

Renton School District No. 403

Career and Life Skills Education

**Material Science and Technology
Curriculum Guide**

Grades 9-12

Adopted by the Board of Directors: June 9, 1999

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A PHILOSOPHY OF EDUCATION FOR THE RENTON PUBLIC SCHOOLS

A basic function and duty of a free society is the education of its children, youth and adults.

It is the responsibility of the schools to provide each student with the opportunities necessary to develop the scholarship, skills and attitudes which will enable the student to achieve mental, physical, emotional and social maturity.

Further, each student should, as a result of the school experience, be able to make decisions and to accept responsibility for those decisions.

POLICY: 6001

ADOPTED: February 3, 1977

Renton School District No. 403

Renton, Washington

Renton School District #403 recognizes the need for every graduate to have acquired job entry skills or at least to possess a level of knowledge and skills permitting continued training after high school.

RENTON SCHOOL DISTRICT NO. 403
GENERAL INSTRUCTIONAL GOALS
Policy 6010

The Renton School District fosters an educational process which helps all students achieve at their highest potential.

The Renton School District:

LEARNING

- Offers a curriculum which prepares our students for the future.
- Emphasizes that diversity contributes positively to the individual and to the community.
- Provides learning experiences matched to the needs, interests, and abilities of our diverse student population.
- Extends learning opportunities beyond the school.

INSTRUCTION

- Offers a variety of high quality instructional resources and services to students, staff, and community.
- Supports multiple instructional strategies.
- Provides resources and opportunities for continuing professional development of our staff.
- Conducts ongoing evaluations of our instructional programs.
- Maintains safe and inviting facilities that are conducive to learning.

COMMUNITY

- Creates partnerships which involve students, parents, staff and other community members and organizations.
- Promotes effective communication.
- Values and encourages development of a spirit of community service.
- Respects the rights and responsibilities of all.

As a result of the educational process in Renton, students will understand and apply:

Language skills including reading, writing and communication, with opportunities to learn

world languages.

Mathematics skills including concepts, procedures, problem solving, reasoning, and mathematical language.

Science Skills including concepts, principles, and the scientific process.

Social studies skills, concepts, and processes - emphasizing history, geography, economics, international perspectives, multiculturalism, and participatory democracy.

Arts and humanities skills, concepts, and processes to create, perform, and solve problems and respond effectively.

Health and physical education skills, concepts, and processes to promote lifelong physical, mental and social well being.

In order to strengthen the above curricular areas, Renton students will understand and apply:

Thinking skills including the ability to - gather and analyze information, think logically, critically and creatively, integrate experience and knowledge in making reasoned judgments, and solve problems.

Career and life skills necessary for successful and responsible participation in family, work and community.

Technological skills to support learning, problem solving, and communication.

Skills necessary to be a lifelong learner and a contributor to the general welfare and the quality of life for all.

EVALUATION: The Renton School District regularly reviews, evaluates and modifies these General Instructional Goals to meet the changing needs of students, staff and community.

CAREER AND LIFE SKILLS EDUCATION GOALS

GOAL 1: PROVIDE HIGH QUALITY VOCATIONAL-TECHNICAL EDUCATION PROGRAMS EDUCATION PROGRAMS AND SERVICE

Objectives:

- A. Assure that students completing Vocational-Technical Education programs have technical and behavioral competencies and basic skills sufficient to succeed in the workplace or higher education.
- B. Establish course and/or program transferability and articulation processes among K-12, community and technical colleges, private schools, colleges and universities, industry, apprentice-related training, and military training.
- C. Establish and regularly review standards for all Vocational-Technical Education programs.
- D. Evaluate Vocational-Technical programs based on standards, objectives, placements, job performance, costs, and community/industry acceptance.
- E. Utilize global, national, state, regional, and local data and advisory committee recommendations to identify appropriate curriculum and course offerings, program standards which meet the need of families, communities, business and industry.
- F. Provide facilities, equipment and instructional programs which meet the needs of a changing workplace.
- G. Revise or discontinue these programs that no longer meet the needs of students, business, labor, industry, and/or the community.
- H. Provide qualified instructors and administrators for Vocational-Technical Education based on relevant certification standards.
- I. Develop and utilize competency-based curricula for Vocational-Technical Education programs.

GOAL 2: CONTRIBUTE TO THE ECONOMIC DEVELOPMENT OF THE STATE

Objectives:

- A. Facilitate cooperation between public and private sector entities.
- B. Establish new Vocational-Technical programs based on existing and projected employment needs/demands and entrepreneurial opportunities.
- C. Work cooperatively with the public and private sectors, economic development organizations, labor, and educational institutions to provide creative, targeted programs that meet the needs of youth in economically depressed areas.
- D. Provide family life education programs which serve to strengthen families and contribute to the effectiveness of workers in managing their consumer and family roles and in their careers.
- E. Strengthen management skills for those seeking employment in worker owned and managed businesses.
- F. Create a stronger working partnership with Team Washington and other economic agencies and the associate development organizations.

GOAL 3: ASSURE ALL INDIVIDUALS EQUAL ACCESS TO VOCATIONAL-TECHNICAL EDUCATION PROGRAMS, SERVICES, AND ACTIVITIES

Objectives:

- A. Provide Vocational-Technical programs, services, and activities that are free from racial, socio-economic, age, ethnic or sex bias, discrimination or stereotyping.
- B. Provide access to barrier-free Vocational-Technical Education programs.
- C. Actively recruit under-represented groups to all aspects of Vocational-Technical Education.
- D. Provide supportive services which promote entrance and success in Vocational-Technical programs.

GOAL 4: PROVIDE/UTILIZE AN INTEGRATED STATE PLANNING PROCESS

Objectives:

- A. Involve business, industry, agriculture, labor and other governmental and educational agencies in the planning processes at the state and local levels to ensure that establishment of delivery objectives and budget priorities.
- B. Identify instructional area/programs based on demand, placements, training needs, program costs, and follow-up.
- C. Utilize local, regional, state, national and global employment data, trends and advisory committees/organizations in identifying program offerings.

GOAL 5: PROVIDE AND MARKET VOCATIONAL-TECHNICAL EDUCATION

Objectives:

- A. Increase public awareness, understanding, and acceptance of Vocational-Technical Education.
- B. Actively involve students, parents, community leaders, legislators, labor representatives, business organizations, industry, representatives, and other decision-makers from state and local arenas in Vocational-Technical Education program events and issues.

GOAL 6: PROVIDE INDIVIDUALS WITH CAREER DEVELOPMENT PROGRAMS AND EXPERIENCES

Objectives:

- A. Provide career orientation, exploration, occupational information, self-appraisal, and educational planning.
- B. Provide instruction in job search, job retention and job change skills and further education pursuits.
- C. Assure that Vocational-Technical Education programs encompass demands of today's workplace and include attitudinal, employability, leadership, basic interpersonal, and job specific skills.

GOAL 7: ASSURE A QUALITY STAFF DEVELOPMENT PROGRAM

Objectives:

- A. Provide appropriate channels for advisory committee recommendations in the program and policy-making process.
- B. Provide in-service training opportunities for local advisory committee members.
- C. Provide in-service training for administrators and Vocational-Technical instructors regarding the effective use of advisory committees.

CAREER AND LIFE SKILLS EDUCATION

Renton School District #403 operates a comprehensive Career and Life Skills Education Program through its four comprehensive high schools and two alternative programs. The district also participates in two countywide Tech Prep consortia with local community and technical colleges. This partnership allows students to earn college credit while still enrolled in high school programs. Secondary and post-secondary curricula are coordinated and students master and achieve skills, concepts, and technical competencies in high school that articulate with college programs. Students earn credit towards high school graduation and college technical programs at their home high schools.

The focus has changed in recent years from an emphasis on only job preparation to one of career exploration and exposure. While skill development and employment readiness is still a primary goal, emphasis has been placed on career exploration, career pathway preparation, and post-secondary articulation.

The **Family and Consumer Science Education Program** is offered at Hazen, Lindbergh, Renton, and Black River High Schools. The program is comprised of the following: Careers in Education; Careers with Children; Children & Parenting; Design; Eating Well/Creative Foods; Exploring Early Childhood and Exploring Early Childhood/Work Experience; Family Health; Health Club; Independent Living; Personal Choices; Teen Parenting/GRADS; and American Sign Language. School district and community sites provide applied workbased learning opportunities for program students.

The **Business Education Program** is offered in the District's three comprehensive high schools and at the Sartori Learning Center. The program consists of technical business related classes sequentially arranged into a course of instruction leading to a Certificate of Proficiency or Mastery to facilitate job placement or post secondary articulation. These courses are as follows: Business Communications; Business Connections 1-2; Business Connections Work Experience 1-2; Business law; Business Management; Computer Applications; Electronic Math Applications; Information Processing; Machine Transcription; Principles of Business; Recordkeeping; Word Processing 1-2; and Advance Word Processing. The Business Connections Workbased Learning component provides actual related job experience through workstations in the community. Business programs are often arranged and blocked with language arts programs to support program integration and technology use in the writing process.

A comprehensive **Workbased Learning Program** is offered in all of the facilities in the Renton School District. This program couples on-the-job experience and related classroom training to prepare students for employment during and beyond high school. The **Marketing Education** and **Diversified Occupations Programs** provide students the opportunity to combine related classroom instruction and paid work experience to earn high school credit. These programs assist and support students as they make the transition from school to work. **Volunteer experiences**, **Internships**, **Job Shadows**, and **Service Learning** are also strong components of this community based applied experiences.

The community also plays a vital role in other programs offered through the Renton School District. The **Health Careers/ Sciences Program** is reliant on clinical training stations and coordinated work experiences for students through local convalescent centers, nursing facilities, and community hospitals. This program is offered to all students in the Renton School District but operates only at Hazen High School.

Technology Education Programs are offered at all three comprehensive high school facilities, and the Sartori Education Center. These programs are often integrated with the Science and Math departments to support applied learning and the development of technical skills and competencies for all students. Courses in this department are: Automotive Service Technician 1-2; CAD & Computer Graphics 1-2; Computer Graphics and Communications Related Careers 1-2; Electronics and Related Careers 1-2; Engineering Drafting and Related 1-2; Fundamentals of Networking Technology 1-2; Light Duty Mechanics and related Careers 1-2; Materials Science and Technology 1-2; Metalworking, Construction, Maintenance and Related Careers 1-2; Power and Energy 1-2; Principles of Technology 1-2; Video Production 1-2; Woodworking, and Construction, Maintenance and Related Careers.

Integrated instruction has been the focus of the Career and Life Skills instructional team for the past several years and the results can be seen throughout the program in each of the secondary schools. Several programs have been launched and are operating very successfully in all of the secondary sites. While these programs qualify for vocational funding, the district has made the commitment to operate them in collaboratively with a related academic instructor. These **Applied Vocationally Approved Programs** are titled: Applied Communications; Applied Mathematics; Material Science Technology; and Principles of Technology.

Renton School District has made a commitment to provide vocational training and job preparation opportunities for Special Needs students in addition to mainstreaming them, when appropriate. In order to have enough students to allow several offerings, the district has entered into interdistrict cooperative agreements with surrounding districts to accept students on a space available basis. There are four such **special programs**: **Building Maintenance** operates at the Sartori Learning Center and the **Career Ladders/Community Classroom** is offered at Valley Medical Center. The **Horticulture/Landscape Design 1-2 Program** is operated at Black River High School and **Health Careers** section is located at Hazen High School.

The district is also a partner in the Vocational/Special Education consortium of King County School Districts. The primary purpose of this participation is to make Vocational-Technical Education more accessible to persons with disabilities, provide additional inservice opportunities to all instructors and support to vocational instructors as they provide applied learning opportunities to special needs students.

**RENTON SCHOOL DISTRICT NO. 403
CAREER AND LIFE SKILLS EDUCATION**

MISSION STATEMENT

The mission of career and life skills education in the Renton School District #403 is to prepare all learners for successful roles in families, careers and communities.

THREE BELIEFS

A. Beliefs about individual needs

1. All learners have unique gifts and talents and can be successful.
2. All learners must develop self-esteem and personal confidence for productive roles in society.
3. All learners need to have and attain personal and career goals, arising from a lifespan approach to personal growth and career development.

B. Beliefs about society's expectations

1. All learners must be prepared to become ethical, responsible and contributing world citizens.
2. All learners must adapt to change and participate in lifelong learning.
3. All learners must prepare for family roles and to balance work and family responsibilities.
4. All learners must develop essential creative/critical thinking, problem solving and communication skills.
5. All learners must value and have an appreciation for diversity in their schools, communities and workplaces.
6. All learners must recognize the impact of productive work on our economy.

C. Beliefs about systems that care for and support learners

1. All learners must have equitable access to a quality education.
2. All learners deserve to participate in learning systems where programs are mutually reinforcing and interdependent and where learning is related to life applications.
3. All learners must discover that school is part of a broader set of community resources they must access for learning and for achieving success in life.
4. All school programs must be developed in cooperative with family, business, labor and community representatives.
5. All staff must be accountable to ensure that all learners have the opportunity to establish and reach their goals.

Material Science Technology History

During the 1996-97 school year, a committee composed of the District's Material Science and Technology Education teachers convened to review the Concepts of the Material Science curriculum. The group reviewed the Material Science Handbook by Batelle Laboratories and the Material Science curriculum by Energy Concepts, Inc. At that time, these were the only two texts on the market for high school Material Science. The text and laboratory manual from Energy Concepts, Inc., have been judged to provide a suitable framework to develop the Concepts of the course. The ECI materials allow for investigations into the realm of science and technology, and teach the processes of science throughout the curriculum. The Batelle Laboratory Manual, on the other hand, was missing an accompanying text. While the Batelle manual is a useful resource for the course, it did not provide a comprehensive framework to develop the necessary Concepts. Material Science Technology is a laboratory-based science, and as such, laboratory work and scientific study are critical to the development of concepts and skills the students must learn. For the curriculum guide to address this in a more comprehensive way, suggested laboratory experiments are essential in each major topic within the curriculum.

Any study of science involves reviewing data that has accumulated over time and from which testable hypotheses are derived. From this process, scientific theories emerge. It is recognized that there are other points of view and these will be treated with respect. The study of these views, however, shall be done in forums outside the school.

During the 1996-1997 school year, a committee composed of the District's Material Science and Technology Education teachers convened to review the curriculum and adopt a textbook. A review of an existing curriculum guide was not possible at the time, because no such curriculum guide had been developed for the Renton School District. Consequently, the committee reviewed a Material Science laboratory manual produced by the Batelle Laboratories and a MST curriculum produced by Energy Concepts, Inc. While the Batelle laboratory manual had many excellent qualities, the absence of an accompanying textbook resulted in many deficiencies. Moreover, the review committee felt that to best meet the needs of students, the MST text, Material Science published by Energy Concepts, Inc., should be recommended for adoption.

In addition, the committee recommended the adoption of the Energy Concepts laboratory manual because of the way it complimented the textbook. The ECI laboratory manuals support the curriculum, utilize materials and equipment available at the high school level, and have strong safety components. Both the textbook and the laboratory manual by ECI allow for investigations into the realm of science and technology and teaches the processes of science through the materials and technologies applications. Finally, the committee recommended using the Batelle laboratory manual for reference and additional curriculum ideas.

The development of the Essential Learning Requirements in science and vocational education by the Washington State Commission on Student Learning has prompted the committee to see how well the Material Science curriculum supports the benchmarks in science and technology. Each student learning objective is correlated to the benchmarks.

**Material Science Technology
Overview**

Material Science Technology is a two semester interdisciplinary elective that is an applied study of science, materials, processes, and applications. Students who successfully complete this comprehensive course of study may choose to receive credit in either science or vocational/occupational areas.

Material Science Technology is a part of an integrated curriculum, which incorporates elements of science and technology, project and process design, communication, teamwork, and career development concepts. Students will demonstrate the ability to master, maintain, and apply basic facts, concepts, skills, and processes associated with science and technology.

Students will also work in teams in a laboratory setting where they will develop and maintain a safe and positive working environment, which simulates a business setting. While working in the laboratory, they will demonstrate the ability to manipulate laboratory materials and equipment, as well as gather, organize, and communicate scientific information.

Additional activities help students to develop a respect for science and technology and understand how these processes and concepts contribute to society, family, and the workplace. Projects and activities will support other related academic areas of study. This integrated curriculum emphasizes applied learning, and infuses multi-disciplinary ideas, which more accurately reflect the learning and working environments students will encounter in the of business and industry.

Material Science Technology Program Goals

The Renton Material Science Program will:

- Provide students with the opportunities to master, maintain and apply the basic facts, concepts, skills and processes associated with science and technology.
- Develop positive attitudes in students toward themselves through their relationships with science and technology.
- Establish and maintain a safe learning environment and develop student safety awareness.
- Foster curiosity, initiative, creativity and objectivity.
- Develop rational thinking process which underlie the scientific approach to problem solving, i.e.
 - A. Define the problem
 - B. Make observations and collect data
 - C. Analyze and classify data
 - D. Build hypotheses
 - E. Design and carry out experiments
 - F. Evaluate results and build theories
 - G. Build model systems to explain theories
- Develop fundamental skills in manipulating laboratory materials and equipment, and gathering, organizing and communicating scientific information.
- Develop a knowledge of and respect for the past contributions, the future possibilities and the existing limitations of science and technology in solving societal problems.
- Provide for the reinforcement of study and academic skills taught in other areas of the curriculum such as mathematics and language arts.
- Provide for opportunities for the student to acquire an understanding of the relationship of science and technology to everyday living and various occupations.
- Increase student awareness of historical developments in science and technology.
- Provide curriculum opportunities for both college and vocationally oriented students.

- Provide each student with the opportunities to master, maintain, and apply the basic concepts and procedures of science and technology.
- Provide for the development of reading skills required for decoding and comprehending printed materials.

**Material Science Technology
Program Standards**

In order for the Renton Material Science Technology Program to be more effective, teachers will:

Target Washington State and Renton School District Essential Academic Learning Requirements as the minimum expectations for all students.

- Emphasize the use of manipulatives at all levels as an effective instructional tool.
- Include a variety of problem solving activities throughout the instructional program.
- Encourage students to clearly and effectively communicate Material Science Technology.
- Emphasize that students will assess their performance on Material Science Technology skills based on pre-determined criteria.
- Utilize broad-based assessment tools to maintain records of students' progress In Material Science Technology.

Essential Academic Learning Requirements

ARTS

Washington State Essential Academic Learning Requirements in Arts

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u> (References identified are not totally inclusive)
<p>1.1 Understand and apply arts concepts and vocabulary to communicate ideas.</p> <p>Understand and apply common concepts in all the arts: craftsmanship, function.</p>	<p>All Units</p> <p>Culminating Projects</p> <p>Laboratory Journal</p>	Exposure	<p>Laboratory Journal: 2.8-2.13</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>1.2 Organize arts elements into artistic compositions.</p> <p>Purposefully organize arts elements for a specific application.</p>	<p>All Units</p> <p>Culminating Projects</p>	Moderately Skilled	<p>Laboratory Journal: 2.8-2.13</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>1.3 Use and develop arts skills and techniques to solve problems and express ideas.</p> <p>Assess and refine technique to improve personal performance/products.</p>	<p>All Units</p> <p>Culminating Projects</p>	Limited Practice	<p>Laboratory Journal: 2.8-2.13</p> <p>Projects: 5.35, 6.49, 7.15, 8.38.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

Washington State Essential Academic Learning Requirements in Art

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>1.4 Use skills of craftsmanship to produce quality work.</p> <p>Develop habits of craftsmanship to produce quality work: persistence, self-discipline, technical skills.</p>	<p>All Units</p> <p>Culminating Projects</p>	Moderately Skilled	<p>Projects: 5.35, 6.49, 7.15, 7.18, 8.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>2.2 Generate and analyze solutions to problems using creativity and imagination.</p> <p>Identify, analyze, and solve a problem in an expressive and imaginative way.</p>	<p>All Units</p> <p>Culminating Projects</p> <p>Laboratory Activities</p>	Limited Practice	<p>Laboratory Journal: 2.8-2.13</p> <p>Projects: 5.35, 6.49, 7.15, 7.18, 8.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>3.1 Use image, sound, action, and movement through the arts to express individual ideas for a specific purpose.</p> <p>Communicate for a variety of functions and audiences, for example, design a video job interview; make a senior project.</p>	<p>All Units</p> <p>Culminating Projects</p> <p>Multi-Instructional Approach: written, oral, and video presentations.</p>	Limited Practice	<p>Projects: 5.35, 6.49, 7.15, 7.18, 8.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

Washington State Essential Academic Learning Requirements in Art

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>4.1 Use arts skills and knowledge in other subject areas.</p> <p>Apply artistic processes to both enhance and demonstrate learning in other subjects.</p>	<p>All Units</p> <p>Culminating Projects</p> <p>Multi-Instructional Approach</p> <p>Real Life Application</p>	Exposure	<p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8.</p> <p>Multi-Instructional Approach: 2.3-2.4</p> <p>Real Life Application: 2.25-2.2</p>
<p>4.4 Recognize the influence of the arts in shaping and reflecting cultures and history.</p> <p>Understand how technological advances change the way cultures express and interpret meaning.</p>	<p>All Units</p> <p>Culminating Projects</p> <p>Video/Community Sources</p> <p>Real Life Application</p>	Limited Practice	<p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8.</p> <p>Multi-Instructional Approach: 2.3-2.4</p> <p>Real Life Application: 2.25-2.2</p>

Washington State Essential Academic Learning Requirements in Art

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
4.5 Incorporate arts knowledge and skills into the workplace. Use art skill and knowledge to present ideas, inform, persuade or design products.	All Units Culminating Projects	Limited Practice	Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8.
4.5 Collaborate to design a project developing his or her own criteria.	All Units Culminating Projects Multi-Instructional Approach	Moderately Skilled	Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8. Multi-Instructional Approach: 2.3-2.4 Cooperative Groups: 2.14 Journal Writes: 2.8-2.13 Problem Solving: 2.5-2.7

COMMUNICATION

Washington State Essential Academic Learning Requirements in Communication

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u> (References identified are not totally inclusive)
1.1 Focus attention. a. Use attention level appropriate for particular circumstances and contexts. b. Analyze and reflect on ideas while paying attention and listening in a variety of situations.	All Units Laboratory Activities Culminating Projects Workplace Readiness	Skilled	Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites: Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8. Workplace Readiness: 3.3
1.2 Listen and observe to gain and interpret information. a. Interpret and draw inferences from verbal and non-verbal communication. b. Draw inferences based on visual information and/or people's behavior. c. Explore different perspectives on viewing a range of visual texts. d. Listen for, identify and explain:	All Units Laboratory Activities Culminating Projects Guest Speakers Problem Solving	Skilled: a,b,c,e Exposure: d	Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites: Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.22, 8. Problem Solving: 2.5-2.7

Washington State Essential Academic Learning Requirements in Communication

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
Information vs. persuasion; inferences; emotive rhetoric vs. reasoned arguments. e. Use a variety of effective listening strategies.	Video/Print Sources		
1.3 Check for Understanding by asking questions and paraphrasing. a. Ask questions to interpret and evaluate oral and visual contexts based on information from a variety of sources. b. Paraphrase to expand and refine understanding. c. Make judgments and inferences. d. Ask questions to refine and verify hypotheses. e. Use a variety of listening skills.	All Units Multi-Instructional Approach Problem Solving Journal Writes Cooperative Groups Laboratory Activities	Skilled	Multi-Instructional Approach: 2.3-2.4 Problem Solving: 2.5-2.7 Journal Writes: 2.8-2.13 Cooperative Groups: 2.14 Fostering Creativity: 2.16

Washington State Essential Academic Learning Requirements in Communication

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>2.1 Communicate clearly to a range of audiences for different purposes.</p> <p>a. Communicate effectively with different audiences.</p> <p>b. Identify and use different forms of oral presentation.</p>	<p>Multi-Instructional Approach</p> <p>Presentations</p> <p>Journal Writes</p> <p>Cooperative Groups</p> <p>Workplace Readiness</p>	<p>Limited Practice</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Journal Writes: 2.8-2.13</p> <p>Cooperative Groups:2.14</p> <p>Workplace Readiness: 3.3</p>
<p>2.2 Develop content and ideas.</p> <p>a. Use a variety of content to convey messages to a chosen audience.</p> <p>b. Access and use a variety of primary and secondary sources.</p> <p>c. Create a comprehensive and organized presentation with a clear sequencing of ideas and transitions.</p> <p>d. Make a well reasoned, insightful presentation supported by related details.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Written and Oral Presentations</p>	<p>Limited Practice: a-c</p> <p>Exposure: d</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p>

Washington State Essential Academic Learning Requirements in Communication

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>2.3 Use effective Delivery.</p> <p>a. Vary tone, pitch, and pace of speech to create effect and aid communication.</p> <p>b. Project voice well.</p> <p>c. Use good posture and eye contact.</p> <p>d. Skillfully use facial expression, body movement, and gestures to convey tone and mood appropriate to the audience and message.</p>	<p>Multi-Instructional Approach</p> <p>Oral Presentations</p> <p>Cooperative Groups</p>	<p>Exposure: a, c, d</p> <p>Limited Practice: b</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Cooperative Groups: 2.14</p>
<p>2.4 Use effective language and style.</p> <p>a. Speak using standard grammar.</p> <p>b. Use a variety of sentence structures.</p> <p>c. Use language that is interesting and well suited to the topic and audience.</p>	<p>Multi-Instructional Approach</p> <p>Oral Presentations</p> <p>Journal Writes</p> <p>Cooperative Groups</p> <p>Problem Solving</p>	<p>Skilled</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Journal Writes: 2.8-2.13</p> <p>Cooperative Groups: 2.14</p> <p>Problem Solving: 2.5-2.7</p>

Washington State Essential Academic Learning Requirements in Communication

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance <u>Level</u>	<u>Reference**</u>
<p>2.5 Effectively use action, sound, and/or images to support presentations.</p> <p>a. Communicate messages through oral, artistic, graphic, and/or multimedia presentations.</p> <p>b. Demonstrate sophisticated use of available technology to present ideas and concepts.</p>	<p>Multi-Instructional Approach</p> <p>Journal Writes</p> <p>Oral Presentations</p> <p>Cooperative Groups</p>	Skilled	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Journal Writes: 2.8-2.13</p> <p>Cooperative Groups: 2.14</p> <p>Problem Solving: 2.5-2.7</p>

MATHEMATICS

Washington State Essential Academic Learning Requirements in Mathematics

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u> References identified are not totally inclusive
1.1 Understand and apply concepts and procedures from number sense. <u>Number and Numeration</u> a. Explain the magnitude of numbers by comparing and ordering real numbers. b. Understand and apply the concepts of ratio and both direct and indirect proportion.	Laboratory Activities: Pb.Sn Lost Wax Cast Al-Zn Alloy Glass Batching Polymer & Composite Activities Problem Solving The Mole Concept and Stoichiometry	Moderately Skilled: a	Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composite: Section 8 Glass Batching and the Mole : 6.2-6.33 Problem Solving: 2.5-2.7
1.1 <u>Computation</u> a. Understand operations on rational numbers. b. Use mental arithmetic, pencil and paper, calculator or computer as appropriate to the task involving rational numbers.	Laboratory Activities Problem Solving The Mole Concept and Stoichiometry Culminating Projects	Moderately Skilled: b	Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composite: Section 8 Glass Batching and the Mole : 6.2-6.33 Problem Solving: 2.5-2.7

Washington State Essential Academic Learning Requirements in Mathematics

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>1.1 <u>Estimation</u> Identify situations involving real numbers in which estimation is sufficient and computation is not required.</p>	<p>Laboratory Activities: Pb-Sn Lost Wax Cast Al-Zn Alloy Glass Batching Polymer & Composite Activities</p> <p>Problem Solving</p> <p>The Mole Concept and Stoichiometry</p>	Moderately Skilled	<p>Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composite: Section 8</p> <p>Glass Batching and the Mole : 6.2-6.33</p> <p>Problem Solving: 2.5-2.7</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>1.2 Understand and apply concepts and procedures from measurement. <u>Attributes and Dimensions</u> a. Understand how changes in dimension affect perimeter, area, and volume. b. Measure objects and events directly or use indirect methods such as finding the volume of a cone given its height and diameter.</p>	<p>Laboratory Activities Lost Wax Cast Raku</p> <p>Batching Glass</p> <p>Journal Writes</p>	Limited Practice	<p>Lost Wax: 5.35</p> <p>Raku: 6.5</p> <p>Glass: 6.5</p> <p>Journal Writes: 2.8-2.13</p>

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Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>1.2 <u>Approximation and Precision</u></p> <p>a. Understand that the precision and accuracy of measurement is affected by the measurement tools and calculating procedures.</p> <p>b. Use estimation to obtain reasonable approximations.</p>	<p>Laboratory Activities:</p> <p>Metals</p> <p>Ceramics</p> <p>Polymers</p>	Skilled	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composite: Section 8</p> <p>Glass Batching and the Mole: 6.2-6.33</p> <p>Problem Solving: 2.5-2.7</p>
<p>1.2 <u>Systems and Tools</u></p> <p>a. Understand the benefits of standard units of measurement and the advantages of the metric system.</p> <p>b. Compare, contrast, and use both the US and SI systems.</p> <p>c. Select and use tools that will provide an appropriate degree of precision.</p>	<p>Laboratory Activities</p> <p>Culminating Projects</p>	Moderately Skilled	<p>Lab activities:</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composite: Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>1.3 Understand and apply concepts and procedures from geometric sense.</p> <p>Understand and use coordinate grids.</p>	<p>Wire Draw Activity</p> <p>Pb-Sn Alloy</p> <p>Al-Zn Alloy</p> <p>Glass Batch</p>	Limited Practice	<p>Wire: 5.16-5.19</p> <p>Pb-Sn: 5.1-5.16</p> <p>Al-Zn: 5.2-5.3</p> <p>Alloying Silver: 5.31-5.35</p> <p>Glass: 6.2-6.36</p>
<p>1.4 Understand and apply concepts and procedures from probability and statistics.</p> <p><u>Statistics</u></p> <p>a. Collect data using appropriate methods and technology.</p> <p>b. Organize and display data in appropriate forms such as tables, graphs, scatter plots, and box plots.</p>	<p>Laboratory Activities:</p> <p>Pb-Sn</p> <p>Al-Zn</p> <p>Glass</p> <p>Polymer ID</p> <p>Polymer Activities</p> <p>Destructive Testing</p>	Moderately Skilled	<p>Pb-Sn: 5.1-5.16</p> <p>Al-Zn: 5.2-5.3</p> <p>Glass: 6.2-6.36</p> <p>Polymer Activities: Section 7</p> <p>Destructive Testing: Section 7</p>

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Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p><u>1.4 Prediction and Inference</u></p> <p>a. Design and conduct experiments to verify or disprove predictions.</p> <p>b. Understand and make inferences based on the analysis of experimental results.</p>	<p>Laboratory Activities</p> <p>Culminating Projects</p>	<p>Limited Practice: a</p> <p>Moderately Skilled: b</p>	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p> <p>Problem Solving: 2.5-2.7</p>
<p>1.4 Understand and apply concepts and procedures form algebraic sense.</p> <p>a. Understand, develop, and express rules describing patterns.</p> <p>b. Translate among tabular, symbolic, and graphical representations of relations.</p>	<p>Pb-Sn Wire Draw</p> <p>Destructive Testing</p> <p>Young's Modulus</p> <p>Composite Activities</p> <p>Polymer Activities</p>	<p>Moderately Skilled</p>	<p>Pb-Sn: 5.1-5.16</p> <p>Wire Draw: 5.16</p> <p>Destructive Testing: Sections 7,8</p> <p>Young's Modulus: 8.8-8.28</p> <p>Composite Activities: Section 7</p> <p>Polymer Activities : Section 7</p>

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Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>2.1 Investigate situations</p> <p>a. Analyze and use multiple strategies.</p> <p>b. Identify what information is missing or extraneous and compensate for it.</p> <p>c. Analyze an unproductive approach and attempt to modify it or try a new approach.</p>	<p>Laboratory Activities</p> <p>Culminating Projects</p>		<p>Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>2.2 Formulate questions and define problems.</p> <p>a. Identify questions to be answered in complex situations.</p> <p>b. Define problems in complex situations.</p> <p>c. Identify the unknowns in complex situations.</p>	<p>Laboratory Activities</p> <p>Culminating Projects</p>	Skilled	<p>Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
2.3 Construct solutions. a. Organize and synthesize information from multiple sources. b. Apply appropriate methods, operations, and processes to construct a solution.	Laboratory Activities Culminating Projects	Moderately Skilled: b Skilled: a	Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29
3.1 Analyze information. Interpret and integrate information from multiple sources.	Laboratory Activities Culminating Projects	Skilled	Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29
3.2 Predict results and make inferences. Make and explain conjectures and inferences based on analysis of problem situations.	Laboratory Activities Culminating Projects	Skilled	Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29

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Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
3.3 Draw conclusions and verify results. a. Support arguments and justify results using inductive and deductive reasoning. b. Check for reasonableness of results. c. Reflect on and evaluate procedures and results and make necessary revisions.	Laboratory Activities Culminating Projects	Skilled	Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29
4.1 Gather information. Develop or select an efficient system for collecting information.	Laboratory Activities Culminating Projects	Skilled	Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
4.2 Organize and interpret information.	Laboratory Activities	Skilled	Laboratory Activities: Metals: Section 5 Ceramics: Section 6

<p>Organize, clarify, and refine mathematical information in multiple ways: reflecting, verbalizing, discussing, or writing.</p>	<p>Culminating Projects</p>		<p>Polymers: Section 7 Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>5.2 Relate mathematical concepts and procedures to other disciplines.</p> <p>a. Extend mathematical thinking and modeling in other disciplines.</p> <p>b. Apply mathematical thinking and modeling in other disciplines.</p>	<p>All Units</p>	<p>Exposure or Limited Practice: b</p> <p>Skilled: a</p>	<p>Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

SCIENCE

Washington State Essential Academic Learning Requirements in Science

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u> References identified are not totally inclusive
<p>1.1 Use properties to identify, describe, and categorize substances, materials, and objects.</p> <p>a. Relate the physical and chemical properties of materials to their underlying structure.</p> <p>b. Describe the properties and organizational pattern used to classify chemical elements.</p> <p>c. Use physical and chemical properties to identify unknown substances.</p>	<p>All Units:</p> <p>Metals Ceramics Polymers Composites</p>	<p>Moderately Skilled: c</p> <p>Skilled: a, b</p>	<p>Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p>
<p>1.3 Measure properties and characteristics.</p> <p>Use appropriate tools, units, and procedures to obtain accurate quantitative information related to physical and chemical properties.</p>	<p>All Units:</p> <p>Metals Ceramics Polymers Composites</p>	<p>Skilled</p>	<p>Laboratory Activities: Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p>

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Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>1.4 Recognize the components, structure, and organization of systems and the interconnections within and among them.</p> <p>a. Describe the subatomic structure of atoms as interacting electrons, protons, and neutrons, that are held together by electric forces.</p> <p>b. Understand how an element's atomic structure determines its properties and the molecules it can form.</p>	<p>Introductory Unit</p> <p>All Units</p>	Skilled	<p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p>
<p>1.5 Understand that interactions within and among systems cause changes in matter and energy.</p> <p>a. Explain how the rate of phase change such as evaporation or condensation is influenced by temperature and pressure.</p> <p>b. Compare and contrast chemical,</p>	<p>Introductory Unit</p> <p>Kinetic Molecular Theory</p> <p>All Units</p>	Exposure/Limited Practice: a-c, f, g	<p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p>

<p>physical, and nuclear changes, including factors such as temperature of reactants.</p> <p>c. Describe transformations of energy among various forms in the universe and on earth.</p> <p>d. Understand that temperature is the measure of the average motion of particles in a substance.</p> <p>e. Understand the Law of Conservation of Matter and Energy.</p> <p>f. Compare and contrast the properties of rocks and minerals.</p> <p>g. Describe how rocks are transformed through processes at and below the earth's surface, and the rate at which these changes occur.</p>			
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Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance <u>Level</u>	<u>Reference**</u>
2.1 Plan and implement scientific investigations.	Multi-Instructional Approach	Skilled	Multi-Instructional Approach: 2.3-2.4
a. Draw inferences based on observations.	Problem Solving		Problem Solving: 2.5-2.7
b. Identify questions and concepts which could guide scientific investigations: define problem; formulate testable hypotheses and use them to guide the inquiry and essential resource requirements: and identify the known facts and acceptable parameters.	Journal Writes Laboratory Activities Culminating Projects		Journal Writes: 2.8-2.13 Introduction: Section 4 Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites: Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29
c. Select appropriate tools, methods, resource requirements, and safety issues and identify the sequential steps to be followed in an investigation.			
d. Analyze and refine the experimental design, and conduct an experiment			

<p>controlling appropriate variables individually and or with others.</p> <p>e. Formulate and revise scientific explanations and models using logic and evidence.</p> <p>f. Communicate accurately the approach, methods, results, conclusions, and known limitations of the investigation in a manner that allows the results to be understood.</p> <p>g. Know and use safe approaches in investigations.</p>			
<p>2.2 Think logically, analytically, and creatively.</p> <p>a. Use analytical thinking to examine the question/problem from different points of view.</p> <p>b. Evaluate evidence to determine scientific validity of claims and explanations.</p> <p>c. Use scientific knowledge to compare, order, and categorize in complex situations.</p> <p>d. Identify and explain</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>	<p>Exposure: b</p> <p>Skilled: a, c, d</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

the thought processes used in conducting a scientific investigation.			
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<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>2.3 Practice the principles of scientific inquiry.</p> <p>a. Record, display, and report data accurately.</p> <p>b. Understand the proprietary nature of scientific discoveries.</p> <p>c. Evaluate the alternative scientific explanations in an open, intellectually hones way.</p> <p>d. Analyze the existing knowledge about a question/problem to determine what is as yet unknown and unanswered; propose strategies to learn more.</p> <p>e. Recognize in what ways faulty procedures can affect the results of scientific inquiry.</p> <p>f. Recognize useful information can result from both successful and unsuccessful and</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>	<p>Exposure: b</p> <p>Skilled: a, c-g</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

unsuccessful scientific investigations. g. Pursue scientific inquiry by continually evaluating investigative strategies and modifying them appropriately.			
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<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>2.3 Understand the relationship between evidence and scientific explanation.</p> <p>a. Understand factors that limit the extent of scientific investigation.</p> <p>b. Understand that scientific principles, theories, and laws are logically consistent, abide by rules of evidence, are open to question and modifications, are based on historical and current scientific knowledge, and are invented by acts of imagination, intelligence, and logic through scientific investigation.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>	Skilled	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction: Section 4 Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>3.1 Identify problems and challenges in which science knowledge and skill can be applied.</p>	<p>Culminating Projects</p>	Skilled	<p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>a. Identify a challenge or problem of interest to students which lends itself to being resolved through the application of science/technology.</p> <p>b. Define the components of a problem and criteria of a suitable solution.</p>			
<p>3.2 Research, design, and test a variety of ways to address problems and/or challenges.</p> <p>a. Research, design, test alternative solutions to a science/technology challenge.</p> <p>b. Identify and describe the risks/benefits, trade-offs, and constraints when developing alternative solutions.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>	<p>Skilled</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>

Washington State Essential Academic Learning Requirements in Science

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>3.3 Evaluate solutions and consequences.</p> <p>a. Using criteria for a suitable solution, compare and evaluate solutions and consequences.</p> <p>b. Using the evaluation results, determine which solution is best and predict the consequences of its implementation.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>		<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>4.1 Use listening, observing, and reading skills to obtain science information.</p> <p>a. Demonstrate comprehension by asking clarifying questions, contributing to the conversation, and paraphrasing the information presented.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p>	Skilled	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction Section 4</p> <p>Metals: Section 5</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
b. Read, comprehend, and critique scientific information from popular, academic, technical, and telecommunication sources.	Culminating Projects		Ceramics: Section 6 Polymers: Section 7 Composites: Section 8 Projects : 5.35, 6.49, 7.15, 7.8.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29
4.2 Use writing and speaking skills to organize and express science ideas. a. Produce science and technical reports and explanations that are coherent, logical, and scientifically accurate. b. Use science vocabulary appropriately in written explanations, conversations, and verbal presentations.	Multi-Instructional Approach Problem Solving Journal Writes Laboratory Activities Culminating Projects	Moderately Skilled: a Skilled: b	Multi-Instructional Approach: 2.3-2.4 Problem Solving: 2.5-2.7 Journal Writes: 2.8-2.13 Introduction: Section 4 Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites: Section 8 Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29

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<u>Benchmark</u>	<u>Unit/Activity</u>	<u>Performance Level</u>	<u>Reference**</u>
<p>4.3 Use effective communication strategies and tools to prepare and present science information.</p> <p>a. Produce science products using standard and advanced software features as available.</p> <p>b. Use available science software programs, computer equipment, telecommunication systems, and peripherals to access information and conduct scientific investigations as available.</p> <p>c. Select and use appropriate science data and strategies to effectively present a clear and persuasive position to an audience.</p>	<p>Multi-Instructional Approach</p> <p>Problem Solving</p> <p>Journal Writes</p> <p>Laboratory Activities</p> <p>Culminating Projects</p>	<p>Moderately Skilled: a</p> <p>Skilled: b</p>	<p>Multi-Instructional Approach: 2.3-2.4</p> <p>Problem Solving: 2.5-2.7</p> <p>Journal Writes: 2.8-2.13</p> <p>Introduction: Section 4 Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites: Section 8</p> <p>Projects: 5.35, 6.49, 7.15, 7.18.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29</p>
<p>5.1 Use Mathematics to enhance scientific understanding.</p>	<p>Introductory Unit</p> <p>All Units</p>	<p>Moderately Skilled: b</p> <p>Skilled: a</p>	<p>Introduction: Section 4 Metals: Section 5 Ceramics Section 6</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>a. Use mathematical relationships to understand results from scientific investigations.</p> <p>b. Use mathematics to represent and describe a situation resulting from scientific investigations.</p>			<p>Polymers: Section 7</p> <p>Composites: Section 8</p>
<p>5.2 Understand the relationship between science and technology.</p> <p>a. Investigate how scientific inquiry and technological design are used in various careers.</p> <p>b. Explain how scientific inquiry results in knowledge that can improve technological designs and vice versa.</p>	<p>Introductory Unit</p> <p>All Units</p> <p>Workplace Readiness</p> <p>Real Life Application</p>	Skilled	<p>Introduction: Section 4</p> <p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Workplace Readiness: 3.3</p> <p>Real Life Applications: 2.25-2.</p>

WRITING

Washington State Essential Academic Learning Requirements in Writing

Exposure (No practice time.)

Limited Practice (Has practiced. Additional practice needed to develop skill.)

Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u> References identified are not totally inclusive
1.1 Develop concept and design. a. Maintain a sharp focus throughout the work; focus text clearly to hold reader's attention, to make a point, to tell a story, and/or describe a process or phenomenon. b. Approach a topic in an individualized and purposeful way. c. Discriminate between essential, intriguing, or useful information and trivia. d. Write coherent paragraphs. e. Develop analysis, synthesis, persuasion, and exposition logically; demonstrate advanced logic.	All Units Culminating Projects Problem Solving Journal Writes Written and Oral Presentations Workplace Readiness	Limited Practice: c, e Moderately Skilled: a, b, d	Metals: Section 5 Ceramics: Section 6 Polymers: Section 7 Composites : Section 8 Culminating Projects: 5.35, 6.49, 7.15, 7.19, 8.3, 8.10, 8.14, 8.16, 8.18, 8.22, 8.29 Problem Solving: 2.5-2.7 Journal Writes: 2.8-2.13 Multi-Instructional Approach: 2.3-2.4 Workplace Readiness: 3.3

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Moderately Skilled (skill developed. Additional practice needed.)

Skilled (Can perform skill independently.)

<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>1.1 Use style appropriate to the audience and purpose.</p> <p>a. Recognize voice; strengthen and modify own voice as appropriate.</p> <p>b. Choose works to convey intended message in a precise, interesting, and natural way.</p> <p>c. Use specialized vocabulary relevant to a specific content area.</p>	<p>All Units</p> <p>Journal Writes</p> <p>Written and Oral Presentations</p>	<p>Exposure: a</p> <p>Moderately Skilled: b, c</p>	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>
<p>1.2 Apply writing Conventions.</p> <p>a. Use standard writing conventions in final draft to enhance meaning and clarity:</p> <ul style="list-style-type: none"> ▪ Grammar/usage ▪ Capitalization ▪ Punctuation ▪ Spelling <p>Use paragraphing and stanza division to reinforce text's organizational structure.</p>	<p>All Units</p> <p>Journal Writes</p> <p>Written and Oral Presentations</p> <p>Culminating Projects</p>	<p>Moderately Skilled</p>	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>2.1 Write for different audiences.</p> <p>a. Identify, analyze, describe, and meet the needs of chosen audience.</p> <p>b. Show a sense of how particular audience may interpret a text.</p>	<p>All Units</p> <p>Journal Writes</p>	Limited Practice	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Journal Writes: 2.8=2.13</p>
<p>2.2 Write for different purposes.</p> <p>Write for a broad range of purposes:</p> <ul style="list-style-type: none"> ▪ To reflect upon own experiences. ▪ To experiment with language. ▪ To make inferences or draw conclusions. ▪ To present an analytical response to literature. ▪ To apply for jobs. ▪ To communicate research findings. ▪ To convey technical information. 	<p>All Units</p> <p>Journal Writes</p> <p>Written and Oral Presentations</p> <p>Workplace Readiness</p>	Moderately Skilled	<p>Metals: Section 5</p> <p>Ceramics: Section 6</p> <p>Polymers: Section 7</p> <p>Composites: Section 8</p> <p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p> <p>Workplace Readiness: 3.3</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>2.4 Write for career applications.</p> <p>a. Identify particular writing skills required for occupational/career areas of interest.</p> <p>b. Produce technical and non-technical documents for career audiences such as a homepage, research report, or blueprint.</p> <p>c. Understand the importance of using reference style consistently when writing reports or technical documents.</p>	<p>Journal Writes</p> <p>Workplace Readiness</p> <p>Written and Oral Presentations</p>	Limited Practice	<p>Journal Writes: 2.8-2.13</p> <p>Workplace Readiness: 3.3</p> <p>Multi-Instructional Approach: 2.3-2.4</p>
<p>3.1 Prewrite</p> <p>a. Generate ideas and plan writing independently such as extensive planning and defining and choosing an appropriate mode of expression.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p>	<p>Limited Practice: a, b</p> <p>Moderately Skilled: c</p>	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>b. Use available tools and technology consistently through the writing process.</p> <p>c. Analyze and synthesize information from a variety of sources.</p>			
<p>3.2 Draft</p> <p>a. Formulate and construct ideas independently.</p> <p>b. Coordinate a number of ideas and point of view.</p> <p>c. Present argumentation effectively by using clarity, coherency, and precision; draft text that uses logical flow of ideas and relationships.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p>	Limited Practice	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

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<p>3.3 Revise</p> <p>a. Confer with others to improve text; incorporate suggestions from others.</p> <p>b. Investigate additional information sources to improve text; use language to enrich text and enhance style.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p> <p>Cooperative Groups</p>	Limited Practice	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p> <p>Cooperative Groups: 2.14</p>
<p>3.4 Edit</p> <p>a. Adapt a new reference technology to further the purpose of writing.</p> <p>b. Demonstrate self-correction</p> <p>c. Change text order to improve argument, flow of information, and logic.</p> <p>d. Correct mechanics and grammar.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p> <p>Cooperative Groups</p>	Limited Practice	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p> <p>Cooperative Groups: 2.14</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>3.5 Publish</p> <p>a. Produce a legible, professional-looking final product.</p> <p>b. Use a variety of technological resources to produce a final product.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p>	<p>Limited Practice Practice/Moderately Skilled</p>	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>
<p>4.1 Assess own strengths and needs for improvement.</p> <p>a. Articulate own and established criteria to improve writing; defend choices to deviate from established criteria.</p> <p>b. Assess own strengths and developmental needs as a writer.</p> <p>c. Demonstrate knowledge of the qualities that make a piece of writing effective.</p>	<p>Journal Writes</p> <p>Written and Oral Presentations</p>	<p>Limited Practice</p>	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

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<u>Benchmark</u>	<u>Unit/Activity</u>	Performance Level	<u>Reference**</u>
<p>4.2 Seek and offer feedback.</p> <p>a. Seek, evaluate, accept, and apply feedback, hold on to one’s own vision.</p> <p>b. Independently offer specific feedback on others’ writing with regard to:</p> <ul style="list-style-type: none"> ▪ Concept and design ▪ Style ▪ Conventions 	<p>Journal Writes</p> <p>Written and Oral Presentations</p>	Limited Practice	<p>Journal Writes: 2.8-2.13</p> <p>Multi-Instructional Approach: 2.3-2.4</p>

**References identified are not totally inclusive.

Material Science Technology Scope and Sequence

- Unit 1: Introduction to Basic Chemistry
- Unit 2: Introduction to Materials Science and Technology
- Unit 3: Creating a MST Environment
- Unit 4: Standards, Learning Goals and Assessment
- Unit 5: Introduction to Experiments and Demonstrations
- Unit 6: Introduction to Metals
- Unit 7: Introduction to Ceramics
- Unit 8: Introduction to Polymers
- Unit 9: Introduction to Composites

Material Science Technology Course Outline

Unit 1: Introduction to Basic Chemistry Concepts

- Scientific Method
- Measurements
- Explanation
- Journal Entries

Unit 2: Introduction to Materials Science and Technology

- What is Material Science
- The Relationship of Science and Technology
- How is basic Science Linked to Everyday materials
- A Short History of Materials Science
- A New Scientific Frontier
- Looking at MST as a Career – ‘The Field of Dreams’

Unit 3: Creating a MST Environment

- MST Curriculum Philosophy/Rationale
- Multi-Instructional Approach
- Course of Study
- Solving Problems
- Creating Student Projects
- Using the laboratory Journal
- Working in Small Groups
- Developing Handiness
- Fostering Creativity
- Teaching in Teams
- Using Community Resources
- Setting Up the MST Classroom and Laboratory
- Laboratory Safety
- Preparing Teachers to Create a MST Environment

Unit 4: Standards, Learning Goals and Assessment

- National Education Standards for Curriculum, Assessment, and Teaching Strategies
- The National Education Standards and MST
- School-to-Work Opportunities Act
- MST Course Content Outline
- Integrating MST into Existing Classes
- Learning Goals
- Assessment
- Recent Trends in Assessment
- Assessment Techniques

Unit 5: Introduction to Experiments and Demonstrations

- Introduction
- Water Lock
- Classification of Materials
- Material Systems
- Crystal Study
- Iron Wire
- Paper Clip Destruction
- Ceramic Mantle
- Light Bulb Filament
- Thixotropy and Dilatancy
- Vocabulary

Unit 6: Introduction to Metals

- Introduction
- Properties of Metals
- Alloying Tin and Lead
- Drawing a Wire
- Aluminum-Zinc: A Solid-State Phase Change in Metals
- Caloric output of Al-Zn: A Solid-State Phase Change in Metals
- Alloying Sterling Silver
- Lost Wax Casting: Investment/Centrifugal Casting
- Making a Light Bulb
- Vocabulary

Unit 7: Introduction to Ceramics

- Introduction
- Thermal Shock
- Glass Bead on a Wire
- Glass Bending and Blowing
- Standard Glass Batching
- Glass Melting
- Dragon Tears/Dragon Dribble
- Glass Coloring
- Glass Fusing
- Stained Glass
- Making Raku
- Ceramic Slip Casting
- Making Glass from Soil
- Making and Testing Superconductors
- Vocabulary

Unit 8: Introduction to Polymers

- Introduction
- Slime
- Polymer Foam Creations
- Nylon 6-10
- Casting a Rubber Mold from RTV
- Epoxy Resin Casting
- Nightlight
- Polymer ID
- Vocabulary

Unit 9: Introduction to Composites

Introduction

- Making Concrete
- Composite Experiments
 - Project 1
 - Project 2
 - Project 3
 - Project 4
- Simple Stressed-Skin Composite
- Airfoils
- Making Paper
- Peanut Brittle
- Vocabulary

Material Science Technology Instructional Materials

Basic Texts

Energy Concepts, Inc., Material Science, 1996

Pacific Northwest Laboratory, Material Science & Technology, Teacher's Handbook,
Science Education Center, 1994

Reference Materials

Batelle Laboratories, Material Science Laboratory Manual

Audio-Visual

Public Broadcasting Network, New York, Superconductors

American Society of Materials (ASM) International, Materials – Engineering the Future,
Materials Park, Ohio, 44073, (216)338-5151

Spectrum Glass Company, Spectrum Glass, Woodinville, WA

Material Science Technology Evaluation

The following criteria are applicable in the total evaluation of student progress:

1. Student performance in the shop and laboratory.
2. Creative solutions to the assigned projects.
3. Project reporting techniques.
4. Class participation.
5. Performance in the project competitions.