures for MIG welding. • Identify the different supplies and accessories used in MIG welding including nozzles, tips, gases, and wires (flux core and solid core) and describe their application and use. Have students use classroom resources or the Internet to determine the price of different supplies and accessories using in MIG welding. Have students compile this price information into a resource sheet. • Demonstrate the setup of MIG welding equipment to include setting amperage, wire speed, and gas flow rate for specific jobs. • Weld mild steel with MIG welding equipment. • Have students write and illustrate the steps of performing Metal Inert Gas (MIG) welding. **Assessment:** • Give a written test on MIG welding processes and procedures. • Use a rubric to evaluate the student's ability to set up MIG equipment and weld mild steel. • Have students insert artifacts from this competency into their portfolio.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
4. Perform Tungsten Arc (TIG) welding. a. Demonstrate safety procedures for TIG welding. b. Identify accessories and supplies used in TIG welding and describe their use. c. Set up TIG welding equipment. d. Weld aluminum and stainless steel with TIG welding equipment.	**Teaching:** • Have students perform an Internet search to find information related to TIG welding. Have students summarize information and develop a list of discussion questions that can be used to facilitate class discussion. • Provide students with a written list of safety procedures for TIG welding and discuss these procedures. • Identify and discuss the use of accessories and supplies used in TIG welding equipment including electrodes and filler rods and gases. • Discuss and demonstrate the set up of TIG welding equipment for a specific job. • Have students weld aluminum and stainless steel with TIG welding equipment. • Have students use technology tools, graphics, and the writing process to develop a "tip sheet" with information related to TIG welding. **Assessment:** • Give a written test on TIG welding processes and procedures. • Use a rubric to evaluate student's ability to set up and fabricate welds using TIG equipment. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

Jeffus, L. (2004). *Welding: Principles and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (2000). *Fundamentals of service: Welding*. East Moline, IL: Author.

Videos

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Agriculture Power and Machinery II
Unit 3: Hydraulic Systems **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain principles of hydraulics. a. Describe safety precautions related to hydraulics systems. b. Describe the physical laws hydraulics. c. Read and interpret hydraulics schematics.	**Teaching:** • Have students define and illustrate terms related to hydraulics. • Use a video, PowerPoint presentation, or Internet resources to identify safety precautions and physical principles related to hydraulics. • Provide students with a schematic of a simple hydraulic system and have them identify the parts of the system and trace the flow of fluids in the system. • Have students write a descriptive summary of the simple hydraulic system. **Assessment:** • Give a written test on principles of hydraulics and safety procedures for working with hydraulic systems. • Check student work on reading and interpreting schematics for a hydraulic system. • Have students insert artifacts from this competency into their portfolio.
2. Explain the functions of the basic hydraulic components. a. Identify the basic hydraulic components. b. Describe how basic hydraulics components function.	**Teaching:** • Using a PowerPoint presentation, identify the different components of a hydraulic system including the different types of valves, cylinders, pumps, filters, and reservoirs. Describe the operation and function of each item. • Divide students into groups. Assign each group a topic, such as valves, cylinders, pumps, filters, and reservoirs. Have each group become an expert on that component of the hydraulic system. Have each group "teach" other members of the class about their assigned topic. **Assessment:** • Give a written test on the basic components of a hydraulic system and their operation and function. • Have students insert artifacts from this competency into their portfolio.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
3. Demonstrate maintenance of hydraulic systems. a. Check fluid levels and condition. b. Service filter system. c. Change hydraulic fluids. d. Inspect system for external leaks and correct where necessary.	**Teaching:** • Provide students with a checklist for performing maintenance on a hydraulic system. Discuss the steps in the checklist and the respective procedures. • Using the checklist, have students inspect and service a hydraulic system. • Give students different scenarios with unexpected problems related to maintenance of hydraulic systems. Have students work in groups to solve the problems presented in the scenarios. • Have students research the cost of maintenance, tools, and equipment related to hydraulic systems. Have students add this information to their reference sheet. **Assessment:** • Evaluate student performance in completing the checklist on inspecting and servicing a hydraulic system. • Have students insert artifacts from this competency into their portfolio.
4. Test a hydraulic system. a. Use the manufacturer's service library to determine specifications. b. Pressure test a hydraulic system.	**Teaching:** • Using manufacturer's service information, have students determine and list specifications for flow and pressure within a given system. • Using hydraulic test equipment, have students test a system for flow rate and pressure. • Give students different scenarios with unexpected problems related to maintenance of hydraulic systems. Have students work in groups to solve the problems presented in the scenarios. **Assessment:** • Give a written test on testing a hydraulic system. • Check student's response to acceptable flow rates and pressures within a system • Using a checklist, evaluate the student's ability to test a system for flow rate and pressure. • Have students insert artifacts from this competency into their portfolio.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Evaluate students' portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

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PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 2 Use available power sources to plan and apply control systems.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (1999). *Fundamentals of service: Hydraulics*. Moline, IL: Author.

Videos

Holm, J. (2001). *Hydraulics troubleshooting* [Videotape]. Lubbock, TX: CEV Multimedia.

Web Sites

Hancock, J. (n.d.). *Hydraulics* [PowerPoint]. Retrieved October 18, 2006, from http://www.glenroseffa.org/Hydraulic.ppt

Agriculture Power and Machinery II
Unit 4: Diesel Engines **(40 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe basic operating principals of diesel engines. a. Identify the differences in a diesel engine and a gasoline engine. b. Describe the sequence of events in a four-stroke cycle diesel engine.	**Teaching:** • Have students use technology productivity tools, classroom resources, and the Internet to define and illustrate terms related to diesel engines. • Use a PowerPoint presentation or video presentation to discuss differences in a diesel and a gasoline engine including ignition by compression, higher compression ratios, and fuel delivery. • Use a PowerPoint or video presentation to illustrate the sequence of events in a four-stroke diesel engine. Have students use technology tools and the writing process to create a flowchart that illustrates the sequence of events in a four-stroke diesel engine. • Have students use a Venn Diagram (see example in Appendix D) to compare and contrast diesel engines to regular engines. Have students summarize their Venn Diagrams. **Assessment:** • Administer a vocabulary test. • Give a written test on basic operating principles of diesel engines. • Have students insert artifacts from this competency into their portfolio.
2. Identify the components of the diesel engine. a. Identify the components of the basic engine block assembly including the cylinder head, pistons, connecting rods, crankshaft and bearings, camshaft and bearings, cylinder liners, and engine block. b. Describe the functions of the components of the diesel engine including the cylinder head, pistons, connecting rods, crankshaft and bearings, camshaft and bearings, cylinder liners, and engine block.	**Teaching:** • Using a PowerPoint or video presentation, identify the different components of the engine block assembly and describe their function and operation. • Have students disassemble and reassemble an engine. As students disassemble and reassemble an engine, reinforce this information by having them identify the specific parts within the engine. **Assessment:** • Give a written test on the parts of the engine block assembly and their function and operation.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	• Have students insert artifacts from this competency into their portfolio.
3. Identify the components of the lubrication system. a. Identify the oil pump, oil cooler, filter, and relief valve. b. Describe the functions of the oil pump, oil cooler, filter, and relief valve.	**Teaching:** • Have students define and illustrate terms related to the components of the lubrication system. • Using a PowerPoint or video presentation, identify the different components of the engine lubrication system and describe their function and operation. • As students disassemble and reassemble an engine, reinforce this information by having them identify the specific parts within the engine. • Have students illustrate and summarize the process of assembling an engine. **Assessment:** • Administer a vocabulary test. • Give a written test on the parts of the engine lubrication system and their function and operation. • Have students insert artifacts from this competency into their portfolio.
4. Identify the components of cooling system. a. Identify the components of the cooling system including radiator, thermostat, water pump, radiator cap, radiator hoses, belts and pulleys, coolant and shroud. b. Describe the functions of the components of the cooling system including radiator, thermostat, water pump, radiator cap, radiator hoses, belts and pulleys, coolant and shroud.	**Teaching:** • Have students define and illustrate terms related to the components of the cooling system. • Using a PowerPoint or video presentation, identify the different components of the engine cooling system and describe their function and operation. As students disassemble and reassemble an engine, reinforce this information by having them identify the specific parts within the engine. **Assessment:** • Administer a vocabulary test. • Give a written test on the parts of the cooling system, their function, and operation. • Have students insert artifacts from this competency into their portfolio.
5. Identify the components of fuel system. a. Identify the components of the fuel system including reservoir, transfer	**Teaching:** • Have students define and illustrate terminology related to the components of a

Competencies and Suggested Objectives	Suggested Strategies for Competencies
pump, injector pump, injectors, filter, valves, lines and hoses, and fuel. b. Describe the functions of the components of the fuel system including reservoir, transfer pump, injector pump, injectors, filter, valves, lines and hoses, and fuel.	fuel system. • Using a PowerPoint or video presentation, identify the different components of the diesel fuel system, and describe their function and operation. As students disassemble and reassemble an engine, reinforce this information by having them identify the specific parts within the engine. • Have students develop a flowchart that explains how fuel systems works. **Assessment:** • Give a written test on the parts of diesel fuel systems, their function, and operation. • Have students insert artifacts from this competency into their portfolio.
6. Disassemble and assemble a diesel engine and service the support systems. a. Disassemble a diesel engine. b. Inspect components according to manufacturer's specifications. c. Assemble a diesel engine and service the support system components.	**Teaching:** • Have students disassemble, inspect, and reassemble a diesel engine. **Assessment:** • Use a rubric to assess the student's ability to disassemble, inspect, and reassemble a diesel engine. (See Diesel Engine Disassembly, Inspection, and Reassembly Rubric in Appendix D.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

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PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 2 Use available power sources to plan and apply control systems.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (1999). *Fundamentals of service: Identification of parts failure*. Moline, IL: Author.

John Deere Publishing. (2003). *Fundamentals of service: Engines.* Moline, IL: Author.

Videos

Harrell, B., & Vogel, B. (n.d.). *Diesel engines: Valves and cylinder heads* [Videotape]. Lubbock, TX: CEV Multimedia.

Web Sites

Wells, J. (2002). *Basic diesel engine technology* [PowerPoint]. Retrieved October 18, 2006, from http://aged.ces.uga.edu/Browseable_Folders/Power_Points/Mechanics/Basic_Disel_Engine_Technology.ppt

Agriculture Power and Machinery II
Unit 5: Electrical/Electronic Systems **(30 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe the use of electronics systems used in agriculture. a. Describe uses of sensors and monitoring systems. b. Describe uses of controllers. c. Discuss the role of integrated systems. d. Identify the types of electric motors and their application and use.	**Teaching:** • Have students complete a KWL chart (found in Appendix D). Have students find research articles from MAGNOLIA to answer topics found in the W column. • Have students define and illustrate terms related to electronic systems in agriculture. Review concepts of Ohm's Law. • Use a PowerPoint or video presentation to identify the different electrical systems on agricultural equipment including sensors, controllers, and integrated systems. • Discussion of the various types of electric motors and their applications in agricultural settings. • Explain to students that an analogy is a demonstration of similarity in some respects among dissimilar things. Analogies allow students to work from a familiar area into a new area of study. Since understanding involves connecting new learning to something already understood, analogies can be useful for learners. It is important to emphasize that point of comparison so that other similarities and differences do not distract from student learning. Share the following analogy relating a paragraph to a hamburger. o A paragraph is a group of sentences that tell about one main topic. A good paragraph is like a good hamburger. It has a fresh bun on top (a topic sentence), a fresh bun on bottom (a conclusion), and a lot of meat and fixings in between (details and transition words). • Have each student develop and illustrate an analogy for electronics systems used in agriculture. Have students share their information with the class.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	Assessment: • Give a written test on electrical/electronic systems in agriculture. • Have students insert artifacts from this competency into their portfolio.
2. Investigate electronics systems used on tractors, implements, and stationary systems. a. Discuss the use of electronic sensors, processors, and controllers on tractors and implements. b. Identify components of electronic systems and their function or purpose. c. Interpret electronic schematics, and blueprints.	**Teaching:** • Write "electronics systems and tractors" on a sheet of bulletin board paper. Draw two circles around the words. Have students write words or phrases that come to mind when they think of "electronics systems and tractors." Have students write or tape these words in the inner circle. Next have students jot down the sources, such as people, events, or classroom experiences that have influenced their thinking related to "electronics systems and tractors." Have students write or tape this into the outer circle. Use information from the bulletin board paper to facilitate classroom discussion. • Have students give an illustrated lecture to discuss the use of electronic sensors, processors, and controllers in modern agricultural equipment. Take students to a local implement dealer to view modern equipment and see a demonstration of diagnostic test equipment. • Provide students with a set of electronic schematics or blueprints and have students complete an assignment to interpret these documents. **Assessment:** • Written test on electronic systems. • Grade student's assignment to interpret an electronic schematic. • Have students insert artifacts from this competency into their portfolio.
3. Identify parts and functions of charging systems on internal combustion engines. a. Describe safety procedures for the charging system. b. Identify the components of the charging system. c. Test charging circuit operation	**Teaching:** • Using a video or PowerPoint presentation, lead a discussion on charging systems that covers safety procedures, components and their functions, and testing and servicing the system. • Use a student assignment to have students

Competencies and Suggested Objectives	Suggested Strategies for Competencies
according to specifications. d. Service the charging system.	test and service a charging system following manufacturer's specifications. • On index cards, describe different parts and functions of charging systems on internal combustion engines. Give a card to each student. Have students turn the cards over and identify the part that is being described. Divide students into two groups. Ask one group to stand and form a circle. When the circle is formed, have students face the outside of the circle. Have students from the second group go and stand facing students in the "inside circle." Have students describe the part listed on the index card. Have partners identify the part. Have the outside circle move to the left until they have practiced identifying parts with everyone in the circle. **Assessment:** • Give a written test on charging system safety, components and operations. • Evaluate student performance in completing the assignment to test and service a system. • Have students insert artifacts from this competency into their portfolio.
4. Identify components and functions of starting systems on internal combustion engines. a. Describe safety procedures for the storage battery. b. Identify the components of the starting system. c. Test starting system components according to specifications. d. Service components of a starting system according to specifications.	**Teaching:** • Use a video or PowerPoint presentation to lead a discussion dealing with starting systems. Discuss safety when working with batteries and identify the other components of the system and their function and operation. • Use a student assignment to have students test and service a starting system including battery and starter. Have students use technology tools to develop a flowchart that describes the process they used to test and service the system. • Create two sets of index cards. One set should contain questions related to different components and functions of starting systems on internal combustion engines. The second set should contain the answers to questions. To challenge

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	students, prepare more answer cards than question cards. Distribute answer cards to students. Place a stack of question cards face down in the middle or front of the room. Designate a student to turn over and read a question card. Have students check their answer cards and see if they have the correct answer. If a student thinks he/she has the correct answer, have them read and defend their answer. If a match is made, the student with the answer turns over and reads the next question aloud. **Assessment:** • Give a written test on starting systems. • Evaluate student performance on testing and servicing a battery and starter. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the portfolio rubric found in Appendix D.

STANDARDS

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PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (2005). *Fundamentals of service: Electronic and electrical systems.* Moline, IL: Author.

Web Sites

Farm Safety Association. (2002). *A guide to safe farm tractor operation*. Retrieved October 19, 2006, from http://www.cdc.gov/NASD/docs/d001501-d001600/d001534/d001534.html

Peavy, V. (2003). *Tractor safety* [PowerPoint]. Retrieved October 19, 2006, from http://aged.ces.uga.edu/Browseable_Folders/Power_Points/Mechanics/Tractor_Safety_Von_Peavy_July_2003.ppt

Agriculture Power and Machinery II
Unit 6: Agricultural Equipment Operation **(20 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review the operator's manuals to determine procedures for safe operation of agricultural equipment. a. Identify equipment controls and describe their function. b. Identify instruments and indicators and describe their function.	**Teaching:** • Provide students with and article(s) related to safe operation of agriculture equipment. Have students use the Text Based Seminar Protocol, found in Appendix D, to discuss the article(s). • Have students define and illustrate terms related to the safe operation of agricultural equipment. • Provide students with copies of an operator's manual. Have students complete an assignment to identify controls and instruments and describe their function and operation. **Assessment:** • Give a written test on tractor instruments and controls. • Evaluate student achievement in completing the assignment to identify controls and instruments and their function and operation. • Have students insert artifacts from this competency into their portfolio.
2. Operate tractor and equipment safely. a. Conduct inspection prior to operation. b. Operate the tractor safely including starting, warm-up, clutch engagement, and brake controls. c. Attach, set up, and adjust an implement on a tractor. d. Demonstrate operation under field conditions.	**Teaching:** • Provide the students with a checklist on operating a tractor safely. Lead a discussion on the process and the procedures. • Provide a checklist to attach, set up, and adjust an implement on a tractor. Lead a discussion on the process and the procedures. • Have students demonstrate tractor and implement operation. • Have students compare and contrast the operation of a tractor and a car or truck. • Have students develop a flowchart that describes how a tractor operates. • Have students develop and illustrate a timeline that shows the history of tractors. **Assessment:** • Use a written test on tractor and implement

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	operations. • Use the FFA Tractor Operations Score Sheet to evaluate student's ability to operate a tractor and implement. (See score sheet in Appendix D.) • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
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E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills

CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

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Journals and Magazines

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Agriculture Power and Machinery II
Unit 7: Periodical and Seasonal Maintenance **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Review manufacturer's manuals for periodic maintenance. a. Read and interpret manufacturer's manuals to obtain specifications for periodic maintenance. b. Perform periodic maintenance according to manufacturer's specifications.	**Teaching:** • Provide students with manufacturer's specifications for periodic maintenance (oil system service, fuel system service, hydraulic system service, etc.). Have students complete an assignment to locate and identify periodic intervals for these services. • Have students use a checklist to perform periodic maintenance following manufacturer's specifications. • Have students summarize the process of performing periodic maintenance. • Have students compare and contrast the periodic maintenance to different equipment related to Agriculture Power and Machinery. **Assessment:** • Use a written test on periodic maintenance procedures. • Evaluate student performance in using a checklist to perform periodic maintenance. • Have students insert artifacts from this competency into their portfolio.
2. Review manufacturer's manuals for seasonal maintenance. a. Read and interpret manufacturer's manuals to obtain specifications for seasonal maintenance. b. Perform seasonal maintenance according to manufacturer's specifications.	**Teaching:** • Provide students with manufacturer's specifications for seasonal maintenance (cooling system, wheel spacing adjustment and alignment, transmission/PTO maintenance, etc.). Have students read and summarize the specifications. The summaries should include a description of the purpose for each specification. • Have students complete an assignment to locate and identify seasonal intervals for these services. • Have students perform seasonal maintenance following manufacturer's recommendations. Have students use technology tools and the writing process to record step-by-step procedures for performing maintenance.

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	Assessment: • Use a written test on periodic maintenance procedures. • Evaluate student performance in using a checklist to perform seasonal maintenance. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

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PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (1994). *Fundamentals of machine operation: Tractors*. Moline, IL: Author.

Mississippi FFA Association. (2005). *Mississippi career development event rules and regulations*. Jackson, MS: Author.

Agriculture Power and Machinery II
Unit 8: Applying Principles of Diagnostics **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe principles of diagnostics. a. Explain the meaning and importance of diagnostics. b. Describe the processes and tools used in equipment diagnostics. c. Apply diagnostic procedures in solving a problem.	**Teaching:** • Using a video or PowerPoint presentation, lead a discussion of the basic principles of diagnostics. Identify and discuss the use of different diagnostic processes and tools. Have students record and organize notes from the discussion. • Invite a local equipment technician to speak to the class on diagnostic procedures. • Provide students with a piece of equipment that is not operating properly or is inoperable. Have students diagnose the problems and present a solution. • Have students compare and contrast the process of diagnostic procedures of today, 10 years ago, and 20 years ago. Have students develop and illustrate a timeline that shows the progress that has been made in diagnostic procedures as it related to agriculture power and machinery. **Assessment:** • Give a written test on diagnostic processes and tools. • Evaluate student performance in applying diagnostic procedures and solving equipment problems. • Have students insert artifacts from this competency into their portfolio. • Evaluate student portfolios using the Portfolio Rubric found in Appendix D.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

TET 1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.

PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

21st Century Skills

CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

John Deere Publishing. (1999). *Fundamentals of machine operation: Preventative maintenance.* Moline, IL: Author.

John Deere Publishing. (2000). *Fuels, lubricants, coolants, and filters*. Moline, IL: Author.

Videos

Bishara, J., Miller, C., & Harrell, B. (n.d.). *Diesel engine maintenance* [Videotape]. Lubbock, TX: CEV Multimedia.

Agriculture Power and Machinery II
Unit 9: Advanced Technology in Agriculture **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Research advanced technology being utilized in agriculture. a. Establish areas of new technology applications. b. Determine locations where demonstrations may be observed. c. Conduct investigations to observe and record applications of advanced technology.	**Teaching:** • Have students research new and emerging technologies in agricultural power and machinery (biodiesel, ethanol, and nanotechnology). Have students use technology tools, the writing process, and APA or MLA formatting guidelines to develop a report. Have students use their report to prepare an illustrated PowerPoint presentation to be made to the class. **Assessment:** • Use a checklist to evaluate student performance on content and presentation methods. • Have students insert artifacts from this competency into their portfolio.
2. Discuss the concepts and operating principles of precision agriculture technology. a. Identify and describe the components of a precision agriculture technology system. b. Describe the use of global positioning receivers in precision agriculture. c. Describe the use of spatial imagery in precision agriculture. d. Describe the use of geographic information system software in precision agriculture. e. Describe the use of variable rate application in precision agriculture. f. Describe the use of yield monitoring in precision agriculture.	**Teaching:** • Invite a crop consultant to speak to the class on the concepts and practices of precision agriculture techniques. Have students capture and organize important points in their notebooks/journals. Review important points with the students in class after the speaker has left to make sure the students have a sound understanding of the speaker's presentation. • Have students research a topic related to global positioning receivers, special imagery, or geographic information systems. Have students use technology tools, the writing process, and APA or MLA formatting guidelines to develop a summary report. Have students use their report to prepare an illustrated PowerPoint presentation to be made to the class. **Assessment:** • Use a written test on precision agriculture components and concepts. • Have students insert artifacts from this competency into their portfolio. Have students present their final portfolios to a team of industry members, teachers, and

Competencies and Suggested Objectives	Suggested Strategies for Competencies
	community members.

STANDARDS

Agriculture, Food, and Natural Resources Standards

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

PWR 1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 2 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
PWR 3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
TEC 1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
TEC 3 Explain geospatial technology to demonstrate its applications.
NRS 1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
NRS 3 Apply scientific principles to natural resources management activities.
NRS 4 Employ knowledge of natural resource industries to describe production practices and processing procedures.

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

21st Century Skills

CS1 Global Awareness
CS2 Financial, Economic, and Business Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills

SUGGESTED REFERENCES

Books

Brase, T. (2006). *Precision agriculture*. Clifton Park, NY: Delmar.

Clapp, S. (2003). *The precision-farming guide for agriculturists*. Moline, IL: John Deere Publishing.

Herren, R. (2006). *Agriculture mechanics: Fundamentals and applications* (5th ed.). Clifton Park, NY: Delmar.

Journals and Magazines

American Society of Agricultural and Biological Engineers. (n.d.). *Applied engineering in agriculture*. St. Joseph, MI: Author.

Web Sites

Agrow Knowledge. (2006). *Curriculum and instructional materials items.* Retrieved October 19, 2006, from http://www.agrowknow.org/Clearinghouse/GroupList.asp?Page=2&GID=1&btnSearch=1

AgWeb.com. (2006). Retrieved October 19, 2006, from http://www.agweb.com/

Mississippi State Cooperative Extension Service. (2006). *MSU Cares: Coordinated Access to the Research and Extension System*. Retrieved October 19, 2006, from http://msucares.com/

The Progressive Farmer. (n.d.). Retrieved October 19, 2006, from http://www.progressivefarmer.com/farmer/home

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Air Compressor (1)
2. Analyzer, Charging and Starting (1)
3. Bandsaw, Metal (1)
4. Cabinet, Flammable Storage (1)
5. Cabinet, Ultraviolet (with Safety Glasses) (1)
6. Computers with printers (5)
7. Drill Press (½" Chuck) (1)
8. Dynamometer, Diesel (1)
9. Engines, Diesel (3 Cylinder or Larger) (2)
10. Engines, Compact (Variety) (10)
11. Global Positioning System (Hand held consumer grade) (4)
12. Global Positioning System (Surveyor Grade) (1)
13. Implement, PTO Driven (1)
14. Jacks, Floor (5 T) (2)
15. Machine, Valve Grinder (with Accessories) (1)
16. Oxyfuel Cutting and Welding (with Accessories) (Set) (2)
17. Plasma Arc Cutter (with Accessories) (5/8" Capacity) (1)
18. Porta Power (with Accessories) (1)
19. Press, Hydraulic (25 T) (1)
20. Tractor, Diesel Powered (Current Technology) (1)
21. Trainer, Hydraulics (1)
22. Tester, Hydraulic System (1)
23. Welder, TIG (Water Cooled with Accessories) (1)
24. Welder, Portable (AC/DC Generator) (1)
25. Welders, AC/DC (with Accessories) (Set) (5)
26. Welders, MIG (with Accessories) (2)

NON-CAPITALIZED ITEMS

1. Anvil (150#) (1)
2. Bar, Pry (Set) (1)
3. Benches, Work (Wood and Metal) (12)
4. Booster Pack, Portable (750 Cranking Amps) (1)
5. Calipers, Dial (2)
6. Cans, Fuel Storage (2)
7. Can, Radiator Fill (1)
8. Carts, Oxyfuel Cutting and Welding (2)
9. Charger, Battery (1)
10. Chisel, Cold (Set) (1)
11. Circular Saw, Portable (1)
12. Clamps, Vise Grip (Set) (2)
13. Clamps, C (8") (10)

14. Compressors, Valve Spring (Small Engine) (2)
15. Compressor, Valve Spring (Diesel) (1)
16. Compressor, Ring (Diesel) (1)
17. Compressors, Ring (Small Engine) (2)
18. Creepers (2)
19. Cutter, Valve Seat (Small Engine) (1)
20. Dial Indicators (2)
21. Drills, Portable Electric (3/8") (2)
22. Drill, Twist (Set 1/16"-1") (1)
23. Drills, Portable Electric (½") (2)
24. Files, Set (2)
25. Flare Tool, Tubing (1)
26. Gauge, Telescoping (Set) (1)
27. Gauge, Compression (Diesel with adapters) (1)
28. Gauge, Compression (Small Engine) (1)
29. Grinder, Bench (8") (1)
30. Grinder, Portable (5") (1)
31. Grinder, Portable (8") (1)
32. Gun, Electric Soldering (1)
33. Gun, Grease (1)
34. Guns, Paint (with Accessories) (2)
35. Hacksaws (4)
36. Hammers, Shop (3#) (2)
37. Hammers, Ball Peen (Set) (4)
38. Hammer, Shop (8#) (1)
39. Hoist, Shop (3 Ton or Larger) (1)
40. Holders, Flywheel (2)
41. Hone, Cylinder (Diesel) (1)
42. Hone, Cylinder (Small Engine) (1)
43. Hoses, Air Pressure (6)
44. Jack, Hydraulic Bottle (10 Ton) (1)
45. Jackstands (5 T) (6)
46. Jackstands (2 T) (6)
47. Jackstands (10 T) (6)
48. Levels, (4') (2)
49. Mallets, Soft Face (4)
50. Micrometer, Outside (Set) (1)
51. Micrometer, Inside (Set) (1)
52. Multimeters, Digital (4)
53. Phone, Remote (1)
54. Pliers, Set (Slipjoint, Needlenose, Adjustable Jaw, Diagonal Cutters,
55. Lockring and Snapring Pliers (5)
56. Puller, Sleeve (1)
57. Puller, Jaw (Set) (1)
58. Punch, Metal (Set) (1)
59. Racks, Metal Storage (4)

60. Regulators, Air Compressor (2)
61. Sanders, Hand (4½" x 9" pad) (5)
62. Sanders, Portable Pneumatic (2)
63. Sanders, Hand (3" x 5" pad) (5)
64. Saw, Metal Cutoff (14") (1)
65. Screwdriver, Torx (Set) (1)
66. Screwdriver, Phillips Sets (4)
67. Screwdriver, Flat Blade Sets (4)
68. Sharpener, Twist Drill (1)
69. Shields, Face (5)
70. Squares, L (2)
71. Stands, Diesel Engine (2)
72. Tables, Welding Portable (2)
73. Tachometer, Hand Held (1)
74. Tank, Used Oil Storage (1)
75. Tap and Die Set (SAE) (1)
76. Tap and Die Set (Metric) (1)
77. Tape Measures (½" x 12') (10)
78. Tape Measures (¾" x 25') (4)
79. Tester, Ignition System (Small Engine) (1)
80. Tester, Coolant System (1)
81. Testers, Circuit (2)
82. Tester, Injection Nozzle (with Adapters) (1)
83. Tester, Spark (Small Engine) (1)
84. Tester, Battery (1)
85. Tool, Bearing Separator (Set) (1)
86. Tool, Bushing Driving (Set) (1)
87. Tool, Clutch Alignment (Set) (1)
88. Tool, Seal Driving (Set) (1)
89. Tool, Bearing Driving (Set) (1)
90. Tool, Bolt Extractor (Set) (1)
91. Vacuum, Shop (1)
92. Vise, Drill Press (1)
93. Vises (6") (4)
94. Washer, Parts (1)
95. Washer, Pressure (Portable 3,500 PSI) (1)
96. Wire Cutters (10)
97. Wrenches, Clutch (2)
98. Wrenches, Allen (Set SAE) (4)
99. Wrenches, Allen (Set Metric) (4)
100. Wrenches, Combination (Set ¼"-1¼" and Metric) (4)
101. Wrench, Combination (Set 1¼"-2") (1)
102. Wrenches, Ignition (Set) (4)
103. Wrench, Line (Set) (1)
104. Wrenches, Impact Socket Set (3/8" Drive SAE and Metric) (1)
105. Wrenches, Socket Set (¾" drive ⅞"-2¼" Deep and Shallow and Metric Sizes) (4)

106. Wrenches, Torque (¼" Drive SAE and Metric in./lbs.) (2)
107. Wrenches, Torque (½" Drive SAE and Metric ft./lbs., 25 to 250 ft./lbs.) (2)
108. Wrench, Pneumatic Ratchet (3/8" Drive (1)
109. Wrench, Impact Pneumatic (½" Drive) (1)
110. Wrench, Impact Socket Set (½" Drive SAE and Metric) (1)
111 Wrenches, Impact Socket Set (3/4" drive) (1)
112. Wrenches, Socket Set (¼" drive ¼"-½" Deep and Shallow and Metric Sizes) (4)
113. Wrenches, Socket Set (3/8" drive ¼"-7/8" Deep and Shallow and Metric Sizes) (4)
114. Wrenches, Socket Set (½" drive 3/8"-1¼" Deep and Shallow and Metric Sizes) (4)
115. Wrenches, Pipe (Set 8"-24") (1)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Digital camcorder
2. Digital camera
3. DVD/VCR player with monitor
4. Geographic information system software
5. Internet access for student and teacher computers
6. LCD desktop projector
7. Teacher notebook computer

ASSESSMENT

BLUEPRINT

This program is assessed using the MS-CPAS. The following blueprint summary contains the competencies that are measured when assessing this program. Competencies are grouped into *clusters* and a weight is given to each cluster to determine the number of items needed from each cluster. The numbers of C1s and C2s (item difficulty levels) are also indicated on the blueprint.

Title of Program: Agriculture Power and Machinery Program Level: Secondary

Cluster/Competency	Level 1 (C1)	Level 2 (C2)	TOTAL	%
	Number	Number		
Cluster 1: **MEASUREMENT AND FASTENERS** Agriculture Power and Equipment I Unit 3: Measurement Unit 4: Fasteners	8	2	10	10%
Cluster 2: **METAL CUTTING AND WELDING** Agriculture Power and Equipment I Unit 5: Oxyfuel Cutting Unit 6: Arc Welding Agriculture Power and Equipment II Unit 2: Advanced Cutting And Welding	16	5	21	21%
Cluster 3: **POWER TRANSMISSION AND HYDRAULIC SYSTEMS** Agriculture Power and Equipment I Unit 7: Mechanics and Power Transmission	9	2	11	11%
Cluster 4: **ENGINE PRINCIPLES, SERVICE, AND REPAIR** Agriculture Power and Equipment I Unit 8: Compact Engines Service and Repair Agriculture Power and Equipment II Unit 4: Diesel Engines	18	6	24	24%
Cluster 5: **MAINTAINING, REPAIRING, FINISHING, AND OPERATION OF AGRICULTURAL EQUIPMENT**	18	6	24	24%

	Level 1 (C1)	Level 2 (C2)	TOTAL	%
Agriculture Power and Equipment I Unit 9: Equipment/Systems Maintenance Unit 10: Repairing and Refinishing Agricultural Equipment Agriculture Power and Equipment II Unit 7: Periodic and Seasonal Maintenance Unit 6: Agricultural Equipment Operation Unit 8: Applying Principles of Diagnostics Unit 9: Advanced Technology in Agriculture				
Cluster 6: **ELECTRICAL/ELECTRONIC SYSTEMS** Agriculture Power And Machinery II Unit 5: Electrical/Electronic Systems	8	2	10	10%
Total Questions:	77	23	100	100%

Appendix A: Standards for Mississippi Agriculture Education Programs[1]

The following standards were adapted from the publication, *Career Cluster Resources for Agriculture, Food, and Natural Resources*. Each standard represents a pathway knowledge and skill statement as listed in this document. Standards are clustered by career pathway. The complete text of this document can be found at http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf.

LEADERSHIP (LEA)

LEA1 Use leadership skills in collaborating with others to accomplish organizational goals and objectives.

a. Embrace empowerment, risk, communication, focusing on results, decision-making, problem-solving, investment in individuals, and resource use and access to develop premier leadership.
b. Embrace compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others to develop premier leadership.
c. Embrace enthusiasm, creativity, the future, conviction, mission, courage, concept, focus, principles, and change to develop premier leadership.
d. Embrace integrity, courage, values, ethics, humility, perseverance, self-discipline, and responsibility to develop premier leadership.
e. Include self, community, diversity, environment, global awareness, and knowledge to develop premier leadership.
f. Embrace innovation, intuition, adaptation, life-long learning, and coachability to develop premier leadership.

LEA2 Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.

a. Embrace attitude, exercise, goal-setting, planning, self-discipline, sense of balance, persistence, and respect to develop personal growth.
b. Embrace friendship, integrity, morals, values, etiquette, citizenship, cross-cultural awareness, acceptance/change, and respect for differences to develop personal growth.
c. Embrace goal setting, planning, decision-making, principles, respect, attitude, dependability, loyalty, trustworthiness, and communication to develop personal growth.
d. Embrace learning, critical thinking, reasoning, creative thinking, attitude, dependability, decision-making, and problem-solving to develop personal growth.
e. Embrace attitude, self-discovery, coping, friendship, self-reliance, sense of balance, empathy, compassion, and integrity to develop personal growth.
f. Embrace ethics, coping, courage, attitude, self-image/worth, values, principles, and sense of balance to develop personal growth.

[1] *Career cluster resources for agriculture, food, and natural resources*. (n.d.). Retrieved November 16, 2005, from http://www.careerclusters.org/ClusterDocuments/agdocuments/AGFinal.pdf

ETHICS AND LEGAL RESPONSIBILITIES (ELR)

ELR1 Know and understand the importance of professional ethics and legal responsibilities.
- a. Apply knowledge of professional and workplace ethics and legal responsibilities to organize guidelines for workplace conduct.
- b. Apply ethical and legal reasoning to workplace situations.
- c. Review appropriate resources to identify national and international rules associated with a desired career.
- d. Identify what ethical issues and concerns affect a desired career field to assist in making career decisions.

ELR2 Demonstrate workplace ethics specific to Agriculture, Food, and Natural Resources (AFNR) occupations.
- a. Evidence interest and concern to demonstrate natural resource stewardship and ethics.
- b. Exercise personal habits and actions to demonstrate workplace ethics.

FOOD PRODUCTS AND PROCESSING SYSTEMS (FPP)

FPP1 Apply principles of food processing to maintain equipment and facilities.
- a. Develop management plans to maintain equipment and facilities.
- b. Interpret and follow, develop, and implement Hazardous Critical Control Point (HACCP) procedures to establish operating parameters.

FPP2 Apply principles of food science to the food industry.
- a. Apply food science principles to enhance product development.

FPP3 Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.
- a. Analyze product preparation options to prepare products for distribution.
- b. Compare and select food preservation methods to develop food preservation programs.

FPP4 Identify processing, handling, and storage factors to show how they impact product quality and safety.
- a. Develop a “quality factors program” to comply with local, national, and governmental, and international standards.
- b. Develop slaughter/inspection techniques to process foods and analyze food product options.

PLANT SYSTEMS (PLT)

PLT1 Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.
- a. Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.
- b. Test appropriate materials or examine data to evaluate and manage soil/media nutrients.
- c. Explain and use basic methods for reproducing and propagating plants.
- d. Develop and use a plan for integrated pest management.

PLT2 Address taxonomic or other classifications to explain basic plant anatomy and physiology.
- a. Examine unique plant properties to identify/describe functional differences in plant structures including roots, stems, flowers, leaves, and fruit.
- b. Classify plants on physiology for taxonomic or other classifications.

PLT3 Apply fundamentals of production and harvesting to produce plants.
- a. Apply fundamentals of plant management to develop a production plan.
- b. Apply fundamentals of plant management to harvest, handle, and store crops.

PLT4 Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, and farm).
- a. Apply basic design elements and principles to create a design using plants.

ANIMAL SYSTEMS (ANM)

ANM1 Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.
- a. Use classification systems to explain basic functions of animal anatomy and physiology.
- b. Recognize the anatomy of animal species to understand how the body structures interact and affect animal health.
- c. Analyze a subject animal to determine the nature of its health status.

ANM2 Recognize animal behaviors to facilitate working with animals safely.
- a. Develop a safety plan for working with a specific animal.

ANM3 Provide proper nutrition to maintain animal performance.
- a. Examine animal developmental stages to comprehend why nutrient requirements are different throughout an animal's life cycle.
- b. Analyze a feed ration to determine whether or not it fulfills a given animal's nutrient requirements.
- c. Record and compare feed variations to assess whether the nutritional requirements of an animal are being met.

ANM4 Know the factors that influence an animal's reproductive cycle to explain species response.
- a. Analyze elements in the reproductive cycle to explain differences in the male and female reproductive systems.
- b. Discuss reproductive cycles to show how they differ from species to species.
- c. Evaluate an animal to determine its breeding soundness.

ANM5 Identify environmental factors that affect an animal's performance.
- a. Recognize optimum performance for a given animal species.
- b. Create a program to develop an animal to its highest potential performance.
- c. Assess an animal to determine if it has reached its optimum performance level.
- d. Develop efficient procedures to produce consistently high-quality animals, well-suited for their intended purposes.

TOOLS, EQUIPMENT, TECHNOLOGY, AND SAFETY (TET)

TET1 Use tools, equipment, machinery, and technology to work in areas related to AFNR.
- a. Select the appropriate tool to perform a given task.
- b. Keep tools in good working order for efficient work use.
- c. Wear protective equipment and handle natural resource tools and equipment with skill to demonstrate safe use of tools and equipment.

POWER SYSTEMS (PWR)

PWR1 Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Relate power generation to energy sources.
- b. Apply principles of lubricants to sort and classify lubricants.

PWR2 Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Perform scheduled service routines to maintain machinery and equipment.
- b. Observe rules of the road to operate machinery and equipment.

PWR3 Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.
- a. Troubleshoot problems and evaluate performance to service and repair components of internal combustion engines.
- b. Follow manufacturer's guidelines to service and repair power transmission systems.
- c. Evaluate performance and check maintenance manuals to service and repair hydraulic lines.
- d. Troubleshoot from schematics to service vehicle electrical systems.
- e. Use company diagrams and scenarios to service vehicle heating and air conditioning systems.
- f. Check performance parameters to service and repair steering, suspension, traction, and vehicle performance systems.
- g. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STRUCTURAL SYSTEMS (STR)

STR1 Exercise basic skills in blueprint and design development to create sketches, drawings, and plans.
- a. Use computer skills to develop simple sketches and plans.

STR2 Read and relate structural plans to specifications and building codes.
- a. Examine blueprints and local codes to develop a logical construction plan.

STR3 Examine structural requirements to estimate project costs.
- a. Use bids and billing information to develop a complete materials list and project cost estimate.

STR4 Develop skills required to use construction/fabrication equipment and tools.
- a. Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

STR5 Plan, implement, manage, and/or provide support services for facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.
- a. Design machinery and equipment including vehicles, implements, buildings, and facilities (e.g., feeding, feed storage).
- b. Follow architectural and mechanical plans to construct buildings and facilities.

TECHNICAL SYSTEMS (TEC)

TEC1 Use a variety of tools available in computer systems to accomplish fast, accurate production in the workplace.
- a. Identify and explain the various types of hardware systems to show their applications and potentials.

TEC2 Use available power sources to plan and apply control systems.
- a. Measure with selective instruments to demonstrate knowledge of basic electricity.
- b. Reference electrical drawings to design, install, and troubleshoot control systems.

TEC3 Explain geospatial technology to demonstrate its applications.
- a. Employ appropriate techniques to demonstrate application of GPS/GIS systems principles.
- b. Use computer applications to produce maps that reflect surveying and mapping principles.
- c. Select an area of personal expertise to demonstrate knowledge of end applications.

NATURAL RESOURCE SYSTEMS (NRS)

NRS1 Recognize importance of resource and human interrelations to conduct management activities in natural habitats.
- a. Identify resource management components to establish relationships in natural resource systems.
- b. Apply cartographic skills to natural resource activities.
- c. Monitor natural resource status to obtain planning data.
- d. Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.
- e. Examine weather and other criteria to recognize dangers related to work in an outdoor environment.
- f. Learn applicable rules or laws to demonstrate natural resource mitigation techniques.

NRS2 Use effective venues to communicate natural phenomena to the public.
- a. Communicate natural resources information to the general public.
- b. Personally interpret natural resource phenomena to natural resource users.

NRS3 Apply scientific principles to natural resource management activities.
- a. Use science concepts, processes, and research techniques to examine natural resource topics.

b. Examine biological and physical characteristics to identify and classify natural resources.
c. Examine natural cycles and related phenomena to describe ecologic concepts and principles.

NRS4 Employ knowledge of natural resource industries to describe production practices and processing procedures.
a. Prepare presentations to describe how natural resource products are produced, harvested, processed, and used.

NRS5 Practice responsible conduct to protect natural resources.
a. Employ techniques and equipment needed to prevent wildfire.
b. Use wildfire suppression techniques to demonstrate abilities in firefighting and control.
c. Recognize symptoms of animal and plant diseases and use appropriate techniques to prevent their spread.
d. Recognize insect types and available controls to prevent insect infestation.
e. Use acceptable pesticides to treat insect infestation.
f. Know law enforcement procedures to manage public gatherings and to gain entry into secure, closed, or restricted areas.

ENVIRONMENTAL SERVICE SYSTEMS (ENV)

ENV1 Use analysis procedures to plan and evaluate environmental service impacts.
a. Use instrumentation to monitor samples.
b. Calibrate and service instruments on a timely schedule to maintain environmental instrumentation.
c. Apply statistics, charts, and scattergrams to measure and monitor operations.

ENV2 Identify public policies and regulations impacting environmental services to determine their effect on facility operations.
a. Consult reliable resources or training to identify the major laws impacting environmental services.

ENV3 Apply scientific principles to environmental services.
a. Apply meteorological knowledge to recognize weather systems and weather patterns.
b. Describe soil composition and properties to demonstrate knowledge of soil science.
c. Explain well design and groundwater supplies to demonstrate knowledge of hydrology.
d. Discuss properties, classifications, and functions in order to understand wetland principles.
e. Discuss properties, classifications, and functions in order to understand watershed principles.
f. Use chemical analysis to conduct tests.
g. Apply sampling techniques and other assessments to demonstrate background knowledge of microbiology.

ENV4 Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.
- a. Use pollution control measures to maintain a safe facility environment.
- b. Apply principles of solid waste management (landfill) to manage safe disposal of all categories of waste.
- c. Apply drinking water treatment principles to assure safe drinking water at a facility.
- d. Apply wastewater treatment operations principles to manage wastewater disposal in keeping with rules and regulations.
- e. Apply hazardous materials management principles to assure a safe facility and to comply with applicable regulations.
- f. Explore conventional and alternative supplies to define energy sources.

ENV5 Use tools, equipment, machinery, and technology to accomplish tasks in environmental services.
- a. Use technology tools to map land, facilities, and infrastructure.

AGRIBUSINESS SYSTEMS (ABS)

ABS1 Employ leadership skills to accomplish goals and objectives in the AFNR business environment.
- a. Develop a mission statement to guide business activities effectively.
- b. Apply leadership skills to accomplish general business activities from production to public relations.
- c. Apply management skills to accomplish general business activities from production to public relations.

ABS2 Practice good record keeping to accomplish AFNR business objectives.
- a. Prepare and maintain all files as needed to accomplish effective record keeping.

ABS3 Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.
- a. Use key accounting fundamentals to accomplish dependable bookkeeping and associated files.

ABS4 Employ AFNR industry concepts and practices to manage inventory.
- a. Monitor inventory levels to accomplish practical inventory control.

ABS5 Utilize technology to accomplish AFNR business objectives.
- a. Use technology and information technology strategies for business improvement.

ABS6 Use marketing and sales principles to accomplish an AFNR business objective.
- a. Conduct market research.
- b. Develop a marketing plan.
- c. Implement a marketing plan.
- d. Merchandise products and services.

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.

[2] *Mississippi mathematics framework—Algebra I.* (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

c. Given a literal equation, solve for any variable of degree one.
d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.

[3] *Mississippi science framework—Biology I.* (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.

e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.
a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.
c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
a. Interact with peers to examine real world and literary issues and ideas.
b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
a. Share, critique, and evaluate works in progress and completed works through a process approach.
b. Communicate effectively in a group to present completed projects and/or compositions.
c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
c. Recognize root words, prefixes, suffixes, and cognates.
d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
b. Read aloud with fluency and expression.
c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.

d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
a. Infuse the study of grammar and vocabulary into written and oral communication.
b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
c. Give oral presentations to reinforce the use of standard English.
d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.
a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

H2 Describe the impact of science and technology on the historical development of the United States in the global community.
a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://www.mde.k12.ms.us/curriculum/index_1.htm

c. Describe the effects of transportation and communication advances since 1877.

H3 Describe the relationship of people, places, and environments through time.

a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).

b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).

a. Interpret special purpose maps, primary/secondary sources, and political cartoons.

b. Analyze technological information on graphs, charts, and timelines.

c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).

b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).

c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).

d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: 21st Century Skills[6]

CS1 Global Awareness

- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

CS2 Financial, Economic, and Business Literacy

- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to our nation's evolving economic and business environment

CS3 Civic Literacy

- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 Information and Communication Skills

- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

CS5 Thinking and Problem-Solving Skills

- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

CS6 Interpersonal and Self-Directional Skills

- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for one's self and others; tolerating ambiguity

[6] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts

Appendix D: Rubrics

Diesel Engine Disassembly, Inspection, and Reassembly Rubric

Rate the ability of the student to perform refinishing tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker.
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker.
2 Introductory – Can perform the task but some coaching and further training is required.
1 Limited – Can perform the task with extensive coaching. Further training and practice is required.

TASK	RATING
Prepare engine for disassembly.	
Remove and inspect cylinder head.	
Remove and inspect a valve assembly.	
Remove and inspect a cam shaft.	
Remove and inspect a piston assembly.	
Inspect the cylinder and block.	
Inspect crankshaft assembly.	
Reassemble all components.	
Follow all safety rules and policies related to equipment and hazardous materials.	
Select and use tools and other equipment in a safe and proper manner.	
Work cooperatively as a team member.	

Disassembling and Assembling a Small Gasoline Engine Rubric

Place a check by each step that the student completed satisfactorily.

Engine Disassembly

___1. Removed flywheel shroud, side shroud, and cylinder shroud.

___2. Removed muffler, air vane, and fuel system (carburetor and fuel tank).

___3. Removed valve spring cover.

___4. Removed spark plug.

___5. Removed cylinder head.

___6. Removed crankcase cover.

___7. Removed camshaft and tappets.

___8. Removed valves.

___8. Removed flywheel.

___9. Remove crankshaft, connecting rod, and piston.

___10. Inspected piston, connecting rod, and crankshaft for excessive wear.

Engine Reassembly

___1. Replaced piston, connecting rod, and crankshaft.

___2. Replaced valves, tappets, and camshaft.

___3. Replace crankcase cover.

___4. Replaced cylinder head.

___5. Replaced sparkplug.

___6. Replaced valve spring cover.

___7. Replaced muffler, air vane, and fuel system.

___8. Replaced shrouds.

Disassembling and Assembling a Small Gasoline Engine Rubric, continued

Engine Testing

___1. Tested engine compression.

___2. Tested engine spark.

General Skills:

___1. Practiced general workplace skills (teamwork and responsibility).

___2. Consistently selected and used proper tools in a proper manner.

___3. Consistently followed all safety practices and procedures.

Employability Skills Rubric
(Resume, Job Application, Job Interview)

Criteria	Excellent (4)	Very Good (3)	Good (2)	Fair (1)
Resume				
Effective Objective that Identifies Employment Goal				
Complete Personal Contact Information including address and telephone number				
Complete List of Previous Work or Work Related Experience				
Complete list of educational experiences				
Complete contact information for at least three personal references				
Job Application Form				
Overall neat, clean, and professional appearance				
All sections answered completely and thoroughly				
Correct verb tense, capitalization, and punctuation				
No spelling errors				
Job Interview				
Preparation for interview (has resume, has knowledge of the job and company)				
Personal attributes (Not overbearing or egotistical not shy and nervous)				
General attitude (Shows interest in position, maintains eye contact, speaks clearly and distinctly)				
Personal appearance (dress and personal grooming appropriate for the job being sought)				
Responses to questions (well thought out, confident)				

KWL Chart

Purposes:

- To help students access prior knowledge through brainstorming
- To identify areas of student interest or concern
- To aid the teacher in planning lessons as well as checking for understanding
- To track student learning throughout the unit
- To identify areas for further student research/study

Process:

- Use this strategy prior to, during, or at the close of any unit of study. The process can be done individually, in small groups, or as a class activity.
- Post the charts or have students record their information in groups.
- During the brainstorming phase, emphasize getting lots of ideas rather than debating or discussing the ideas as they are generated. Debates, clarifications, and discussions of ideas occur once the brainstorming is over. Do not clarify any confusion or react in any way other than to record the data. Conflicting data may be recorded.
- During the lesson or unit of study, misconception, confusion, or curiosity should be addressed.

Sample Chart:

K WHAT DO YOU ALREADY **K**NOW ABOUT THE TOPIC?	**W** WHAT DO YOU **W**ANT TO LEARN ABOUT THE TOPIC?	**L** WHAT HAVE YOU LEARNED ABOUT THE TOPIC?

Oxyacetylene Welding and Cutting Operations Rubric

CATEGORY	4	3	2	1	SCORE:
Equipment Setup and Safety	The student selected and set up equipment safely and correctly with the proficiency of an experienced welder. No further practice is required.	The student selected and set up the equipment safely and correctly. Additional practice may be required to become as proficient as an experienced welder.	The student selected and set up the equipment safely and correctly with some assistance from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching to select and correctly set up the equipment.	
Cutting Mild Steel	The student was able to cut mild steel safely with the proficiency of an experienced welder. No further training or practice is required.	The student was able to cut mild steel safely. Further practice may be required to become truly proficient.	The student was able to cut mild steel with some assistance and coaching from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to cut mild steel safely.	
Total Score:					

Performing Routine Equipment Maintenance and Repair Tasks Rubric

Rate the ability of the student to perform maintenance and repair tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker.
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker.
2 Introductory – Can perform the task but some coaching and further training is required.
1 Limited – Can perform the task with extensive coaching. Further training and practice is required.

TASK	RATING
Check engine oil level and condition.	
Check coolant level and concentration.	
Check hydraulic/transmission fluid and condition.	
Check pleated paper air filter.	
Check oil bath air filter.	
Assess machinery parts for wear or breakage.	
Recondition agricultural machinery.	

Portfolio Rubric

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Artifacts	Has produced 14 or less artifacts that support knowledge learned from the course.	Has produced 15-19 artifacts that support knowledge learned from the course.	Has produced 20-24 artifacts that support knowledge learned from the course.	Has produced 25-29 artifacts that support knowledge learned from the course.	Has produced more than 30 high quality artifacts that support knowledge learned from the course.
Writing	Uses simple sentences only to describe each artifact.	Uses mostly simple sentences and a few complex sentences.	Uses an equal amount of simple and complex sentences.	Uses simple and complex sentences and a few compound sentences.	Uses a wide variety of simple, complex, and compound sentences.
Revision of Artifacts	Has not revised artifacts based on assessment and review.	Has made 10 – 20 revisions of artifacts based on assessment and review.	Has made 21 – 25 revisions of artifacts based on assessment and review.	Has made 26 – 30 revisions of artifacts based on assessment and review.	Has made revisions to all artifacts based on assessment and review.
Organization	Artifacts are unorganized; contain many errors in writing, vocabulary, and content.	Artifacts are somewhat organized but contain more than two errors.	Artifacts are organized; contain no more than two writing, vocabulary, or content errors.	Artifacts are organized; contain no more than one writing, vocabulary, or content error.	Artifacts are well organized; contain no writing or vocabulary errors; and have high quality content.

Refinishing Equipment Rubric

Rate the ability of the student to perform refinishing tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker.
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker.
2 Introductory – Can perform the task but some coaching and further training is required.
1 Limited – Can perform the task with extensive coaching. Further training and practice is required.

TASK	RATING
Inspect equipment for bad paint, rust, and worn parts.	
Clean and prepare equipment for refinishing.	
Prime equipment for refinishing.	
Apply top coats and other coatings.	
Clean and service equipment.	
Follow all safety rules and policies related to equipment and hazardous materials.	

SAE Plan Rubric

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE:
Occupational Goals	Detailed long range and short term goals for reaching an occupational goal in the field of agriculture, food, and natural resources occupations are provided.	General long range and short term goals for reaching an occupational goal in the field of agriculture, food, and natural resources occupations are provided.	General long range and short term goals for reaching an occupational objective in fields outside of agriculture, food, and natural resources occupations are provided.	Only vague general statements concerning any occupational goal are provided.	
Resources Required	Detailed resources required to achieve goals are identified.	General resources required to achieve goals are identified.	A general statement on the resources required to achieve the goals is provided.	Very limited information on resources required to achieve program goals is provided.	
Training Agreement	Responsibilities of all parties (students, parents, teachers, employers/sponsors) in the SAE are detailed and accepted by signature.	General responsibilities of all parties in the SAE are identified.	Responsibilities of all parties in the SAE are stated in very general terms.	Responsibilities of all parties are not clearly defined.	
Skills to be Accomplished	A detailed list of skills representing a broad range of activities associated with the SAE is provided.	A general list of skills representing a moderately broad range of activities is provided.	A general list of skills representing a narrow range of activities is provided.	A very limited list of skills to be accomplished is provided.	
Outcomes	A detailed list of outcomes including income and expenses, if applicable, is provided.	A general list of outcomes is provided.	Expected outcomes are listed but not in specifics.	Limited outcomes are identified.	
Total Score:					

Text Based Seminar Rubric

Text Based Seminar

In a text-based seminar of 40 minutes to one hour, a team examines an issue from an outside point of view by focusing on a specific article or excerpt from a book. This seminar helps build a culture of discourse in a school by creating a safe place for individuals to approach difficult issues. Participants read a short article or excerpt from a book that is related to teaching and learning and engage in a discussion about the text.

The purpose of the discussion is not to persuade other group members of a particular point of view but to clarify, build upon, and enhance understanding of the actual text.

Text-based seminars give participants an opportunity to extract different meanings and ideas from a text and discuss important issues related to the text.

Procedure

1. Select the Text

Choose an article or book excerpt that will have implications for teaching and learning. The article may be selected by the team facilitator or by an individual member of the team.

2. Read the Text (10 – 15 Minutes)

If the text is long, the facilitator may distribute it before the meeting, or a shorter text may be read for the first time during the meeting. In either case, 10 –15 minutes of seminar time are devoted to reading or reviewing the article. While reading, participants may take notes, underline or highlight important ideas, and record questions the text raises for them.

3. Begin the Discourse (5 –10 Minutes)

There are two effective ways to begin the discourse. Each member of the seminar may take turns reading aloud a sentence or two that has particular significance to them. Or, the facilitator may present a framing question to start the discussion.

4. Discuss the Text (20 – 30 Minutes)

The facilitator leads the discussion. He or she should remind participants to refer to the text to support their comments. Groups may want to follow these guidelines:

- *Listen actively*
- *Build on what others say*
- *Expose/suspend your assumptions*
- *Don't step on other's talk. Silences and pauses are OK*
- *Emphasize clarification, amplification, and implications of ideas*
- *Converse directly with each other, not through the facilitator*
- *Let the conversation flow without raising hands, as much as possible*
- *Make references to the text and encourage others to do the same*
- *Watch your air time for how often you speak and how much you say when you speak*

5. Close the Discussion (5 Minutes)

The facilitator closes the discussion about the text, highlighting two or three main points of discussion and thanking participants for their perspective. The result is that all participants leave the seminar with a deeper understanding of the text.

Tractor Operations Score Sheet

Tractor Inspection (Verbal Response)

1.	Check oil Level		x 5		
2.	Check brakes		x 5		
3.	Check tires		x 5		
4.	Check tractor warning lamps and/or SMV emblem		x 5		
5.	Check and adjust seat and/or steering column		x 5		

Starting Tractor (Verbal Response)

1.	Check fuel shut-off valve		x 5		
2.	Check transmission Neutral or Park position		x 25		
3.	Check brake setting		x 25		
4.	Check clutch position		x 5		
5.	Check throttle setting (approximate 1/3 of travel)		x 5		
6.	Do not operate starter motor over 10 seconds		x 5		

During Operation (Read Gauges and Provide Verbal Response)

1.	Check oil pressure		x 5		
2.	Check ammeter reading		x 5		
3.	Check temperature reading		x 5		
4.	Check fuel level		x 5		

Observe at All Times During Above Operations:

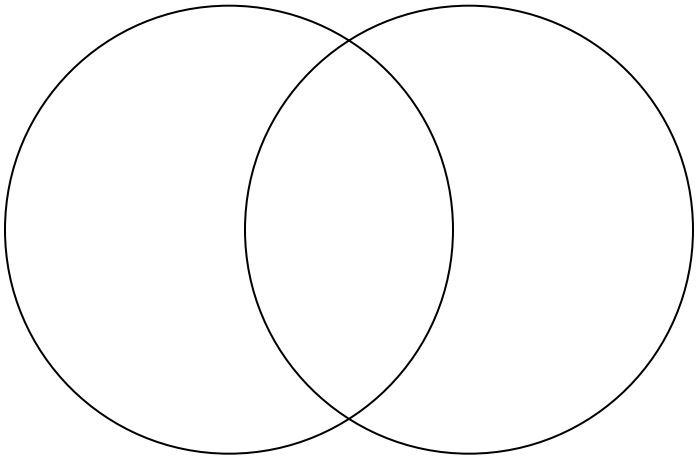
1.	For failure to wear seat belt		x 25		
2.	For failure to set brakes when getting off tractor		x 25		
3.	For rough clutch engagement		x 10		
4.	For clashing gears		x 10		
5.	For stalling the engine		x 10		
6.	For excessive engine speed		x 10		
7.	For excessive tractor speed		x 10		
8.	For standing up while tractor is in motion		x 10		
9.	For any unsafe conduct while on or around the tractor		x 10		

Total Deductions _____

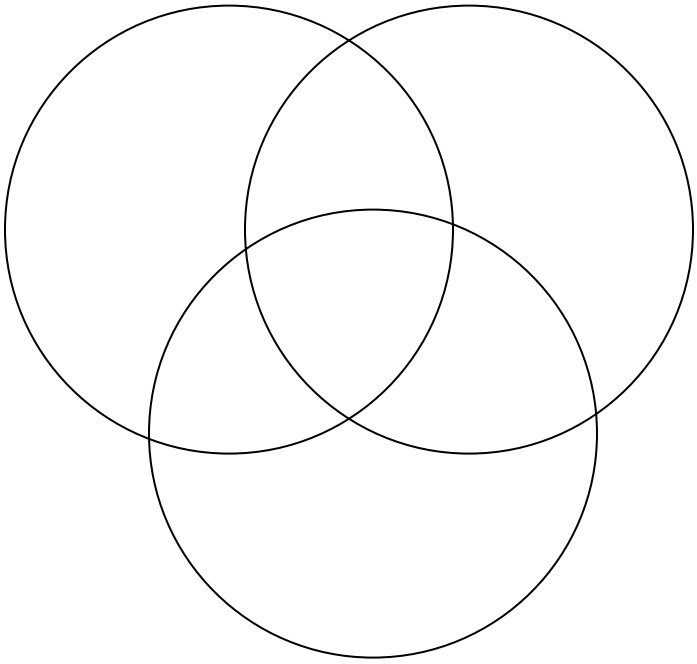
Venn Diagram

Have students use a Venn Diagram to compare and contrast subjects. Have students write details that tell how subjects are different in the outer circles and details that tell how the subjects are alike where circles overlap. After students present their ideas in the graphic, have them organize their ideas into a writing summary.

Use the following Venn Diagram to compare and contrast two subjects:



Use the following Venn Diagram to compare and contrast three subjects:



Weekly Learning Reflections

Name: _____ Week of: _____

What did I learn this week?

How can I use this information in the real world?

In what areas am I making progress?

In what areas do I need to improve?

What learning goals do I have for next week?

What did I enjoy most about this week?

Parent's Signature and Comments: _____

_____

_____

Student's Signature and Comments: _____

_____

_____

Welding Techniques Rubrics

CATEGORY	4	3	2	1	SCORE:
Equipment Setup and Safety	The student selected and set up equipment safely and correctly with the proficiency of an experienced welder. No further practice is required.	The student selected and set up the equipment safely and correctly. Additional practice may be required to become as proficient as an experienced welder.	The student selected and set up the equipment safely and correctly with some assistance from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching to select and correctly set up the equipment.	
Striking an Arc	The student repeatedly struck an arc and ran a short bead with the proficiency of an experienced worker. No further practice is required.	The student was able to strike an arc and run a short bead correctly. Further practice may be required to become truly proficient.	The student was able to strike an arc and run a short bead with coaching and assistance from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to strike an arc and run a short bead.	
Running a Bead	The student was able to run a bead on mild steel in the flat position with the proficiency of an experienced welder. No further training or practice is required.	The student was able to run a bead on mild steel in the flat position. Further practice may be required to become truly proficient.	The student was able to run a bead on mild steel in the flat position with some assistance and coaching from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to run a bead on mild steel in the flat position.	
Building a Pad	The student was able to build a pad on mild steel in the flat position with the proficiency of an experienced welder. No further training or practice is required.	The student was able to build a pad on mild steel in the flat position. Further practice may be required to become truly proficient.	The student was able to build a pad on mild steel in the flat position with some assistance and coaching from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to build a pad on mild steel in the flat position.	
Constructing a Flat Butt Weld	The student was able to construct a butt weld on mild steel in the flat position with the proficiency of an experienced welder. No further training or practice is required.	The student was able to construct a butt weld on mild steel in the flat position. Further practice may be required to become truly proficient.	The student was able to construct a butt weld on mild steel in the flat position with some assistance and coaching from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to construct a butt weld on mild steel in the flat position.	
Constructing a Fillet Weld	The student was able to construct a fillet weld on mild steel in the flat position with the proficiency of an experienced welder. No further training or practice is required.	The student was able to construct a fillet weld on mild steel in the flat position. Further practice may be required to become truly proficient.	The student was able to construct a fillet weld on mild steel in the flat position with some assistance and coaching from the instructor. Further training and practice will be required to become proficient.	The student required a great deal of assistance and coaching from the instructor to construct a fillet weld on mild steel in the flat position.	
Total Score:					

Workplace Skills Weekly Checklist

Name: _____ Date: _____ Period: _____

Behavior Skill	Never	Rarely	Most of the Time	Always
On Time and Prepared				
1. Arrives to class on time.				
2. Brings necessary materials.				
3. Completes homework.				
Respects Peers				
1. Respects others' property.				
2. Listens to peers.				
3. Responds appropriately to peers.				
4. Respects others' opinions.				
5. Refrains from abusive language.				
Respects Teachers/Staff				
1. Follows directions.				
2. Listens to teacher/staff.				
3. Accepts responsibility for actions.				
Demonstrates Appropriate Character Traits				
1. Demonstrates positive character traits (kindness, trustworthy, honesty).				
2. Demonstrates productive character traits (patient, thorough, hardworking).				
3. Demonstrates a level of concern for others.				
Demonstrates a Level of Concern for Learning				
1. Remains on task.				
2. Allows others to remain on task.				

The Writing Process

Step 1: Prewriting
During this step, allow students to brainstorm and determine ideas for their content. Students may complete the following during prewriting activities:

- Free writing
- Journaling
- Image streaming (transplant yourself to another place or time and describe from a first person point of view)
- Lists
- Visualization
- Brainstorming - individually or as a group
- Webbing/mapping/clustering
- Graphic organizers
- Topic or word chart

Step 2: Writing
During this step, allow students to develop a rough draft of their writing. Encourage students to be selective in the ideas they choose to include. Have students focus on developing content and putting their ideas on paper. Do not require students to count words, but have them complete ideas instead.

Step 3: Revising
During this step, have students make decisions about how they want to improve their writing. Have students look at their writing from a different point of view. Encourage students to focus on making their writing clearer, more interesting, more informative, and more convincing. To help students revise their writing product, use the following strategies:

- Divide students into groups of three – five in varying ability. Distribute student writing samples to all group members. Make sure there are no names on the pieces of writing. Have everyone in each group read one paper and make marks for improvement. Have the reader write positive and corrective comments about each piece for later discussion within the group. Have the reader present the piece of writing to the group and discuss their comments. Have each group member add comments to each piece of writing.
- Have students ask themselves the following questions:
    - Can I read this piece of writing out loud without stumbling?
    - Is the series of events logical? Do they relate?
    - Is it clear what my goal is throughout the piece of writing?
    - Are vivid/descriptive words used to describe characters and/or events?
    - Is my train of thought clear?
    - Do I use a variety of verbs throughout the piece?
    - Is my writing wordy or redundant? Am I using the same words and phrases over and over again?
    - Is there a catch introduction?
    - Are transitional devices used throughout?

The Writing Process, Continued

- Is there a strong hook, main idea or theses, and lead-in?
- Is proper format followed throughout?
- Are all sentences complete?
- Did I use a thesaurus?

Step 4: Editing
Editing is checking spelling, capitalization, punctuation, grammar, sentence structure, subject/verb agreement, consistent verb tense, and word usage. During this step, have students do the following:

- Have students read their own work backwards. Encourage them to read the last sentence, then the second to last sentence, etc. Have students ask themselves the following questions.
  - Does each sentence make sense when you read it on its own?
  - Do you see or hear any errors in the sentence?
- Have students use a checklist to peer- or self-edit.

Step 5: Publishing
During this step, have students publish their final document. Students may use a word processing program or a blue or black pen to present their final copy. Give students a set of guidelines before they begin to publish their writing. Have students submit the following when they turn in their writing to ensure that they followed all of the steps in the writing process:

- Prewriting document
- Rough draft
- Edited copy
- Final document

Written Report Rubric

	Exemplary	Accomplished	Developing	Beginning	Score
	4 points	3 points	2 points	1 point	
Content	Clear thesis and focus that remain apparent	Thesis and focus that remain apparent	Addresses subject matter with minimal support	Does not focus on topic	
Grammar	Correct and effective use of grammar and mechanics	Occasional errors in use of grammar and mechanics	Problems in use of grammar and mechanics	Repeated errors in use of grammar and mechanics	
Organization	Ideas flow smoothly and logically with clarity and coherence	Logical order and appropriate sequencing of ideas with adequate transition	Some evidence of an organizational plan or strategy	Lacks organization	

Written Report Rubric

CATEGORY	4-Exceptional	3-Admirable	2-Acceptable	1-Amateur	SCORE
Organization	Content is extremely well organized in a logical format that is easy to follow and flows smoothly from one idea to another enhancing the effectiveness of the project.	Content is presented in a thoughtful, organized manner, and most transitions were easy to follow. Only a few ideas were unclear.	While content was somewhat organized, ideas were not presented coherently, and transitions were not always smooth.	The content was choppy and confusing. It was difficult to follow; transitions were abrupt and seriously distracted the audience.	
Content Accuracy	All content was completely accurate; all facts were precise and explicit.	Content was mostly accurate with only a few inconsistencies or errors in information.	Content was somewhat accurate, but there were more than a few inconsistencies or errors in information.	Content was grossly inaccurate to the point that the facts in this project were misleading to the audience.	
Research	Research on the project went above and beyond expectations. The student solicited material in addition to what was provided, brought in personal ideas and information to enhance project, and utilized more than six types of resources to make project effective.	The student did a very good job of researching, using materials provided to their full potential; the student used more than four types of research to enhance project (at least one source from information outside of the school).	The student used at least three references provided by the school in an acceptable manner but did not consult any additional resources.	The student did not use provided resources effectively and did little or no fact gathering on the topic.	
Creativity	The report demonstrated exceptional creativity and originality on the part of the student.	The report was cleverly presented in a thoughtful and interesting manner.	The student did add a few creative touches to enhance the report but mostly reported the information as provided.	The report showed little creativity or originality.	