FRAMEWORKS FOR
VOCATIONAL-TECHNICAL PROGRAMS
ARCHITECTURE AND DRAFTING

SECONDARY
EXECUTIVE SUMMARY
2012

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Published by

Office of Career and Technical Education
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit
Mississippi State University
Mississippi State, MS 39762

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Foreword

Secondary career-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 Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary career-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 have 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 Education 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

Architecture and Drafting Executive Summary 6
Course Outlines 11
Architecture and Drafting Competencies and Objectives 15
Architecture and Drafting Competency Profile 27
Appendix A: 21st Century Skills Standards 30
Appendix B: MS Academic Standards 32
Appendix C: ACT College Readiness Standards 61
Appendix D: Pathway Content Standards 75
Appendix E: National Educational Technology Standards for Students 78

Architecture and Drafting

Architecture and Drafting Executive Summary

Pathway Description

Architecture and Drafting is a pathway in the Architecture and Construction career cluster. Study in this program allows students to produce workable drawings on the drawing board and with the computer. Upon successful completion of the program, the student will be qualified for an entry-level drafting or related position or may pursue postsecondary education. Skills developed through the course of study assist students in meeting requirements for the ADDA certification. Students are provided the opportunity to participate in career and technical student organizations, including SkillsUSA.

Architectural Design and Drafting I is the entry-level course of the secondary Architecture and Drafting program. Students will gain foundation competencies related to orientation, safety, leadership and personal development, and drafting and CAD skills. Students receive 2-2.5 Carnegie units, depending upon time spent in the course.

Architectural Design and Drafting II is the exit level course of the secondary Architecture and Drafting program. Students will gain foundation competencies related to orientation, safety, advanced leadership and personal development, architectural drafting, and CAD skills. The architectural drafting section includes floor plans, elevations, foundations, and sections. Students receive 2-2.5 Carnegie units, depending upon time spent in the course.

Industry Certification

An industry-recognized certification is available through the American Design Drafting Association and the American Digital Design Association.

Assessment

Students will be assessed using the Architecture and Drafting MS-CPAS2 test. The MS-CPAS2 blueprint can be found at the Research and Curriculum Unit's Web site (www.rcu.msstate.edu). All students will test after Year 1 of the Architecture and Drafting program. A second test covering the second year material in Architecture and Drafting will be administered to students upon completion of their program. If there are questions regarding assessment of this program, please contact the Architecture and Construction instructional design specialist at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be successful in the Installation and Service: HVAC program, the following student prerequisites are in place:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)

   or

3. Instructor approval and TABE reading score (eighth grade or higher)

   or

4. Instructor approval

Applied Academic Credit (if applicable)

Applied Math content from the curriculum was aligned to the 2007 Mississippi Math Framework Revised Academic Benchmarks. It is proposed that upon the completion of this program, students will earn 1 Carnegie unit of Applied Math credit that can be used for graduation requirements.

If there are questions regarding applied academic credit, please contact the program supervisor listed on the front page of this document.

Licensure Requirements

986 Career Pathway: Architecture and Drafting

This endorsement licenses a person to teach the following secondary courses:

994300	2-Carnegie unit Architectural Design and Drafting I
994301	2-Carnegie unit Architectural Design and Drafting II
994302	1-Carnegie unit Concepts of Drafting
994303	1-Carnegie unit Drafting Design
994304	1-Carnegie unit Architectural Drafting
994305	1-Carnegie unit Architectural Drafting Application

<u>Minimum Requirements for this Endorsement</u>:

1. <u>Education</u>

- Hold a 2-year college degree (associate degree) or higher from an accredited institution of higher education.

2. Occupational Experience and Related Assessment of that Experience

-Applicants with an associate degree must have at least 2 years of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.

- Applicants with a bachelor's or higher degree must have at least 1 year of verifiable occupational experience in the past 10 years. Experience must be appropriate to the subject to be taught.

This endorsement requires the following assessment(s) of occupational expertise:

American Design Drafting Association Certification: ADDA Certified Drafter

OR

Other teacher occupational competency assessment approved by the Mississippi Department of Education Office of Career and Technical Education.

3. Technology Literacy and Related Assessment of that Competency

- Applicant must validate technology competency by attaining the established minimum score or higher on an assessment approved by the Mississippi Department of Education (MDE). The assessment must be directly related to technology competency required by the grade level and subject matter being taught. Approved assessments for this license are IC3, Propulse, or other specific assessment created by third-party vendors, authorized by the Local Education Agency and approved by the MDE.

4. Teacher Education Preparation and Related Assessment(s) of that Education

- Applicant must enroll immediately in the Vocational Instructor Preparation (VIP) program.

- Applicant must complete the individualized professional development plan requirements of the VIP program prior to the expiration date of the 3-year vocational license.

- Applicant must successfully complete a certification for online learning workshop, module, or course that is approved by the MDE.

- Applicant must successfully complete the Architecture and Drafting Certification workshop, module, or course that is approved by the MDE.

note: If the applicant meets all requirements listed above, that applicant will be issued a 986 endorsement—a 5-year license. If the applicant does not meet all requirements, the applicant may be issued a 3-year endorsement (license), and all requirements stated above must be satisfied prior to the ending date of that license.

Professional Learning

The professional learning itinerary for the middle school or individual pathways can be found at http://redesign.rcu.msstate.edu. If you have specific questions about the content of each training session provided, please contact the Research and Curriculum Unit at 662.325.2510, and ask for the professional learning specialist.

Course Outlines

Option 1—Four 1-Carnegie-Unit Courses

Architecture and Drafting is an instructional program designed to teach students to produce workable drawings on the drawing board and with the computer. Upon successful completion of the program, the student will be qualified for an entry level drafting or related position or may pursue postsecondary education.

The content of this curriculum framework is based on national standards as developed by the **American Design Drafting Association**.

This curriculum consists of four one-credit courses, which should be completed in the following sequence:

1. Concepts of Drafting (Course Code: 994302)
2. Drafting Design (Course Code: 994303)
3. Architectural Drafting (Course Code: 994304)
4. Architectural Drafting Application (Course Code: 994305)

Course Description: Concepts of Drafting (Course Code: 994302) includes an introduction to the field as well as fundamentals of safety, math, geometric construction, graphic projection, and computer aided drafting (CAD) applications. This is a one-Carnegie-unit course.

Course Description: Drafting and Design (Course Code: 994303) emphasizes an overview of safety and an in-depth study of the elements of drafting. This course gives student's real-world, hands-on practice in these areas. This one-Carnegie-unit course should only be taken after student successfully passes Concepts of Drafting.

Course Description: Architectural Drafting (Course Code: 994304) includes a study of mathematics used in drafting and residential and commercial drafting techniques. This course also reinforces safety related to the drafting and design industry. This one-Carnegie-unit course should only be taken after student successfully passes Drafting and Design.

Course Description: Architectural Drafting Application (Course Code: 994305) is a continued study of residential and commercial drafting techniques. This course also includes a study of the uses of drafting and design in today's global market place. This one-Carnegie-unit course should only be taken after student successfully passes Architectural Drafting.

Concepts of Drafting—Course Code: 994302

Unit	Unit Name	Hours
1	Orientation and Safety	14
2	Introduction to Drafting	15
3	Lettering	7
4	Geometric Construction	25
5	Computer Aided Drafting (CAD)	20
6	Orthographic Projection	30
Total		111

Drafting and Design—Course Code: 994303

Unit	Unit Name	Hours
1	Orientation and Safety	14
7	Dimensioning	8
8	Sectional Views	14
9	Auxiliary Views	10
10	Pictorial Views	15
11	Machine Drafting	40
Total		101

Architectural Drafting—Course Code: 994304

Unit	Unit Name	Hours
1	Orientation and Safety	14
12	Architectural Drafting Math	25
13	Residential Architectural Drafting I	70
Total		109

Architectural Drafting Application—Course Code: 994305

Unit	Unit Name	Hours
1	Orientation and Safety	14
14	Residential Architectural Drafting II	70
15	Field Applications of Architectural Drafting	25
Total		109

Option 2—Two 2-Carnegie-Unit Courses

Architecture and Drafting is an instructional program designed to teach students to produce workable drawings on the drawing board and with the computer. Upon successful completion of the program, the student will be qualified for an entry level drafting or related position or may pursue postsecondary education.

The content of this curriculum framework is based on national standards as developed by the American Design Drafting Association.

Course Description: Architectural Design and Drafting I (994300) is the entry level course of the secondary Architecture I & II program. Students will gain foundation competencies related to orientation, safety, leadership and personal development, and drafting and CAD skills. Students receive 2-2½ Carnegie units, depending upon time spent in the course.

Course Description: Architectural Design and Drafting II (994301) is the exit level course of the secondary Architecture and Drafting program. Students will gain foundation competencies related to orientation, safety, advanced leadership and personal development, architectural drafting, and CAD skills. The architectural drafting section includes floor plans, elevations, foundations, and sections. Students receive 2-2½ Carnegie units, depending upon time spent in the course. This course should only be taken after the student successfully passes Architectural Design and Drafting I.

Architectural Design and Drafting I — Course Code: 994300

Unit	Unit Name	Hours
1	Orientation and Safety	28
2	Introduction to Drafting	15
3	Lettering	7
4	Geometric Construction	25
5	Computer Aided Drafting (CAD)	20
6	Orthographic Projection	30
7	Dimensioning	8
8	Sectional Views	14
9	Auxiliary Views	10
10	Pictorial Drawings	15
11	Machine Drafting	40
Total		212

Architectural Design and Drafting II — Course Code: 994301

Unit	Unit Name	Hours
1	Orientation and Safety (Review)	28
12	Architectural Drafting Math	25
13	Residential Architectural Drafting I	70
14	Residential Architectural Drafting II	70
15	Field Applications of Architectural Drafting	25
Total		218

Architecture and Drafting Competencies and Objectives

Unit 1: Orientation and Safety

1. Demonstrate understanding of local program requirements. (DOK1, PDC)
   a. Observe local student handbook and classroom requirements. CS1, CS3, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL3, CCSL5, CCL1, CCL2, CCL3, T1, T2, T3, T5, T6
2. Explore leadership skills and personal development opportunities provided students by student organizations, including SkillsUSA. (DOK 1, PDC)
   a. Demonstrate effective teambuilding and leadership skills. CS1, CS3, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL3, CCSL5, CCL1, CCL2, CCL3, T1, T2, T3, T5, T6
   b. Practice appropriate work ethics. CS1, CS3, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL3, CCSL5, CCL1, CCL2, CCL3, T1, T2, T3, T5, T6
3. Research career opportunities, earnings, and educational requirements in the architecture industry. (DOK1, PDC)
   a. Describe earnings, educational requirements, career ladder, and organizations associated with the architecture industry. CS1, CS3, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL3, CCSL5, CCL1, CCL2, CCL3, T1, T2, T3, T5, T6

Unit 2: Introduction to Drafting

1. Explain the purpose of technical drawing and freehand technical sketches.(DOK2, ASO, LLT)
   a. Identify appropriate techniques for technical drawing and freehand technical sketches. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, T1, T2, T3, T4, T5, T6
2. Create freehand technical sketches. (DOK2, ASO, LLT)
   a. Identify appropriate techniques for freehand sketches. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, T1, T2, T3, T4, T5, T6
   b. Construct a freehand technical sketch. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, T1, T2, T3, T4, T5, T6

   c. Recognize the alphabet of lines. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, T1, T2, T3, T4, T5, T6
3. Identify and demonstrate drafting tools and media. .(DOK2, DEM, INM)
   a. Identify drafting tools. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, T1, T2, T3, T4, T5, T6
   b. Examine media and various sheet sizes. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, T1, T2, T3, T4, T5, T6
   c. Interpret architect, engineering, and metric scale units. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, T1, T2, T3, T4, T5, T6
4. Demonstrate skills in mathematical concepts related to drafting technology. (DOK2, MAG)
   THIS COMPETENCY WILL BE ONGOING THROUGHOUT THE YEAR
   a. Use mathematical concepts to solve problems of measurement. CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR7, CCSL1, CCSL2, CCSL3, CCL3, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, T1, T2, T3, T4, T5, T6

Unit 3: Lettering

1. Demonstrate the techniques of lettering and construct uppercase gothic letters and numerals. (DOK2, LLT)
   a. Construct freehand uppercase and lowercase letters and numerals in various script fonts. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CS16, CCR4, CCR7, CCW2, CCW4, CSL3, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM10, T1, T2, T5

Unit 4: Geometric Construction

1. Define basic geometric shapes and terms. (DOK2, MAG)
   a. Define geometric terms. CS6, CS7, CS8, CCR1, CCR2, CCR3, CCR4, CCR10, CCW2, CCW4, CCSL3, CCL4, CCL5, CCL6, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6
2. Construct various geometric shapes using constructional techniques on a drawing table. (DOK2, ASO, MAG, INM)
   a. Construct various geometric shapes using constructional techniques on a drawing table.
      - Bisect a line, arc, and angle.
      - Construct a perpendicular line from a point on a line.

- Divide a line into equal parts.
- Draw tangencies.
- Construct various polygons.
- Construct an octagon.
- Construct a hexagon.
- Construct a line parallel to a given line or plane. CS6, CS7, CS8, CCR1, CCR2, CCR3, CCR4, CCR10, CCW2, CCW4, CCSL3, CCL4, CCL5, CCL6, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6

Unit 5: Computer Aided Drafting (CAD)

1. Use CAD hardware and software. (DOK2, DEM)
   a. Recognize the various hardware components of a CAD system.
      - Define CAD hardware/software terms.
      - Demonstrate care and maintenance of computer software/
      - hardware.
      - Startup/shut down CAD system.
      - Operate plotter/printer. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR4, CCR5, CCR7, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, T1, T2, T3, T4, T5, T6
2. Create text using appropriate style and size on a CAD system. (DOK2, DEM, LLT)
   a. Demonstrate inserting text using CAD.
      - Select text style.
      - Create various text sizes.
      - Utilize CAD text-edit commands.
      - Create borders and title blocks for various sheet sizes. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR4, CCR5, CCR7, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, T1, T2, T3, T4, T5, T6
3. Create a basic CAD drawing. (DOK3, ASO,LLT, INM)
   a. Identify basic commands for CAD drawing. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR4, CCR5, CCR7, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, T1, T2, T3, T4, T5, T6
   b. Construct a CAD drawing using endpoint, midpoint, and intersection Osnaps correctly. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR4, CCR5, CCR7, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, T1, T2, T3, T4, T5, T6
   c. Demonstrate inserting text using CAD.
      - Select text style.
      - Create various text sizes.
      - Utilize CAD text-edit commands.
      - Create borders and title blocks for various sheet sizes. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR4, CCR5, CCR7, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, T1, T2, T3, T4, T5, T6

Unit 6: Orthographic Projection

1. Describe terms, views, line types, and the spacing of views used in orthographic projections. (DOK2, APS, ASO, MAG, LLT)
   a. Describe terms, views, line types, and the spacing of views used in orthographic projections. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6
2. Construct principal views in orthographic projections. (DOK3, APS, ASO, MAG, LLT, INM)
   a. Construct principal views in orthographic projections. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6
3. Construct orthographic views using a CAD station. (DOK3, APS, ASO, MAG, LLT, INM)
   a. Construct orthographic views using a CAD station. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6

Unit 7: Dimensioning

1. Apply general rules, line types, and notes for dimensioning per ANSI standards. (DOK2, LLT, MAG. INM, DAN)
   a. Identify line types used in dimensioning. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
   b. Dimension objects with various geometric shapes. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

c. Apply size and location dimensions of an object. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
d. Apply general rules, line types, and notes for dimensioning per ANSI standards. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

Unit 8: Sectional Views

1. Demonstrate creating sectional views. (DOK3, MAG, SSS)
   a. Describe and identify the types of sectional views. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
   b. Construct full and half section views. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
2. Construct a sectional view using CAD. (DOK3, MAG, SSS)
   a. Identify CAD commands used to create sectional drawings. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

Unit 9: Auxiliary Views

1. Demonstrate creating auxiliary views. (DOK2, ASO, LLT, MAG, APS, INM, DAN)
   a. Describe and construct primary auxiliary views. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

2. Construct a primary auxiliary view using CAD. (DOK2, ASO, LLT, MAG, APS, INM, DAN)
    a. Identify CAD commands used to create a primary auxiliary view. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

Unit 10: Pictorial Drawings

1. Identify the different types of pictorial drawings. (DOK2, LLT, MAG, APS, LIT, DAN)
    a. Describe the methods of constructing pictorial drawings. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
2. Construct pictorial drawings. (DOK3, LLT, MAG, APS, LIT, DAN)
    a. Construct pictorial drawings.
        - Construct an isometric drawing.
        - Construct an oblique drawing.
        - Construct a perspective drawing. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
3. Construct an isometric drawing on the CAD system. (DOK3, LLT, MAG, APS, LIT, DAN)
    a. Identify CAD commands used to create an isometric drawing. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

Unit 11: Machine Drafting

1. Identify terms and symbols associated with machining and manufacturing processes. (DOK2, ATI, DMR, SLG, MAG)
    a. Identify terms and symbols associated with machining and manufacturing processes. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31,

CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

2. Identify thread forms and representations of threads and fasteners. (DOK3, ATI, SCG, DAN, OPI GCD, MAG, DIN)
   a. Describe uses of threads. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
   b. Describe and draw threads.
      - Describe types of threads.
      - Match thread terms with definitions.
      - Illustrate the various thread representations.
      - Draw an internal and external thread form.
      - Interpret thread notes.
      - Create a detailed machine drawing illustrating threads. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
   c. Describe methods of thread representation. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
   d. Draw an internal and external thread form. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6
3. Produce an assembly drawing. (DOK3, ATI, SCG, DAN, OPI, GCD, GDT, MAG, DIN)
   a. Produce a basic assembly drawing with fasteners. CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T5, T6

Unit 12: Architectural Drafting Math (Ongoing throughout the year)

1. Calculate linear measurements. (DOK2, MAG)
    a. Calculate linear measurements. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5
2. Read and interpret the architect and engineering scale. (DOK2, MAG)
    a. Read and interpret the architect and engineering scale for architectural and mechanical application. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5
3. Calculate residential square footage. (DOK2, MAG)
    a. Calculate residential square footage for area, volume, and plan specification. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5
4. Employ the adjustable triangle to lay out angles. (DOK3, MAG)
    a. Utilize the adjustable triangle and/or protractor to indicate length and bearing of property lines using the Polar Coordinate System. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5
    b. Plot the X and Y values of the Cartesian Coordinate System. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17,

CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5

5. Calculate and apply spacial requirements for residential design. (DOK2, MAG, ESC)
   a. Calculate the requirements of a residential design. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T4, T5
6. Estimate material for a project. (DOK3 MAG, ESC, DBM)
   a. List the rule-of-thumb guidelines for estimating. CS2, CS6, CS7, CS8, CS9, CS11, CS12, CS13, CS14, CS15, CS16, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR9, CCR10, CCSL1, CCSL2, CCSL3, CCSL4, CCSL5, CCSL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM6, CCM7, CCM8, CCM9, CCM10, CCM11, CCM12, CCM13, CCM14, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM23, CCM24, CCM25, CCM26, CCM27, CCM28, CCM29, CCM30, CCM31, CCM32, CCM33, CCM34, CCM35, CCM36, CCM37, CCM38, CCM39, CCM40, CCM41, CCM42, CCM43, CCM44, T1, T2, T3, T4, T5, T6

Unit 13: Residential Architectural Drafting I

1. Produce sketches in planning the three main residential areas. (DOK3, MAG, FPL, HPE, RPI, FFP, FPI, SSS, SDW)
   a. Describe requirements for the three main residential areas. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
   b. Sketch rooms, including service, living, and sleeping areas, and floor plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
2. Produce an architecturally correct floor plan. (DOK3, MAG, FPL, HPE, RPI, FFP, SSS, SDW)

a. Identify architectural terms and symbols related to floor plans. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
b. Construct architectural letters. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
c. Draw and dimension a floor plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

3. Produce an architecturally correct foundation plan. (DOK3, MAG, FFP)
   a. Describe terms, symbols, and requirements related to foundation plans. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
   b. Draw and dimension a foundation plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
   c. Draw footing details. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
4. Draw, dimension, and label an exterior wall section. (DOK3, MAG, FPL, FFP, SDW)
   a. Identify building material terms, symbols, and requirements. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3,

CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

b. Draw, dimension, and label a typical exterior wall section. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

5. Draw and note exterior elevations. (DOK3, MAG, LIT, BCG,ELE)
   a. Identify architectural terms, symbols, and requirements related to elevations.
      - Construct a front elevation.
      - Construct side elevations.
      - Construct a rear elevation. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

Unit 14: Residential Architectural Drafting II

1. Produce an electrical, plumbing, and HVAC plan. (DOK3, MAG, BCG, HPE)
   a. Describe terms, symbols, and requirements related to an electrical, plumbing, and HVAC plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
   b. Draw an electrical, plumbing, or HVAC plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6
2. Develop a residential plot/site plan. (DOK3, MAG, LIT, DAN, BCG,ELE)
   a. Describe terms, symbols, and requirements related to a plot/site plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5,

CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

b. Draw a plot/site plan. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS10, CS11, CS12, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR10, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCSL1, CCSL2, CCSL3, CCSL5, CCL1, CCL2, CCL4, CCL5, CCL6, CCM1, CCM2, CCM3, CCM4,CCM5, CCM10, CCM15, CCM16, CCM17, CCM18, CCM19, CCM20, CCM21, CCM22, CCM25, CCM26, CCM27, CCM28, CCM29, T1, T2, T3, T4, T5, T6

Unit 15: Field Applications of Architectural Drafting

1. Integrate business/industry experiences with the drafting program. (DOK1, {AAD-PDC}, {MAD-PDC})
   a. Explore how architectural and mechanical drafting are used in business and industry. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS11, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR9, CCR10, CCW1, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL2, CCSL3, CCSL4, CCSL5, CCSL6, CCL1, CCL2, CCL3, CCL4, CCL5, CCL6, T1, T2, T5, T6
2. Investigate career opportunities related to architectural drafting. (DOK1, {AAD-PDC})
   a. Explore career opportunities for architectural designers and drafters. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS11, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR9, CCR10, CCW1, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL2, CCSL3, CCSL4, CCSL5, CCSL6, CCL1, CCL2, CCL3, CCL4, CCL5, CCL6, T1, T2, T5, T6
3. Investigate career opportunities related to mechanical drafting. (DOK1, {MAD-PDC})
   a. Explore career opportunities for architectural designers and drafters. CS1, CS2, CS3, CS5, CS6, CS7, CS8, CS9, CS11, CS13, CS14, CS15, CCR1, CCR2, CCR3, CCR4, CCR5, CCR6, CCR7, CCR8, CCR9, CCR10, CCW1, CCW2, CCW3, CCW4, CCW5, CCW6, CCW7, CCW8, CCW9, CCW10, CCSL1, CCSL2, CCSL3, CCSL4, CCSL5, CCSL6, CCL1, CCL2, CCL3, CCL4, CCL5, CCL6, T1, T2, T5, T6

Architecture and Drafting Competency Profile
Program CIP: 15.1301

Unit 1: Orientation and Safety

_____ 1. Demonstrate understanding of local program requirements. (DOK1, PDC)

_____ 2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. (DOK 1, PDC)

_____ 3. Research career opportunities, earnings, and educational requirements in the architecture industry. (DOK1, PDC)

Unit 2: Introduction to Drafting

_____ 1. Explain the purpose of technical drawing and freehand technical sketches.(DOK2, ASO, LLT)

_____ 2. Create freehand technical sketches. (DOK2, ASO, LLT)

_____ 3. Identify and demonstrate drafting tools and media. .(DOK2, DEM, INM)

_____ 4. Demonstrate skills in mathematical concepts related to drafting technology. (DOK2, MAG)

Unit 3: Lettering

_____ 1. Demonstrate the techniques of lettering, and construct uppercase gothic letters and numerals. (DOK2, LLT)

Unit 4: Geometric Construction

_____ 1. Define basic geometric shapes and terms. (DOK2, MAG)

_____ 2. Construct various geometric shapes using constructional techniques on a drawing table. (DOK2, ASO, MAG, INM)

Unit 5: Computer Aided Drafting (CAD)

_____ 1. Use CAD hardware and software. (DOK2, DEM)

_____ 2. Create text using appropriate style and size on a CAD system. (DOK2, DEM, LLT)

_____ 3. Create a basic CAD drawing. (DOK3, ASO,LLT, INM)

Unit 6: Orthographic Projection

_____ 1. Describe terms, views, line types, and the spacing of views used in orthographic projections. (DOK2, APS, ASO, MAG, LLT)

_____ 2. Construct principal views in orthographic projections. (DOK3, APS, ASO, MAG, LLT, INM)

_____ 3. Construct orthographic views using a CAD station. (DOK3, APS, ASO, MAG, LLT, INM)

Unit 7: Dimensioning

1. Apply general rules, line types, and notes for dimensioning per ANSI standards. (DOK2, LLT, MAG. INM, DAN)

Unit 8: Sectional Views

1. Demonstrate creating sectional views. (DOK3, MAG, SSS)

2. Construct a sectional view using CAD. (DOK3, MAG, SSS)

Unit 9: Auxiliary Views

1. Demonstrate creating auxiliary views. (DOK2, ASO, LLT, MAG, APS, INM, DAN)
2. Construct a primary auxiliary view using CAD. (DOK2, ASO, LLT, MAG, APS, INM, DAN)

Unit 10: Pictorial Drawings

1. Identify the different types of pictorial drawings. (DOK2, LLT, MAG, APS, LIT, DAN)
2. Construct pictorial drawings. (DOK3, LLT, MAG, APS, LIT, DAN)
3. Construct an isometric drawing on the CAD system. (DOK3, LLT, MAG, APS, LIT, DAN)

Unit 11: Machine Drafting

1. Identify terms and symbols associated with machining and manufacturing processes. (DOK2, ATI, DMR, SLG, MAG)
2. Identify thread forms and representations of threads and fasteners. (DOK3, ATI, SCG, DAN, OPI GCD, MAG, DIN)
3. Produce an assembly drawing. (DOK3, ATI, SCG, DAN, OPI, GCD, GDT, MAG, DIN)

Unit 12: Architectural Drafting Math (Ongoing throughout the year)

1. Calculate linear measurements. (DOK2, MAG)
2. Read and interpret the architect and engineering scale. (DOK2, MAG)
3. Calculate residential square footage. (DOK2, MAG)
4. Employ the adjustable triangle to lay out angles. (DOK3, MAG)
5. Calculate and apply spacial requirements for residential design. (DOK2, MAG, ESC)
6. Estimate material for a project. (DOK3 MAG, ESC, DBM)

Unit 13: Residential Architectural Drafting I

1. Produce sketches in planning the three main residential areas. (DOK3, MAG, FPL, HPE, RPI, FFP, FPI, SSS, SDW)
2. Produce an architecturally correct floor plan. (DOK3, MAG, FPL, HPE, RPI, FFP, SSS, SDW)
3. Produce an architecturally correct foundation plan. (DOK3, MAG, FFP)
4. Draw, dimension, and label an exterior wall section. (DOK3, MAG, FPL, FFP, SDW)
5. Draw and note exterior elevations. (DOK3, MAG, LIT, BCG,ELE)

Unit 14: Residential Architectural Drafting II

1. Produce an electrical, plumbing, and HVAC plan. (DOK3, MAG, BCG, HPE)
2. Develop a residential plot/site plan. (DOK3, MAG, LIT, DAN, BCG,ELE)

Unit 15: Field Applications of Architectural Drafting

1. Integrate business/industry experiences with the drafting program. (DOK1, {AAD-PDC}, {MAD-PDC})
2. Investigate career opportunities related to Architectural drafting. (DOK1, {AAD-PDC})
3. Investigate career opportunities related to Mechanical drafting. (DOK1, {MAD-PDC})

Appendix A: 21st Century Skills Standards

CSS1-21st Century Themes

CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. 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
3. Understanding other nations and cultures, including the use of non-English languages

CS2 Financial, Economic, Business and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national, and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water, and ecosystems
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others
3. Implement Innovations

CS7 Critical Thinking and Problem Solving

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

CS8 Communication and Collaboration

1. Communicate Clearly
2. Collaborate with Others

CSS3-Information, Media and Technology Skills

CS9 Information Literacy

1. Access and Evaluate Information
2. Use and Manage Information

CS10 Media Literacy

1. Analyze Media
2. Create Media Products

CS11 ICT Literacy

1. Apply Technology Effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability

1. Adapt to change
2. Be Flexible

CS13 Initiative and Self-Direction

1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

CS14 Social and Cross-Cultural Skills

1. Interact Effectively with others
2. Work Effectively in Diverse Teams

CS15 Productivity and Accountability

1. Manage Projects
2. Produce Results

CS16 Leadership and Responsibility

1. Guide and Lead Others
2. Be Responsible to Others

Appendix B: MS Academic Standards

MISSISSIPPI SCIENCE FRAMEWORK COMPETENCIES

Marine and Aquatic Science

AQ 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
AQ 2	Develop an understanding of physical and chemical properties of water and aquatic environments.
AQ 3	Apply an understanding of the diverse organisms found in aquatic environments.
AQ 4	Draw conclusions about the relationships between human activity and aquatic organisms.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
   a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
      - Safety rules and symbols
      - Proper use and care of the compound light microscope, slides, chemicals, etc.
      - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers

   b. Formulate questions that can be answered through research and experimental design. (DOK 3)
   c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
   d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
   e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
   f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
   g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. **Develop an understanding of physical and chemical properties of water and aquatic environments.**
   a. Analyze the physical and chemical properties of water, and justify why it is essential to living organisms. (DOK 1)
   b. Explain the causes and characteristics of tides. (DOK 1)
   c. Research, create diagrams, and summarize principles related to waves and current characteristics and formation. (DOK 2)

d. Compare and contrast the physical and chemical parameters of dissolved O2, pH, temperature, salinity, and results obtained through analysis of different water column depths/zones. (DOK 2)
e. Investigate the causes and effects of erosion and discuss conclusions. (DOK 2)
f. Describe and differentiate among the major geologic features of specific aquatic environments. (DOK 1)
   - Plate tectonics
   - Rise, slope, elevation, and depth
   - Formation of dunes, reefs, barrier/volcanic islands, and coastal/flood plains
   - Watershed formation as it relates to bodies of freshwater
g. Compare and contrast the unique abiotic and biotic characteristics of selected aquatic ecosystems. (DOK 2)
   - Barrier island, coral reef, tidal pool, and ocean
   - River, stream, lake, pond, and swamp
   - Bay, sound, estuary, and marsh

3. <u>Apply an understanding of the diverse organisms found in aquatic environments.</u>

a. Analyze and explain the diversity and interactions among aquatic life. (DOK 3)
   - Adaptations of representative organisms for their aquatic environments
   - Relationship of organisms in food chains/webs within aquatic environments
b. Research, calculate, and interpret population data. (DOK 2)
c. Research and compare reproductive processes in aquatic organisms. (DOK 2)
d. Differentiate among characteristics of planktonic, nektonic, and benthic organisms. (DOK 1)
e. Explore the taxonomy of aquatic organisms, and use dichotomous keys to differentiate among the organisms. (DOK 2)
f. Research and explain the symbiotic relationships in aquatic ecosystems. (DOK 3)

4. <u>Draw conclusions about the relationships between human activity and aquatic organisms.</u>

a. Describe the impact of natural and human activity on aquatic ecosystems, and evaluate the effectiveness of various solutions to environmental problems. (DOK 3)
   - Sources of pollution in aquatic environments and methods to reduce the effects of the pollution
   - Effectiveness of a variety of methods of environmental management and stewardship
   - Effects of urbanization on aquatic ecosystems and the effects of continued expansion
b. Research and cite evidence of the effects of natural phenomena such as hurricanes, floods, or drought on aquatic habitats and organisms. (DOK 3)
c. Discuss the advantages and disadvantages involved in applications of modern technology in aquatic science. (DOK 2)
   - Careers related to aquatic science
   - Modern technology within aquatic science (e.g., mariculture and aquaculture)
   - Contributions of aquatic technology to industry and government

Biology I

BIOI 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
BIOI 2	Describe the biochemical basis of life, and explain how energy flows within and between the living systems.
BIOI 3	Investigate and evaluate the interaction between living organisms and their environment.
BIOI 4	Analyze and explain the structures and function of the levels of biological organization.
BIOI 5	Demonstrate an understanding of the molecular basis of heredity.
BIOI 6	Demonstrate an understanding of principles that explain the diversity of life and biological evolution.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
   a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
      - Safety rules and symbols
      - Proper use and care of the compound light microscope, slides, chemicals, etc.
      - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers

   d. Formulate questions that can be answered through research and experimental design. (DOK 3)
   e. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 2)
   f. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
   g. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
   h. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
   i. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. **Describe the biochemical basis of life, and explain how energy flows within and between the living systems.**
   a. Explain and compare with the use of examples the types of bond formation (e.g., covalent, ionic, hydrogen, etc.) between or among atoms. (DOK 2)
      - Subatomic particles and arrangement in atoms
      - Importance of ions in biological processes

   b. Develop a logical argument defending water as an essential component of living systems (e.g., unique bonding and properties including polarity, high specific heat, surface tension, hydrogen bonding, adhesion, cohesion, and expansion upon freezing). (DOK 2)

c. Classify solutions as acidic, basic, or neutral, and relate the significance of the pH scale to an organism's survival (e.g., consequences of having different concentrations of hydrogen and hydroxide ions). (DOK 2)
d. Compare and contrast the structure, properties, and principle functions of carbohydrates, lipids, proteins, and nucleic acids in living organisms. (DOK 2)
   - Basic chemical composition of each group
   - Building components of each group (e.g., amino acids, monosaccharides, nucleotides, etc.)
   - Basic functions (e.g., energy, storage, cellular, heredity) of each group
e. Examine the life processes to conclude the role enzymes play in regulating biochemical reactions. (DOK 2)
   - Enzyme structure
   - Enzyme function, including enzyme-substrate specificity and factors that affect enzyme function (pH and temperature)
f. Describe the role of adenosine triphosphate (ATP) in making energy available to cells. (DOK 1)
   - ATP structure
   - ATP function
g. Analyze and explain the biochemical process of photosynthesis and cellular respiration, and draw conclusions about the roles of the reactant and products in each. (DOK 3)
   - Photosynthesis and respiration (reactants and products)
   - Light-dependent reactions and light independent reactions in photosynthesis, including requirements and products of each
   - Aerobic and anaerobic processes in cellular respiration, including products each and energy differences

3. <u>Investigate and evaluate the interaction between living organisms and their environment.</u>

a. Compare and contrast the characteristics of the world's major biomes (e.g., deserts, tundra, taiga, grassland, temperate forest, tropical rainforest). (DOK 2)
   - Plant and animal species
   - Climate (temperature and rainfall)
   - Adaptations of organisms
b. Provide examples to justify the interdependence among environmental elements. (DOK 2)
   - Biotic and abiotic factors in an ecosystem (e.g., water, carbon, oxygen, mold, leaves)
   - Energy flow in ecosystems (e.g., energy pyramids and photosynthetic organisms to herbivores, carnivores, and decomposers)
   - Roles of beneficial bacteria
   - Interrelationships of organisms (e.g., cooperation, predation, parasitism, commensalism, symbiosis, and mutualism)

c. Examine and evaluate the significance of natural events and human activities on major ecosystems (e.g., succession, population growth, technology, loss of genetic diversity, consumption of resources). (DOK 2)

4. <u>Analyze and explain the structures and function of the levels of biological organization.</u>

a. Differentiate among plant and animal cells and eukaryotic and prokaryotic cells. (DOK 2)
   - Functions of all major cell organelles and structures (e.g., nucleus, mitochondrion, rough ER, smooth ER, ribosomes, Golgi bodies, vesicles, lysosomes, vacuoles, microtubules, microfiliaments, chloroplast, cytoskeleton, centrioles, nucleolus, chromosomes, nuclear membrane, cell wall, cell membrane [active and passive transport], cytosol)
   - Components of mobility (e.g., cilia, flagella, pseudopodia)

b. Differentiate between types of cellular reproduction. (DOK 1)
   - Main events in the cell cycle and cell mitosis (including differences in plant and animal cell divisions)
   - Binary fission (e.g., budding, vegetative propagation, etc.)
   - Significance of meiosis in sexual reproduction
   - Significance of crossing over

c. Describe and differentiate among the organizational levels of organisms (e.g., cells, tissues, organs, systems, types of tissues.) (DOK 1)

d. Explain and describe how plant structures (vascular and nonvascular) and cellular functions are related to the survival of plants (e.g., movement of materials, plant reproduction). (DOK 1)

5. <u>Demonstrate an understanding of the molecular basis of heredity.</u>

a. Analyze and explain the molecular basis of heredity and the inheritance of traits to successive generations by using the Central Dogma of Molecular Biology. (DOK 3)
   - Structures of DNA and RNA
   - Processes of replication, transcription, and translation
   - Messenger RNA codon charts

b. Utilize Mendel's laws to evaluate the results of monohybrid Punnett squares involving complete dominance, incomplete dominance, codominance, sex linked, and multiple alleles (including outcome percentage of both genotypes and phenotypes). (DOK 2)

c. Examine inheritance patterns using current technology (e.g., pedigrees, karyotypes, gel electrophoresis). (DOK 2)

d. Discuss the characteristics and implications of both chromosomal and gene mutations. (DOK 2)
   - Significance of nondisjunction, deletion, substitutions, translocation, frame shift mutation in animals
   - Occurrence and significance of genetic disorders such as sickle cell anemia, Tay-Sachs disorder, cystic fibrosis, hemophilia, Down syndrome, color blindness

6. <u>Demonstrate an understanding of principles that explain the diversity of life and biological evolution.</u>

a. Draw conclusions about how organisms are classified into a hierarchy of groups and subgroups based on similarities that reflect their evolutionary relationships. (DOK 2)
   - Characteristics of the six kingdoms
   - Major levels in the hierarchy of taxa (e.g., kingdom, phylum/division, class, order, family, genus, and species)
   - Body plans (symmetry)
   - Methods of sexual reproduction (e.g., conjugation, fertilization, pollination)
   - Methods of asexual reproduction (e.g., budding, binary fission, regeneration, spore formation)
b. Critique data (e.g., comparative anatomy, Biogeography, molecular biology, fossil record, etc.) used by scientists (e.g., Redi, Needham, Spallanzani, Pasteur) to develop an understanding of evolutionary processes and patterns. (DOK 3)
c. Research and summarize the contributions of scientists (including Darwin, Malthus, Wallace, Lamarck, and Lyell) whose work led to the development of the theory of evolution. (DOK 2)
d. Analyze and explain the roles of natural selection, including the mechanisms of speciation (e.g., mutations, adaptations, geographic isolation) and applications of speciation (e.g., pesticide and antibiotic resistance). (DOK 3)
e. Differentiate among chemical evolution, organic evolution, and the evolutionary steps along the way to aerobic heterotrophs and photosynthetic autotrophs. (DOK 2)

Biology II

BIOII 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
BIOII 2	Describe and contrast the structures, functions, and chemical processes of the cell.
BIOII 3	Investigate and discuss the molecular basis of heredity.
BIOII 4	Demonstrate an understanding of the factors that contribute to evolutionary theory and natural selection.
BIOII 5	Develop an understanding of organism classification.

1. **<u>Apply inquiry-based and problem-solving processes and skills to scientific investigations.</u>**
   a. Use current technologies such as CD-ROM, DVD, Internet, and on-line data search to explore current research related to a specific topic. (DOK 3)
   b. Clarify research questions and design laboratory investigations. (DOK 3)
   c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
   d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
   e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
   f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)

g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)

2. **<u>Describe and contrast the structures, functions, and chemical processes of the cell.</u>**
   a. Relate the structure and function of a selectively permeable membrane to its role in diffusion and osmosis. (DOK 2)
   b. Summarize how cell regulation controls and coordinates cell growth and division. (DOK 2)
   c. Analyze and describe the function of enzymes in biochemical reactions. (DOK 2)
      - The impact of enzymatic reactions on biochemical processes
      - Factors that affect enzyme function (e.g., pH, concentration, temperature, etc.)
   d. Differentiate between photosynthesis and cellular respiration. (DOK 2)
      - Cellular sites and major pathways of anaerobic and aerobic respiration (with reactants, products, and ATP per monosaccharide)
      - Cellular respiration with respect to the sites at which they take place, the reactions involved, and the energy input and output in each stage (e.g., glycolysis, Krebs cycle, electron transport chain)
      - Pigments, absorption, reflection of light, and light-dependent and light-independent reactions of photosynthesis
      - Oxidation and reduction reactions
3. **<u>Investigate and discuss the molecular basis of heredity.</u>**
   a. Explain how the process of meiosis clarifies the mechanism underlying Mendel's conclusions about segregation and independent assortment on a molecular level. (DOK 1)
   b. Research and explain how major discoveries led to the determination of DNA structure. (DOK 2)
   c. Relate gene expression (e.g., replication, transcription, translation) to protein structure and function. (DOK 2)
      - Translation of a messenger RNA strand into a protein
      - Processing by organelles so that the protein is appropriately packaged, labeled, and eventually exported by the cell
      - Messenger RNA codon charts to determine the effects of different types of mutations on amino acid sequence and protein structure (e.g., sickle cell anemia resulting from base substitution mutation)
      - Gene expression regulated in organisms so that specific proteins are synthesized only when they are needed by the cell (e.g., allowing cell specialization)
   d. Assess the potential implications of DNA technology with respect to its impact on society. (DOK 3)
      - Modern DNA technologies (e.g., polymerase chain reaction (PCR), gene splicing, gel electrophoresis, transformation, recombinant DNA) in agriculture, medicine, and forensics
   e. Develop a logical argument defending or refuting bioethical issues arising from applications of genetic technology (e.g., the human genome project, cloning, gene therapy, stem cell research). (DOK 3)

4. **<u>Demonstrate an understanding of the factors that contribute to evolutionary theory and natural selection.</u>**
   a. Explain the history of life on earth, and infer how geological changes provide opportunities and constraints for biological evolution. (DOK 2)
      - Main periods of the geologic timetable of earth's history
        - Roles of catastrophic and gradualistic processes in shaping planet Earth
   b. Provide support for the argument based upon evidence from anatomy, embryology, biochemistry, and paleontology that organisms descended with modification from common ancestry. (DOK 2)
   c. Identify and provide supporting evidence for the evolutionary relationships among various organisms using phylogenetic trees and cladograms. (DOK 2)
   d. Formulate a scientific explanation based on fossil records of ancient life-forms, and describe how new species could originate as a result of geological isolation and reproductive isolation. (DOK 2)
   e. Compare and contrast the basic types of selection (e.g., disruptive, stabilizing, directional, etc.). (DOK 2)
   f. Cite examples to justify behaviors that have evolved through natural selection (e.g., migration, parental care, use of tools, etc.). (DOK 1)
   g. Research and explain the contributions of 19th century scientists (e.g., Malthus, Wallace, Lyell, and Darwin) on the formulation of ideas about evolution. (DOK 2)
   h. Develop a logical argument describing ways in which the influences of 20th century science have impacted the development of ideas about evolution (e.g., synthetic theory of evolution, molecular biology). (DOK 3)
   i. Analyze changes in an ecosystem resulting from natural causes (succession), changes in climate, human activity (pollution and recycling), or introduction of nonnative species. (DOK 2)
5. **<u>Develop an understanding of organism classification.</u>**
   a. Classify organisms according to traditional Linnaean classification characteristics (e.g., cell structure, biochemistry, anatomy, fossil record, methods of reproduction) and the cladistic approach. (DOK 2)
   b. Categorize organisms according to the characteristics that distinguish them as Bacteria, Archaea, or Eucarya. (DOK 1)
      - Bacteria, fungi, and protists
      - Characteristics of invertebrates (e.g., habitat, reproduction, body plan, locomotion) as related to phyla (e.g., Porifera, Cnidarians, Nematoda, Annelida, Platyhelmenthes, and Arthropoda) and classes (e.g., Insecta, Crustacea, Arachnida, Mollusca, Echinodermata)
      - Characteristics of vertebrates (e.g., habitat, reproduction, body plan, locomotion) as related to classes (e.g., Agnatha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves, Mammalia)
      - Nomenclature of various types of plants (e.g., Bryophyta, Tracheophyta, Gymnospermae, Angiospermae, Monocotyledonae, Dicotyledonae, vascular plants, nonvascular plants)

Botany

BO 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
BO 2	Distinguish among the characteristics of botanical organization, structure, and function.
BO 3	Demonstrate an understanding of plant reproduction.
BO 4	Draw conclusions about the factors that affect the adaptation and survival of plants.
BO 5	Relate an understanding of plant genetics to its uses in modern living.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
    a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
        - Safety rules and symbols
        - Proper use and care of the compound light microscope, slides, chemicals, etc.
        - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
    b. Formulate questions that can be answered through research and experimental design. (DOK 3)
    c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
    d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
    e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
    f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
    g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. **Distinguish among the characteristics of botanical organization, structure, and function.**
    a. Relate plant cell structures to their functions (e.g., major organelles, cell wall components, photosynthetic chemical reactions, plant pigments, plant tissues, roots, stems, leaves, flowers). (DOK 1)
    b. Differentiate the characteristics found in various plant divisions. (DOK 2)
        - Differences and similarities of nonvascular plants
        - Characteristics of seed-bearing and non-seed bearing vascular plants relative to taxonomy
        - Major vegetative structures and their modifications in angiosperms and gymnosperms
    c. Compare and contrast leaf modifications of gymnosperms and angiosperms (e.g., needles, overlapping scales, simple leaves, compound leaves, evergreen trees, and deciduous trees). (DOK 2)

d. Apply the modern classification scheme utilized in naming plants to identify plant specimens. (DOK 2)
    - Classification scheme used in botany
    - Classification of native Mississippi plants
e. Use inquiry to investigate and discuss the physical and chemical processes of plants. (DOK 3)
    - Relationships among photosynthesis, cellular respiration, and translocation
    - Importance of soil type and soil profiles to plant survival
    - Mechanism of water movement in plants
    - Effects of environmental conditions for plant survival
    - Tropic responses of a plant organ to a given stimulus

3. <u>Demonstrate an understanding of plant reproduction.</u>

a. Compare and contrast reproductive structures (e.g., cones, flowers). (DOK 2)
b. Differentiate among the vegetative organs of monocots, herbaceous dicots, and woody dicots. (DOK 1)
c. Differentiate between the structures and processes of sexual and asexual reproduction in plants. (DOK 1)
    - Reproductive structures, their modifications, and the mechanisms involved in plant reproduction
    - Functions of flower parts, seeds, cones
    - Spore production in bryophytes and ferns
d. Explain and provide examples of the concept of alternation of generations and its examples. (DOK 2)
e. Categorize types of fruits and methods of seed distribution in plants. (DOK 1)
f. Research and compare various methods of plant propagation. (DOK 2)

4. <u>Draw conclusions about the factors that affect the adaptation and survival of plants.</u>

a. List and assess several adaptations of plants to survive in a given biome. (DOK 2)
b. Design and conduct an experiment to determine the effects of environmental factors on photosynthesis. (DOK 3)
c. Explain how natural selection and the evolutionary consequences (e.g., adaptation or extinction) support scientific explanations for similarities of ancient life-forms in the fossil record and molecular similarities present in living organisms. (DOK 2)
d. Research factors that might influence or alter plant stability, and propose actions that may reduce the negative impacts of human activity. (DOK 2)

5. <u>Relate an understanding of plant genetics to its uses in modern living.</u>

a. Research, prepare, and present a position relating to issues surrounding the current botanical trends involving biotechnology. (DOK 3)
b. Apply an understanding of the principles of plant genetics to analyze monohybrid and dihybrid crosses, and predict the potential effects the crosses might have on agronomy and agriculture. (DOK 3)
c. Discuss the effects of genetic engineering of plants on society. (DOK 2)
d. Describe the chemical compounds extracted from plants, their economical importance, and the impact on humans. (DOK 3)
    - Plant extracts, their function, and origin

- Impact of the timber industry on local and national economy

Chemistry I

CHI 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
CHI 2	Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.
CHI 3	Develop an understanding of the periodic table.
CHI 4.	Analyze the relationship between microscopic and macroscopic models of matter.
CHI 5	Compare factors associated with acid/base and oxidation/reduction reactions.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
    a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
    b. Clarify research questions and design laboratory investigations. (DOK 3)
    c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
    d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
    e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
    f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
    g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)
2. **Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.**
    a. Describe and classify matter based on physical and chemical properties and interactions between molecules or atoms. (DOK 1)
        - Physical properties (e.g., melting points, densities, boiling points) of a variety of substances
        - Substances and mixtures
        - Three states of matter in terms of internal energy, molecular motion, and the phase transitions between them
    b. Research and explain crucial contributions and critical experiments of Dalton, Thomson, Rutherford, Bohr, de Broglie, and Schrődinger, and describe how each discovery contributed to the current model of atomic and nuclear structure. (DOK 2)
    c. Develop a model of atomic and nuclear structure based on theory and knowledge of fundamental particles. (DOK 2)
        - Properties and interactions of the three fundamental particles of the atom

- Laws of conservation of mass, constant composition, definite proportions, and multiple proportions

d. Write appropriate equations for nuclear decay reactions, describe how the nucleus changes during these reactions, and compare the resulting radiation with regard to penetrating ability. (DOK 1)
   - Three major types of radioactive decay (e.g., alpha, beta, gamma) and the properties of the emissions (e.g., composition, mass, charge, penetrating power)
   - The concept of half-life for a radioactive isotope (e.g., carbon-14 dating) based on the principle that the decay of any individual atom is a random process

e. Compare the properties of compounds according to their type of bonding. (DOK 1)
   - Covalent, ionic, and metallic bonding
   - Polar and nonpolar covalent bonding
   - Valence electrons and bonding atoms

f. Compare different types of intermolecular forces, and explain the relationship between intermolecular forces, boiling points, and vapor pressure when comparing differences in properties of pure substances. (DOK 1)

g. Develop a three-dimensional model of molecular structure. (DOK 2)
   - Lewis dot structures for simple molecules and ionic compounds
   - Valence shell electron pair repulsion theory (VSEPR)

3. <u>Develop an understanding of the periodic table.</u>

a. Calculate the number of protons, neutrons, and electrons in individual isotopes using atomic numbers and mass numbers, write electron configurations of elements and ions following the Aufbau principle, and balance equations representing nuclear reactions. (DOK 1)

b. Analyze patterns and trends in the organization of elements in the periodic table, and compare their relationship to position in the periodic table. (DOK 2)
   - Atomic number, atomic mass, mass number, and number of protons, electrons, and neutrons in isotopes of elements
   - Average atomic mass calculations
   - Chemical characteristics of each region
   - Periodic properties (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius)

c. Classify chemical reactions by type. (DOK 2)
   - Single displacement, double displacement, synthesis (combination), decomposition, disproportionation, combustion, or precipitation
   - Products (given reactants) or reactants (given products) for each reaction type
   - Solubility rules for precipitation reactions and the activity series for single and double displacement reactions

d. Use stoichiometry to calculate the amount of reactants consumed and products formed. (DOK 3)
   - Difference between chemical reactions and chemical equations
   - Formulas and calculations of the molecular (molar) masses
   - Empirical formula given the percent composition of elements

- Molecular formula given the empirical formula and molar mass

4. **<u>Analyze the relationship between microscopic and macroscopic models of matter.</u>**
    a. Calculate the number of protons, neutrons, and electrons in individual isotopes using atomic numbers and mass numbers, write electron configurations of elements and ions following the Aufbau principle, and balance equations representing nuclear reactions. (DOK 1)
    b. Analyze patterns and trends in the organization of elements in the periodic table, and compare their relationship to position in the periodic table. (DOK 2)
        - Atomic number, atomic mass, mass number, and number of protons, electrons, and neutrons in isotopes of elements
        - Average atomic mass calculations
        - Chemical characteristics of each region
        - Periodic properties (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius)
    c. Classify chemical reactions by type. (DOK 2)
        - Single displacement, double displacement, synthesis (combination), decomposition, disproportionation, combustion, or precipitation
        - Products (given reactants) or reactants (given products) for each reaction type
        - Solubility rules for precipitation reactions and the activity series for single and double displacement reactions
    d. Use stoichiometry to calculate the amount of reactants consumed and products formed. (DOK 3)
        - Difference between chemical reactions and chemical equations
        - Formulas and calculations of the molecular (molar) masses
        - Empirical formula given the percent composition of elements
        - Molecular formula given the empirical formula and molar mass

5. **<u>Compare factors associated with acid/base and oxidation/reduction reactions.</u>**
    a. Analyze and explain acid/base reactions. (DOK 2)
        - Properties of acids and bases, including how they affect indicators and the relative pH of the solution
        - Formation of acidic and basic solutions
        - Definition of pH in terms of the hydronium ion concentration and the hydroxide ion concentration
        - The pH or pOH from the hydrogen ion or hydroxide ion concentrations of solution
        - How a buffer works and examples of buffer solutions
    b. Classify species in aqueous solutions according to the Arrhenius and Bronsted-Lowry definitions respectively, and predict products for aqueous neutralization reactions. (DOK 2)
    c. Analyze a reduction/oxidation reaction (REDOX) to assign oxidation numbers (states) to reaction species, and identify the species oxidized and reduced, the oxidizing agent, and reducing agent. (DOK 2)

Organic Chemistry

ORGC 1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.

ORGC 2 Demonstrate an understanding of the properties, structure, and function of organic compounds.

ORGC 3 Discuss the versatility of polymers and the diverse application of organic chemicals.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
    a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
        - Safety rules and symbols
        - Proper use and care of the compound light microscope, slides, chemicals, etc.
        - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
    b. Formulate questions that can be answered through research and experimental design. (DOK 3)
    c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
    d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
    e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
    f. Recognize and analyze alternative explanations for experimental results, and make predictions based on observations and prior knowledge. (DOK 3)
    g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. **Demonstrate an understanding of the properties, structure, and function of organic compounds.**
    a. Apply International Union of Pure and Applied Chemistry (IUPAC) nomenclature, and differentiate the structure of aliphatic, aromatic, and cyclic hydrocarbon compounds. (DOK 1)
        - Structures of hydrocarbon compounds
        - Isomerism in hydrocarbon compounds
    b. Relate structure to physical and chemical properties of hydrocarbon. (DOK 1)
    c. Apply principles of geometry and hybridization to organic molecules. (DOK 2)
        - Lewis structures for organic molecules
        - Bond angles
        - Hybridization (as it applies to organic molecules)
    d. Write, complete, and classify common reactions for aliphatic, aromatic, and cyclic hydrocarbons. (DOK 1)

e. Construct, solve, and explain equations representing combustion reactions, substitution reactions, dehydrogenation reactions, and addition reactions. (DOK 2)
f. Classify functional groups (e.g., alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides, and nitrides) by their structure and properties. (DOK 2)
   - Structural formulas from functional group names and vice versa
   - Chemical and physical properties of compounds containing functional groups
   - Equations representing the transformation of one functional group into another

3. <u>Discuss the versatility of polymers and the diverse application of organic chemicals.</u>

a. Describe and classify the synthesis, properties, and uses of polymers. (DOK 2)
   - Common polymers
   - Synthesis of polymers from monomers by addition or condensation
   - Condensations of plastics according to their commercial types
   - Elasticity and other polymer properties
b. Develop a logical argument supporting the use of organic chemicals and their application in industry, drug manufacture, and biological chemistry. (DOK 1)
   - Common uses of polymers and organic compounds in medicine, drugs, and personal care products
   - Compounds that have the property to dye materials
   - Petrochemical production
   - Biologically active compounds in terms of functional group substrate interaction
c. Research and summarize the diversity, applications, and economics of industrial chemicals (solvents, coatings, surfactants, etc.). (DOK 3)

Earth and Space Science

E1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
E2	Develop an understanding of the history and evolution of the universe and earth.
E3	Discuss factors that are used to explain the geological history of earth.
E4	Demonstrate an understanding of earth systems relating to weather and climate.
E5	Apply an understanding of ecological factors to explain relationships between earth systems.

1. <u>Apply inquiry-based and problem-solving processes and skills to scientific investigations.</u>

a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
   - Safety rules and symbols
   - Proper use and care of the compound light microscope, slides, chemicals, etc.
   - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers.
b. Formulate questions that can be answered through research and experimental design. (DOK 3)

c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

2. <u>Develop an understanding of the history and evolution of the universe and earth.</u>

a. Summarize the origin and evolution of the universe. (DOK 2)
   - Big bang theory
   - Microwave background radiation
   - The Hubble constant
   - Evidence of the existence of dark matter and dark energy in the universe and the history of the universe
b. Differentiate methods used to measure space distances, including astronomical unit, light-year, stellar parallax, Cepheid variables, and the red shift. (DOK 1)
c. Interpret how gravitational attraction played a role in the formation of the planetary bodies and how the fusion of hydrogen and other processes in "ordinary" stars and supernovae lead to the formation of all other elements. (DOK 2)
d. Summarize the early evolution of the earth, including the formation of Earth's solid layers (e.g., core, mantle, and crust), the distribution of major elements, the origin of internal heat sources, and the initiation of plate tectonics. (DOK 2)

- How the decay of radioactive isotopes is used to determine the age of rocks, earth, and the solar system
- How Earth acquired its initial oceans and atmosphere

3. <u>Discuss factors which are used to explain the geological history of earth.</u>

a. Develop an understanding of how plate tectonics create certain geological features, materials, and hazards. (DOK 1)
   - Plate tectonic boundaries (e.g., divergent, convergent, and transform)
   - Modern and ancient geological features to each kind of plate tectonic boundary
   - Production of particular groups of igneous and metamorphic rocks and mineral resources
   - Sedimentary basins created and destroyed through time
b. Compare and contrast types of mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, phosphates). (DOK 2)
c. Categorize minerals and rocks by determining their physical and/or chemical characteristics. (DOK 2)
d. Justify the causes of certain geological hazards (e.g., earthquakes, volcanoes, tsunamis) to their effects on specific plate tectonic locations. (DOK 2)

e. Interpret and explain how rock relationships and fossils are used to reconstruct the geologic history of the earth. (DOK 2)
f. Apply principles of relative age (e.g., superposition, original horizontality, crosscutting relations, and original lateral continuity) to support an opinion related to earth's geological history. (DOK 3)
    - Types of unconformity (e.g., disconformity, angular unconformity, nonconformity)
    - Geological timetable
g. Apply the principle of uniformitarianism to relate sedimentary rock associations and their fossils to the environments in which the rocks were deposited. (DOK 2)
h. Compare and contrast the relative and absolute dating methods (e.g., the principle of fossil succession, radiometric dating, and paleomagnetism) for determining the age of the earth. (DOK 1)

4. <u>Demonstrate an understanding of earth systems relating to weather and climate.</u>

a. Explain the interaction of earth systems that affect weather and climate. (DOK 1)
    - Latitudinal variations in solar heating
    - The effects of Coriolis forces on ocean currents, cyclones, anticyclones, ocean currents, topography, and air masses (e.g., warm fronts, cold fronts, stationary fronts, and occluded fronts).
b. Interpret the patterns in temperature and precipitation that produce the climate regions on earth, and relate them to the hazards associated with extreme weather events and climate change (e.g., hurricanes, tornadoes, El Niño/La Niña, global warming). (DOK 2)
c. Justify how changes in global climate and variation in earth/sun relationships contribute to natural and anthropogenic (human-caused) modification of atmospheric composition. (DOK 2)
d. Summarize how past and present actions of ice, wind, and water contributed to the types and distributions of erosional and depositional features in landscapes. (DOK 1)
e. Research and explain how external forces affect earth's topography. (DOK 2)
    - How surface water and groundwater act as the major agents of physical and chemical weathering
    - How soil results from weathering and biological processes
    - Processes and hazards associated with both sudden and gradual mass wasting

5. <u>Apply an understanding of ecological factors to explain relationships between earth systems.</u>

a. Draw conclusions about how life on earth shapes earth systems and responds to the interaction of earth systems (lithosphere, hydrosphere, atmosphere, and biosphere). (DOK 3)
    - Nature and distribution of life on earth, including humans, to the chemistry and availability of water
    - Distribution of biomes (e.g., terrestrial, freshwater, and marine) to climate regions through time
    - Geochemical and ecological processes (e.g., rock, hydrologic, carbon, nitrogen) that interact through time to cycle matter and energy and how human activity

alters the rates of these processes (e.g., fossil fuel formation and combustion, damming and channeling of rivers)

b. Interpret the record of shared ancestry (fossils), evolution, and extinction as related to natural selection. (DOK 2)
c. Identify the cause and effect relationships of the evolutionary innovations that most profoundly shaped earth systems. (DOK 1)
    - Photosynthesis and the atmosphere
    - Multicellular animals and marine environments
    - Land plants and terrestrial environments
d. Cite evidence about how dramatic changes in earth's atmosphere influenced the evolution of life. (DOK 1)

Environmental Science

ES 1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.

ES 2 Develop an understanding of the relationship of ecological factors that affect an ecosystem.

ES 3 Discuss the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
    a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
        - Safety rules and symbols
        - Proper use and care of the compound light microscope, slides, chemicals, etc.
        - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
    b. Formulate questions that can be answered through research and experimental design. (DOK 3)
    c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
    d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
    e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
    f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
    g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK3)
2. **Develop an understanding of the relationship of ecological factors that affect an ecosystem.**

a. Compare ways in which the three layers of the biosphere change over time and their influence on an ecosystem's ability to support life. (DOK 2)
b. Explain the flow of matter and energy in ecosystems. (DOK 2)
    - Interactions between biotic and abiotic factors
    - Indigenous plants and animals and their roles in various ecosystems
    - Biogeochemical cycles within the environment
c. Predict the impact of the introduction, removal, and reintroduction of an organism on an ecosystem. (DOK 3)
d. Develop a logical argument explaining the relationships and changes within an ecosystem. (DOK 2)
    - How a species adapts to its niche
    - Process of primary and secondary succession and its effects on a population
    - How changes in the environment might affect organisms
e. Explain the causes and effects of changes in population dynamics (e.g., natural selection, exponential growth, predator/prey relationships) to carrying capacity and limiting factors. (DOK 2)
f. Research and explain how habitat destruction leads to the loss of biodiversity. (DOK 2)
g. Compare and contrast the major biomes of the world's ecosystems, including location, climate, adaptations and diversity. (DOK 1)

3. <u>Discuss the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems.</u>

a. Summarize the effects of human activities on resources in the local environments. (DOK 2)
    - Sources, uses, quality, and conservation of water
    - Renewable and nonrenewable resources
    - Effects of pollution (e.g., water, noise, air, etc.) on the ecosystem
b. Research and evaluate the impacts of human activity and technology on the lithosphere, hydrosphere, and atmosphere, and develop a logical argument to support how communities restore ecosystems. (DOK 3)
c. Research and evaluate the use of renewable and nonrenewable resources, and critique efforts to conserve natural resources and reduce global warming in the United States including (but not limited) to Mississippi. (DOK 3)

Genetics

G 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
G 2	Analyze the structure and function of the cell and cellular organelles.
G 3	Apply the principles of heredity to demonstrate genetic understandings.

1. <u>Use critical thinking and scientific problem solving in designing and performing biological research and experimentation. (L, P, E)</u>

a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
b. Clarify research questions and design laboratory investigations. (DOK 3)

c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for pie, bar, and line graphs) to draw conclusions and make inferences. (DOK 3)
e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)

2. <u>Review the structure and function of the cell as it applies to genetics. (L)</u>

a. Cite evidence to illustrate how the structure and function of cells are involved in the maintenance of life. (DOK 2)
b. Describe how organic components are integral to biochemical processes. (DOK 2)
c. Differentiate among the processes by which plants and animals reproduce. (DOK 1)
    - Cell cycle and mitosis
    - Meiosis, spermatogenesis, and oogenesis
d. Explain the significance of the discovery of nucleic acids. (DOK 1)
e. Analyze and explain the structure and function of DNA and RNA in replication, transcription, translation and DNA repair. (DOK 2)
f. Cite examples to compare the consequences of the different types of mutations. (DOK 1)
g. Draw conclusions about the importance and potential impacts of the process of gene transfer used in biotechnology. (DOK 3)

3. <u>Analyze the structure and function of DNA and RNA molecules. (L, P)</u>

a. Cite evidence that supports the significance of Mendel's concept of "particulate inheritance" to explain the understanding of heredity. (DOK 1)
b. Apply classical genetics principles to solve basic genetic problems. (DOK 2)
    - Genes and alleles, dominance, recessiveness, the laws of segregation, and independent assortment
    - Inheritance of autosomal and sex-linked traits
    - Inheritance of traits influenced by multiple alleles and traits with polygenetic inheritance
    - Chromosomal theory of inheritance
c. Apply population genetic concepts to summarize variability of multicellular organisms. (DOK 2)
    - Genetic variability
    - Hardy-Weinberg formula
    - Migration and genetic drift
    - Natural selection in humans
d. Distinguish and explain the applications of various tools and techniques used in DNA manipulation. (DOK 1)

- Steps in genetic engineering experiments
- Use of restriction enzymes
- Role of vectors in genetic research
- Use of transformation techniques

e. Research and present a justifiable explanation the practical uses of biotechnology (e.g., chromosome mapping, karyotyping, and pedigrees). (DOK 2)
f. Develop and present a scientifically-based logical argument for or against moral and ethical issues related to genetic engineering. (DOK 3)
g. Research genomics (human and other organisms), and predict benefits and medical advances that may result from the use of genome projects. (DOK 2)

Geology

GE1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
GE2	Develop an understanding of plate tectonics and geochemical and ecological processes that affect earth.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
   a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
      - Safety rules and symbols
      - Proper use and care of the compound light microscope, slides, chemicals, etc.
      - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers

   b. Formulate questions that can be answered through research and experimental design. (DOK 3)
   c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
   d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
   e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
   f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
   g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. **Develop an understanding of plate tectonics and geochemical and ecological processes that affect earth.**
   a. Differentiate the components of the earth's atmosphere and lithosphere. (DOK 1)
   b. Research and summarize explanations of how earth acquired its initial atmosphere and oceans. (DOK 2)

c. Compare the causes and effects of internal and external components that shape earth's topography. (DOK 2)
   - Physical weathering (e.g., atmospheric, glacial, etc.)
   - Chemical weathering agents (e.g., acid precipitation, carbon dioxide, oxygen, water, etc.)
d. Develop an understanding of how plate tectonics create certain geologic features, materials, and hazards. (DOK 2)
   - Types of crustal movements and the resulting landforms (e.g., seafloor spreading, paleomagnetic measurements, and orogenesis)
   - Processes that create earthquakes and volcanoes
   - Asthenosphere
e. Summarize the theories of plate development and continental drift, and describe the causes and effects involved in each. (DOK 2)
f. Develop a logical argument to explain how geochemical and ecological processes (e.g., rock, hydrologic, carbon, nitrogen) interact through time to cycle matter and energy and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion, damming, and channeling of rivers). (DOK 2)
g. Interpret how the earth's geological time scale relates to geological history, landforms, and life-forms. (DOK 2)
h. Research and describe different techniques for determining relative and absolute age of the earth (e.g., index of fossil layers, superposition, radiometric dating, etc.). (DOK 1)
i. Summarize the geological activity of the New Madrid fault line, and compare and contrast it to geological activity in other parts of the world. (DOK 2)
j. Identify and differentiate the major geological features in Mississippi (e.g., Delta, Coastal Areas, etc.). (DOK 1)
k. Evaluate an emergency preparedness plan for natural disasters associated with crustal movement. (DOK 3)

Physical Science

PS 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
PS 2	Describe and explain how forces affect motion.
PS 3	Demonstrate an understanding of general properties and characteristics of waves.
PS 4	Develop an understanding of the atom.
PS 5	Investigate and apply principles of physical and chemical changes in matter.

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

a. Use appropriate laboratory safety symbols and procedures to design and conduct a scientific investigation. (DOK 2)
   - Safety symbols and safety rules in all laboratory activities
   - Proper use and care of the compound light microscope

- Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers

b. Identify questions that can be answered through scientific investigations. (DOK 3)
c. Identify and apply components of scientific methods in classroom investigations. (DOK 3)
    - Predicting, gathering data, drawing conclusions
    - Recording outcomes and organizing data from a variety of sources (e.g., scientific articles, magazines, student experiments, etc.)
    - Critically analyzing current investigations/problems using periodicals and scientific scenarios
d. Interpret and generate graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
e. Analyze procedures and data to draw conclusions about the validity of research. (DOK 3)
f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
g. Communicate effectively to present and explain scientific results, using appropriate terminology and graphics. (DOK 3)

2. <u>Describe and explain how forces affect motion.</u>

a. Demonstrate and explain the basic principles of Newton's three laws of motion including calculations of acceleration, force, and momentum. (DOK 2)
    - Inertia and distance-time graphs to determine average speed
    - Net force (accounting for gravity, friction, and air resistance) and the resulting motion of objects
    - Effects of the gravitational force on objects on Earth and effects on planetary and lunar motion
    - Simple harmonic motion (oscillation)
b. Explain the connection between force, work, and energy. (DOK 2)
    - Force exerted over a distance (results in work done)
    - Force-distance graph (to determine work)
    - Network on an object that contributes to change in kinetic energy (work-to-energy theorem)
c. Describe (with supporting details and diagrams) how the kinetic energy of an object can be converted into potential energy (the energy of position) and how energy is transferred or transformed (conservation of energy). (DOK 2)
d. Draw and assess conclusions about charges and electric current. (DOK 2)
    - Static/current electricity and direct current/alternating current
    - Elements in an electric circuit that are in series or parallel
    - Conductors and insulators
    - Relationship between current flowing through a resistor and voltage flowing across a resistor
e. Cite evidence and explain the application of electric currents and magnetic fields as they relate to their use in everyday living (e.g., the application of fields in motors and generators and the concept of electric current using Ohm's law). (DOK 2)

3. **<u>Demonstrate an understanding of general properties and characteristics of waves.</u>**
    a. Differentiate among transverse, longitudinal, and surface waves as they propagate through a medium (e.g., string, air, water, steel beam). (DOK 1)
    b. Compare properties of waves (e.g., superposition, interference, refraction, reflection, diffraction, Doppler effect), and explain the connection among the quantities (e.g., wavelength, frequency, period, amplitude, and velocity). (DOK 2)
    c. Classify the electromagnetic spectrum's regions according to frequency and/or wavelength, and draw conclusions about their impact on life. (DOK 2)
        - The emission of light by electrons when moving from higher to lower levels
        - Energy (photons as quanta of light)
        - Additive and subtractive properties of colors
        - Relationship of visible light to the color spectrum
    d. Explain how sound intensity is measured and its relationship to the decibel scale. (DOK 1)
4. **<u>Develop an understanding of the atom.</u>**
    a. Cite evidence to summarize the atomic theory. (DOK 1)
        - Models for atoms
        - Hund's rule and Aufbau process to specify the electron configuration of elements
        - Building blocks of matter (e.g., proton, neutron, and electron) and elementary particles (e.g., positron, mesons, neutrinos, etc.)
        - Atomic orbitals (s, p, d, f) and their basic shapes
    b. Explain the difference between chemical and physical changes, and demonstrate how these changes can be used to separate mixtures and compounds into their components. (DOK 2)
    c. Research the history of the periodic table of the elements, and summarize the contributions that led to the atomic theory. (DOK 2)
        - Contributions of scientists (e.g., John Dalton, J.J. Thomson, Ernest Rutherford, Newton, Einstein, Neils, Bohr, Louis de Broglie, Erwin Schrödinger, etc.)
        - Technology (e.g., X-rays, cathode-ray tubes, spectroscopes)
        - Experiments (e.g., gold-foil, cathode-ray, etc.)
    d. Utilize the periodic table to predict and explain patterns and draw conclusions about the structure, properties, and organization of matter. (DOK 2)
        - Atomic composition and valence electron configuration (e.g., atomic number, mass number of protons, neutrons, electrons, isotopes, and ions)
        - Periodic trends using the periodic table (e.g., valence, reactivity, atomic radius)
        - Average atomic mass from isotopic abundance
        - Solids, liquids, and gases
        - Periodic properties of elements (e.g., metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity, electron affinity, ionization energy, atomic/covalent/ionic radius) and how they relate to position in the periodic table
5. **<u>Investigate and apply principles of physical and chemical changes in matter.</u>**
    a. Write chemical formulas for compounds comprising monatomic and polyatomic ions. (DOK 1)
    b. Balance chemical equations. (DOK 2)

c. Classify types of chemical reactions (e, g., composition, decomposition, single displacement, double displacement, combustion, acid/base reactions). (DOK 2)

Physics I

PHYI 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
PHYI 2	Develop an understanding of concepts related to forces and motion.
PHYI 3	Develop an understanding of concepts related to work and energy.
PHYI 4	Discuss the characteristics and properties of light and sound.
PHYI 5	Apply an understanding of magnetism, electric fields, and electricity.
PHYI 6	Analyze and explain concepts of nuclear physics.

1. **Investigate and apply principles of physical and chemical changes in matter.**
   a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
   b. Clarify research questions, and design laboratory investigations. (DOK 3)
   c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
   d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
   e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
   f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
   g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBL's, etc.). (DOK 3)
2. **Develop an understanding of concepts related to forces and motion.**
   a. Use inquiry to investigate and develop an understanding of the kinematics and dynamics of physical bodies. (DOK 3)
      - Vector and scalar quantities
      - Vector problems (solved mathematically and graphically)
      - Vector techniques and free-body diagrams to determine the net force on a body when several forces are acting on it
      - Relations among mass, inertia, and weight
   b. Analyze, describe, and solve problems by creating and utilizing graphs of one-dimensional motion (e.g., position, distance, displacement, time, speed, velocity, acceleration, the special case of free fall). (DOK 2)
   c. Analyze real-world applications to draw conclusions about Newton's three laws of motion. (DOK 2)
   d. Apply the effects of the universal gravitation law to graph and interpret the force between two masses, acceleration due to gravity, and planetary motion. (DOK 2)
      - Situations where g is constant (falling bodies)

- Concept of centripetal acceleration undergoing uniform circular motion
- Kepler's third law
- Oscillatory motion and the mechanics of waves

3. **<u>Develop an understanding of concepts related to work and energy.</u>**
    a. Explain and apply the conservation of energy and momentum. (DOK 2)
        - Concept of work and applications
        - Concept of kinetic energy, using the elementary work-energy theorem
        - Concept of conservation of energy with simple examples
        - Concepts of energy, work, and power (qualitatively and quantitatively)
        - Principles of impulse in inelastic and elastic collisions
    b. Analyze real-world applications to draw conclusions about mechanical potential energy (the energy of configuration). (DOK 3)
    c. Apply the principles of impulse, and compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions. (DOK 1)
    d. Investigate and summarize the principles of thermodynamics. (DOK 2)
        - How heat energy is transferred from higher temperature to lower temperature until equilibrium is reached
        - Temperature and thermal energy as related to molecular motion and states of matter
        - Problems involving specific heat and heat capacity
        - First and second laws of thermodynamics as related to heat engines, refrigerators, and thermal efficiency
    e. Develop the kinetic theory of ideal gases and explain the concept of Carnot efficiency. (DOK 2)
4. **<u>Discuss the characteristics and properties of light and sound.</u>**
    a. Describe and model the characteristics and properties of mechanical waves. (DOK 2)
        - Simple harmonic motion
        - Relationships among wave characteristics such as velocity, period, frequency, amplitude, phase, and wavelength
        - Energy of a wave in terms of amplitude and frequency.
        - Standing waves and waves in specific media (e.g., stretched string, water surface, air, etc.)
    b. Differentiate and explain the Doppler effect as it relates to a moving source and to a moving observer. (DOK 1)
    c. Explain the laws of reflection and refraction, and apply Snell's law to describe the relationship between the angles of incidence and refraction. (DOK 2)
    d. Use ray tracing and the thin lens equation to solve real-world problems involving object distance from lenses. (DOK 2)
    e. Investigate and draw conclusions about the characteristics and properties of electromagnetic waves. (DOK 2)
5. **<u>Apply an understanding of magnetism, electric fields, and electricity.</u>**
    a. Analyze and explain the relationship between electricity and magnetism. (DOK 2)
        - Characteristics of static charge and how a static charge is generated

- Electric field, electric potential, current, voltage, and resistance as related to Ohm's law
- Magnetic poles, magnetic flux and field, Ampère's law and Faraday's law
- Coulomb's law

b. Use schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential. (DOK 2)

c. Analyze and explain the relationship between magnetic fields and electrical current by induction, generators, and electric motors. (DOK 2)

6. <u>Analyze and explain concepts of nuclear physics.</u>

a. Analyze and explain the principles of nuclear physics. (DOK 1)
- The mass number and atomic number of the nucleus of an isotope of a given chemical element
- The conservation of mass and the conservation of charge
- Nuclear decay

b. Defend the wave-particle duality model of light, using observational evidence. (DOK 3)
- Quantum energy and emission spectra
- Photoelectric and Compton effects

Spatial Information Science

SP 1 Apply inquiry-based and problem-solving processes and skills to scientific investigations.

SP 2 Develop an understanding of geographic information systems.

1. <u>Demonstrate the basic concepts of global positioning systems (GPS). (E)</u>

a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)

b. Clarify research questions, and design laboratory investigations. (DOK 3)

c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, and theory development). (DOK 3)

d. Organize data to construct graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences). (DOK 3)

e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)

f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)

g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBLs, etc.). (DOK 3)

2. <u>Demonstrate the basic concepts of remote sensing. (E, P)</u>

a. Describe the characteristics of the electromagnetic spectrum.

b. Using images and graphs, interpret the absorption/reflection spectrum.

c. Distinguish between passive vs. active sensor systems.
d. Analyze the effects of changes in spatial, temporal, and spectral resolution.
e. Analyze the effects on images due to changes in scale.
f. Identify the types of sensor platforms.

Zoology

ZO 1	Apply inquiry-based and problem-solving processes and skills to scientific investigations.
ZO 2	Develop an understanding of levels of organization and animal classification.
ZO 3	Differentiate among animal life cycles, behaviors, adaptations, and relationships.
ZO 4	Demonstrate an understanding of the principles of animal genetic diversity and evolution.

1. **Apply inquiry-based and problem-solving processes and skills to scientific investigations.**
   a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
      - Safety rules and symbols
      - Proper use and care of the compound light microscope, slides, chemicals, etc.
      - Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
   b. Formulate questions that can be answered through research and experimental design. (DOK 3)
   c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)
   d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
   e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
   f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
   g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. **Develop an understanding of levels of organization and animal classification.**
   a. Explain how organisms are classified, and identify characteristics of major groups. (DOK 1)
      - Levels of organization of structures in animals (e.g., cells, tissues, organs, and systems)
      - Characteristics used to classify organisms (e.g., cell structure, biochemistry, anatomy, fossil record, and methods of reproduction)
   b. Identify and describe characteristics of the major phyla. (DOK 1)
      - Symmetry and body plan
      - Germ layers and embryonic development

- Organ systems (e.g., digestive, circulatory, excretory, and reproductive)
- Locomotion and coordination

c. Distinguish viruses from bacteria and protists, and give examples. (DOK 1)

d. Differentiate among the characteristics of bacteria, archaea, and eucarya. (DOK 1)
   - Phylogenic sequencing of the major phyla
   - Invertebrate characteristics (e.g., habitat, reproduction, body plan, locomotion) of the following phyla: Porifera, Cnidarians, Nematoda, Annelida, Platyhelmenthes, Arthropoda, Insecta, Crustacea, Arachnida, Mollusca [Bivalvia and Gastropoda], and Echinodermata)
   - Vertebrate characteristics (e.g., habitat, reproduction, body plan, locomotion) of the following classes: Agnatha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves, and Mammalia

3. <u>Differentiate among animal life cycles, behaviors, adaptations, and relationships.</u>

a. Describe life cycles, alternation of generations, and metamorphosis of various animals, and evaluate the advantages and disadvantages of asexual and sexual reproduction. (DOK 1)

b. Describe and explain concepts of animal behavior, and differentiate between learned and innate behavior. (DOK 1)
   - Division of labor within a group of animals
   - Communication within animals groups
   - Degree of parental care given in animal groups

c. Evaluate the unique protective adaptations of animals as they relate to survival. (DOK 2)

d. Compare and contrast ecological relationships, and make predictions about the survival of populations under given circumstances. (DOK 3)
   - Terrestrial and aquatic ecosystems
   - Herbivores, carnivores, omnivores, decomposers and other feeding relationships
   - Symbiotic relationships such as mutualism, commensalisms, and parasitism

e. Contrast food chains and food webs. (DOK 2)

4. <u>Demonstrate an understanding of the principles of animal genetic diversity and evolution.</u>

a. Categorize and explain sources of genetic variation on the cellular level (e.g., mutations, crossing over, and nondisjunction) and the population level (e.g., nonrandom mating, migration, etc.). (DOK 2)
   - Relationship between natural selection and evolution
   - Mutations, crossing over, nondisjunction
   - Nonrandom mating, migration, etc.
   - Effects of genetic drift on evolution

b. Develop a logical argument defending or refuting issues related to genetic engineering of animals. (DOK 3)

Appendix C: ACT College Readiness Standards

English

E1 Topic Development in Terms of Purpose and Focus

- Identify the basic purpose or role of a specified phrase or sentence.
- Delete a clause or sentence because it is obviously irrelevant to the essay.
- Identify the central idea or main topic of a straightforward piece of writing.
- Determine relevancy when presented with a variety of sentence-level details.
- Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal.
- Delete material primarily because it disturbs the flow and development of the paragraph.
- Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement.
- Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence or to determine the need to delete plausible but irrelevant material.
- Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation.
- Determine whether a complex essay has accomplished a specific purpose.
- Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay.

E2 Organization, Unity, and Coherence

- Use conjunctive adverbs or phrases to show time relationship in simple narrative essays (e.g., *then, this time*, etc.).
- Select the most logical place to add a sentence in a paragraph.
- Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., *first, afterward, in response*).
- Decide the most logical place to add a sentence in an essay.
- Add a sentence that introduces a simple paragraph.
- Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., *therefore, however, in addition*).
- Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
- Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward.
- Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs.
- Rearrange sentences to improve the logic and coherence of a complex paragraph.
- Add a sentence to introduce or conclude a fairly complex paragraph.
- Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay.

E3 Word Choice in Terms of Style, Tone, Clarity, and Economy

- Revise sentences to correct awkward and confusing arrangements of sentence elements.
- Revise vague nouns and pronouns that create obvious logic problems.
- Delete obviously synonymous and wordy material in a sentence.
- Revise expressions that deviate from the style of an essay.
- Delete redundant material when information is repeated in different parts of speech (e.g., *alarmingly startled*).
- Use the word or phrase most consistent with the style and tone of a fairly straightforward essay.
- Determine the clearest and most logical conjunction to link clauses.
- Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.
- Identify and correct ambiguous pronoun references.
- Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay.
- Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., *an aesthetic viewpoint* versus *the outlook of an aesthetic viewpoint*).
- Correct vague and wordy or clumsy and confusing writing containing sophisticated language.
- Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.

E4 Sentence Structure and Formation

- Use conjunctions or punctuation to join simple clauses.
- Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences.
- Determine the need for punctuation and conjunctions to avoid awkward sounding sentence fragments and fused sentences.
- Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.
- Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, dangling or misplaced modifiers).
- Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems.
- Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence.
- Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs.
- Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.

- Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses.

E5 Conventions of Usage

- Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives.
- Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject–verb and pronoun–antecedent agreement, and which preposition to use in simple contexts.
- Recognize and use the appropriate word in frequently confused pairs such as *there* and *their*, *past* and *passed*, and *led* and *lead*.
- Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., *long for, appeal to*).
- Ensure that a verb agrees with its subject when there is some text between the two.
- Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences.
- Identify the correct past and past participle forms of irregular and infrequently used verbs, and form present–perfect verbs by using *have* rather than *of*.
- Correctly use reflexive pronouns, the possessive pronouns *its* and *your*, and the relative pronouns *who* and *whom*.
- Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject–verb order is inverted or when the subject is an indefinite pronoun).
- Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas.
- Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb.

E6 Conventions of Punctuation

- Delete commas that create basic sense problems (e.g., between verb and direct object).
- Provide appropriate punctuation in straightforward situations (e.g., items in a series).
- Delete commas that disturb the sentence flow (e.g., between modifier and modified element).
- Use commas to set off simple parenthetical phrases.
- Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause).
- Use punctuation to set off complex parenthetical phrases.
- Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by *and*).
- Use apostrophes to indicate simple possessive nouns.
- Recognize inappropriate uses of colons and semicolons.

- Use commas to set off a nonessential/nonrestrictive appositive or clause.
- Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical).
- Use an apostrophe to show possession, especially with irregular plural nouns.
- Use a semicolon to indicate a relationship between closely related independent clauses.
- Use a colon to introduce an example or an elaboration.

Math

M1 Basic Operations and Applications

- Perform one-operation computation with whole numbers and decimals.
- Solve problems in one or two steps using whole numbers.
- Perform common conversions (e.g., inches to feet or hours to minutes).
- Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent.
- Solve some routine two-step arithmetic problems.
- Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average.
- Solve multistep arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour).
- Solve word problems containing several rates, proportions, or percentages.
- Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings).

M2 Probability, Statistics, and Data Analysis

- Calculate the average of a list of positive whole numbers.
- Perform a single computation using information from a table or chart.
- Calculate the average of a list of numbers.
- Calculate the average, given the number of data values and the sum of the data values.
- Read tables and graphs.
- Perform computations on data from tables and graphs.
- Use the relationship between the probability of an event and the probability of its complement.
- Calculate the missing data value, given the average and all data values but one.
- Translate from one representation of data to another (e.g., a bar graph to a circle graph).
- Determine the probability of a simple event.
- Exhibit knowledge of simple counting techniques.*
- Calculate the average, given the frequency counts of all the data values.
- Manipulate data from tables and graphs.
- Compute straightforward probabilities for common situations.
- Use Venn diagrams in counting.*
- Calculate or use a weighted average.

- Interpret and use information from figures, tables, and graphs.
- Apply counting techniques.
- Compute a probability when the event and/or sample space is not given or obvious.
- Distinguish between mean, median, and mode for a list of numbers.
- Analyze and draw conclusions based on information from figures, tables, and graphs.
- Exhibit knowledge of conditional and joint probability.

M3 Numbers: Concepts and Properties

- Recognize equivalent fractions and fractions in lowest terms.
- Recognize one-digit factors of a number.
- Identify a digit's place value.
- Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor.
- Find and use the least common multiple.
- Order fractions.
- Work with numerical factors.
- Work with scientific notation.
- Work with squares and square roots of numbers.
- Work problems involving positive integer exponents.*
- Work with cubes and cube roots of numbers.*
- Determine when an expression is undefined.*
- Exhibit some knowledge of the complex numbers.†
- Apply number properties involving prime factorization.
- Apply number properties involving even and odd numbers and factors and multiples.
- Apply number properties involving positive and negative numbers.
- Apply rules of exponents.
- Multiply two complex numbers.†
- Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers.
- Exhibit knowledge of logarithms and geometric sequences.
- Apply properties of complex numbers.

M4 Expressions, Equations, and Inequalities

- Exhibit knowledge of basic expressions (e.g., identify an expression for a total as $b + g$).
- Solve equations in the form $x + a = b$, where a and b are whole numbers or decimals.
- Substitute whole numbers for unknown quantities to evaluate expressions.
- Solve one-step equations having integer or decimal answers.
- Combine like terms (e.g., $2x + 5x$).
- Evaluate algebraic expressions by substituting integers for unknown quantities.
- Add and subtract simple algebraic expressions.
- Solve routine first-degree equations.
- Perform straightforward word-to-symbol translations.
- Multiply two binomials.*

- Solve real-world problems using first-degree equations.
- Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions).
- Identify solutions to simple quadratic equations.
- Add, subtract, and multiply polynomials.*
- Factor simple quadratics (e.g., the difference of squares and perfect square trinomials).*
- Solve first-degree inequalities that do not require reversing the inequality sign.*
- Manipulate expressions and equations.
- Write expressions, equations, and inequalities for common algebra settings.
- Solve linear inequalities that require reversing the inequality sign.
- Solve absolute value equations.
- Solve quadratic equations.
- Find solutions to systems of linear equations.
- Write expressions that require planning and/or manipulating to accurately model a situation.
- Write equations and inequalities that require planning, manipulating, and/or solving.
- Solve simple absolute value inequalities.

M5 Graphical Representations

- Identify the location of a point with a positive coordinate on the number line.
- Locate points on the number line and in the first quadrant.
- Locate points in the coordinate plane.
- Comprehend the concept of length on the number line.*
- Exhibit knowledge of slope.*
- Identify the graph of a linear inequality on the number line.*
- Determine the slope of a line from points or equations.*
- Match linear graphs with their equations.*
- Find the midpoint of a line segment.*
- Interpret and use information from graphs in the coordinate plane.
- Match number line graphs with solution sets of linear inequalities.
- Use the distance formula.
- Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point.
- Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle).†
- Match number line graphs with solution sets of simple quadratic inequalities.
- Identify characteristics of graphs based on a set of conditions or on a general equation such as y = ax2 + c.
- Solve problems integrating multiple algebraic and/or geometric concepts.
- Analyze and draw conclusions based on information from graphs in the coordinate plane.

M6 Properties of Plane Figures

- Exhibit some knowledge of the angles associated with parallel lines.
- Find the measure of an angle using properties of parallel lines.
- Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°).
- Use several angle properties to find an unknown angle measure.
- Recognize Pythagorean triples.*
- Use properties of isosceles triangles.*
- Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles.
- Use the Pythagorean theorem.
- Draw conclusions based on a set of conditions.
- Solve multistep geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas.
- Use relationships among angles, arcs, and distances in a circle.

M7Measurement

- Estimate or calculate the length of a line segment based on other lengths given on a geometric figure.
- Compute the perimeter of polygons when all side lengths are given.
- Compute the area of rectangles when whole number dimensions are given.
- Compute the area and perimeter of triangles and rectangles in simple problems.
- Use geometric formulas when all necessary information is given.
- Compute the area of triangles and rectangles when one or more additional simple steps are required.
- Compute the area and circumference of circles after identifying necessary information.
- Compute the perimeter of simple composite geometric figures with unknown side lengths.*
- Use relationships involving area, perimeter, and volume of geometric figures to compute another measure.
- Use scale factors to determine the magnitude of a size change.
- Compute the area of composite geometric figures when planning or visualization is required.

M8Functions

- Evaluate quadratic functions, expressed in function notation, at integer values.
- Evaluate polynomial functions, expressed in function notation, at integer values.†
- Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths.†
- Evaluate composite functions at integer values.†
- Apply basic trigonometric ratios to solve right-triangle problems.†
- Write an expression for the composite of two simple functions.†
- Use trigonometric concepts and basic identities to solve problems.†
- Exhibit knowledge of unit circle trigonometry.†
- Match graphs of basic trigonometric functions with their equations.

Notes

- Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.
- Standards followed by an asterisk (*) apply to the PLAN and ACT Mathematics tests only.
- Standards followed by a dagger (†) apply to the ACT Mathematics test only.

Reading

R1 Main Ideas and Author's Approach

- Recognize a clear intent of an author or narrator in uncomplicated literary narratives.
- Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in uncomplicated passages.
- Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages.
- Infer the main idea or purpose of straightforward paragraphs in more challenging passages.
- Summarize basic events and ideas in more challenging passages.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in more challenging passages.
- Infer the main idea or purpose of more challenging passages or their paragraphs.
- Summarize events and ideas in virtually any passage.
- Understand the overall approach taken by an author or narrator (e.g., point of view, kinds of evidence used) in virtually any passage.
- Identify clear main ideas or purposes of complex passages or their paragraphs.

R2 Supporting Details

- Locate basic facts (e.g., names, dates, events) clearly stated in a passage.
- Locate simple details at the sentence and paragraph level in uncomplicated passages.
- Recognize a clear function of a part of an uncomplicated passage.
- Locate important details in uncomplicated passages.
- Make simple inferences about how details are used in passages.
- Locate important details in more challenging passages.
- Locate and interpret minor or subtly stated details in uncomplicated passages.
- Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages.
- Locate and interpret minor or subtly stated details in more challenging passages.
- Use details from different sections of some complex informational passages to support a specific point or argument.

- Locate and interpret details in complex passages.
- Understand the function of a part of a passage when the function is subtle or complex.

R3 Sequential, Comparative, and Cause–Effect Relationships

- Determine when (e.g., first, last, before, after) or if an event occurred in uncomplicated passages.
- Recognize clear cause–effect relationships described within a single sentence in a passage.
- Identify relationships between main characters in uncomplicated literary narratives.
- Recognize clear cause–effect relationships within a single paragraph in uncomplicated literary narratives.
- Order simple sequences of events in uncomplicated literary narratives.
- Identify clear relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear cause–effect relationships in uncomplicated passages.
- Order sequences of events in uncomplicated passages.
- Understand relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear relationships between characters, ideas, and so forth in more challenging literary narratives.
- Understand implied or subtly stated cause–effect relationships in uncomplicated passages.
- Identify clear cause–effect relationships in more challenging passages.
- Order sequences of events in more challenging passages.
- Understand the dynamics between people, ideas, and so forth in more challenging passages.
- Understand implied or subtly stated cause–effect relationships in more challenging passages.
- Order sequences of events in complex passages.
- Understand the subtleties in relationships between people, ideas, and so forth in virtually any passage.
- Understand implied, subtle, or complex cause–effect relationships in virtually any passage.

R4 Meaning of Words

- Understand the implication of a familiar word or phrase and of simple descriptive language.
- Use context to understand basic figurative language.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages.
- Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages.

- Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts.
- Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage.

R5 Generalizations and Conclusions

- Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives.
- Draw simple generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw simple generalizations and conclusions using details that support the main points of more challenging passages.
- Draw subtle generalizations and conclusions about characters, ideas, and so forth in uncomplicated literary narratives.
- Draw generalizations and conclusions about people, ideas, and so forth in more challenging passages.
- Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so forth.
- Draw complex or subtle generalizations and conclusions about people, ideas, and so forth, often by synthesizing information from different portions of the passage.
- Understand and generalize about portions of a complex literary narrative.

Science

S1 Interpretation of Data

- Select a single piece of data (numerical or non-numerical) from a simple data presentation (e.g., a table or graph with two or three variables, a food web diagram).
- Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, axis labels).
- Select two or more pieces of data from a simple data presentation.
- Understand basic scientific terminology.
- Find basic information in a brief body of text.
- Determine how the value of one variable changes as the value of another variable changes in a simple data presentation.
- Select data from a complex data presentation (e.g., a table or graph with more than three variables, a phase diagram).
- Compare or combine data from a simple data presentation (e.g., order or sum data from a table).
- Translate information into a table, graph, or diagram.
- Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table).

- Compare or combine data from a complex data presentation.
- Interpolate between data points in a table or graph.
- Determine how the value of one variable changes as the value of another variable changes in a complex data presentation.
- Identify and/or use a simple (e.g., linear) mathematical relationship between data.
- Analyze given information when presented with new, simple information.
- Compare or combine data from a simple data presentation with data from a complex data presentation.
- Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data.
- Extrapolate from data points in a table or graph.
- Compare or combine data from two or more complex data presentations.
- Analyze given information when presented with new, complex information.

S2 Scientific Investigation

- Understand the methods and tools used in a simple experiment.
- Understand the methods and tools used in a moderately complex experiment.
- Understand a simple experimental design.
- Identify a control in an experiment.
- Identify similarities and differences between experiments.
- Understand the methods and tools used in a complex experiment.
- Understand a complex experimental design.
- Predict the results of an additional trial or measurement in an experiment.
- Determine the experimental conditions that would produce specified results.
- Determine the hypothesis for an experiment.
- Identify an alternate method for testing a hypothesis.
- Understand precision and accuracy issues.
- Predict how modifying the design or methods of an experiment will affect results.
- Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results.

S3 Evaluation of Models, Inferences, and Experimental Results

- Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model.
- Identify key issues or assumptions in a model.
- Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a simple hypothesis or conclusion and why.
- Identify strengths and weaknesses in one or more models.
- Identify similarities and differences between models.
- Determine which model(s) is/are supported or weakened by new information.
- Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion.

- Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model.
- Determine whether new information supports or weakens a model and why.
- Use new information to make a prediction based on a model.
- Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a complex hypothesis or conclusion and why.

Writing

W1 Expressing Judgments

- Show a little understanding of the persuasive purpose of the task, but neglect to take or to maintain a position on the issue in the prompt.
- Show limited recognition of the complexity of the issue in the prompt.
- Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt but may not maintain that position.
- Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position.
- Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt.
- Show some recognition of the complexity of the issue in the prompt by doing the following:
    - Acknowledging counterarguments to the writer's position
    - Providing some response to counterarguments to the writer's position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion.
- Show recognition of the complexity of the issue in the prompt by doing the following:
    - Partially evaluating implications and/or complications of the issue
    - Posing and partially responding to counterarguments to the writer's position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion.
- Show understanding of the complexity of the issue in the prompt by doing the following:
    - Examining different perspectives
    - Evaluating implications or complications of the issue
    - Posing and fully discussing counterarguments to the writer's position

W2 Focusing on the Topic

- Maintain a focus on the general topic in the prompt through most of the essay.
- Maintain a focus on the general topic in the prompt throughout the essay.
- Maintain a focus on the general topic in the prompt throughout the essay, and attempt a focus on the specific issue in the prompt.
- Present a thesis that establishes focus on the topic.
- Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay.

- Present a thesis that establishes a focus on the writer's position on the issue.
- Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay.
- Present a critical thesis that clearly establishes the focus on the writer's position on the issue.

W3 Developing a Position

- Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas.
- Show little or no movement between general and specific ideas and examples.
- Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas.
- Show little movement between general and specific ideas and examples.
- Develop ideas by using some specific reasons, details, and examples.
- Show some movement between general and specific ideas and examples.
- Develop most ideas fully, using some specific and relevant reasons, details, and examples.
- Show clear movement between general and specific ideas and examples.
- Develop several ideas fully, using specific and relevant reasons, details, and examples.
- Show effective movement between general and specific ideas and examples.

W4 Organizing Ideas

- Provide a discernible organization with some logical grouping of ideas in parts of the essay.
- Use a few simple and obvious transitions.
- Present a discernible, though minimally developed, introduction and conclusion.
- Provide a simple organization with logical grouping of ideas in parts of the essay.
- Use some simple and obvious transitional words, though they may at times be inappropriate or misleading.
- Present a discernible, though underdeveloped, introduction and conclusion.
- Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas.
- Use some simple and obvious, but appropriate, transitional words and phrases.
- Present a discernible introduction and conclusion with a little development.
- Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas.
- Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas.
- Present a somewhat developed introduction and conclusion.
- Provide unity and coherence throughout the essay, often with a logical progression of ideas.
- Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas.

- Present a well-developed introduction and conclusion.

W5 Using Language

- Show limited control of language by doing the following:
    - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes significantly impede understanding
    - Using simple vocabulary
    - Using simple sentence structure
    - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes impede understanding
    - Using simple but appropriate vocabulary
    - Using a little sentence variety, though most sentences are simple in structure
    - Correctly employing many of the conventions of standard English grammar, usage, and mechanics but with some distracting errors that may occasionally impede understanding
    - Using appropriate vocabulary
    - Using some varied kinds of sentence structures to vary pace
    - Correctly employing most conventions of standard English grammar, usage, and mechanics with a few distracting errors but none that impede understanding
    - Using some precise and varied vocabulary
    - Using several kinds of sentence structures to vary pace and to support meaning
    - Correctly employing most conventions of standard English grammar, usage, and mechanics with just a few, if any, errors
    - Using precise and varied vocabulary
    - Using a variety of kinds of sentence structures to vary pace and to support meaning

Appendix D: Pathway Content Standards

ADDA International

ADDA International Crosswalk for Architecture and Drafting											
	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Architectural Apprentice Drafter											
PDC		X									
DEM			X			X					
ASO			X		X	X	X			X	
LLT			X	X		X	X	X		X	X
MAG			X		X		X	X	X	X	X
APS							X			X	X
LIT											X
INM			X		X	X	X	X		X	
DAN								X		X	X
FPL											
HPE											
RPI											
ELE											
FFP											
FPL											
SSS									X		
BCG											
SDW											
ESC											
DBM											

	Units	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Architectural Apprentice Drafter						
PDC						X
DEM						
ASO						
LLT						
MAG		X	X	X	X	
APS						
LIT				X	X	
INM						
DAN					X	
FPL						
HPE					X	
RPI				X		
ELE				X		
FFP				X		
FPL				X		
SSS				X		
BCG				X	X	
SDW				X		
ESC			X			
DBM			X			

Mechanical Apprentice Drafter						
ATI		X				
DMR		X				
SLG		X				
DAN		X				
OPI		X				
GCD		X				
GDT		X				
DIN		X				
PDC						X

Architectural Apprentice Drafter *

PDC. Professional Drafting Practices in the Workplace – Communications

DEM. Drafting Equipment – Media – Reproduction

ASO. Architectural Sketching – Orthographic Projection

LLT. Lines – Lettering – General Terminology

MAG. Mathematics and Geometry

APS. Architectural Products – Styles – History – Identification and Terminology

LIT. Site Layout – Identifications and Terminology

INM. Drawing Identification – Architectural Numbering – Drawing Management

DAN. Dimensioning and Notations

FPL. Floor Plan Layout – Relationships – Identification and Terminology

HPE. HVAC – Plumbing – Electrical Plans – Identification and Terminology

RPI. Roof Plans – Identification and Terminology

ELE. Elevations

FFP. Framing – Framing Plans – Identification and Terminology

FPI. Foundation Plans – Identification and Terminology

SSS. Sections, Stairs and Steps

BCG. Building Codes and Governing Bodies

SDW. Schedules – Doors – Windows – Finishes

ESC. Estimations – Specifications – Calculations

DBM. Definitions and Building Materials

Mechanical Apprentice Drafter *

ATI. Abbreviations – Terms – Identification

DMR. Drafting Equipment – Media – Reproduction

SLG. Shapes – Lettering – Geometric Symbology

DAN. Dimensioning and Notations

OPI. Orthographic Projections – Identification and Terminology

GCD. Geometric Construction and Descriptive Geometry

GDT. Basic Tolerancing – GD&T

MAG. Basic Math and Geometry – Drafting Math

DIN. Drawing Implementation - Identification – Numbering – Drawing Management

PDC. Professional Drafting Practices in the Workplace – Communications

Appendix E: National Educational Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

T1 Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:

a. Apply existing knowledge to generate new ideas, products, or processes.
b. Create original works as a means of personal or group expression.
c. Use models and simulations to explore complex systems and issues.
d. Identify trends and forecast possibilities.

T2 Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
c. Develop cultural understanding and global awareness by engaging with learners of other cultures.
d. Contribute to project teams to produce original works or solve problems.

T3 Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students do the following:

a. Plan strategies to guide inquiry.
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
d. Process data and report results.

T4 Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students do the following:

a. Identify and define authentic problems and significant questions for investigation.

b. Plan and manage activities to develop a solution or complete a project.
c. Collect and analyze data to identify solutions and/or make informed decisions.
d. Use multiple processes and diverse perspectives to explore alternative solutions.

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:

a. Advocate and practice safe, legal, and responsible use of information and technology.
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. Demonstrate personal responsibility for lifelong learning.
d. Exhibit leadership for digital citizenship.

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:

a. Understand and use technology systems.
b. Select and use applications effectively and productively.
c. Troubleshoot systems and applications.
d. Transfer current knowledge to learning of new technologies.