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2014 Food Products (Meats)

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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Acknowledgments

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Dr. Lynn House, Interim State Superintendent of Education
Dr. O. Wayne Gann, Chair
Mr. Howell "Hal" N. Gage, Vice Chair
Ms. Kami Bumgarner
Mr. William Harold Jones
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Mr. Charles McClelland
Mr. Richard Morrison
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Mr. Simon F. Weir, II

Jean Massey, Associate Superintendent of Education for the Office of Career and Technical Education, at the Mississippi Department of Education assembled a taskforce committee to provide input throughout the development of the Food Products (Meats) *Curriculum Framework and Supporting Materials.*

Lemond Irvin, Instructional Design Specialist for the Research and Curriculum Unit at Mississippi State University researched and authored this framework.
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Lee James, Program Coordinator, Office of Career and Technical Education and Workforce Development, Mississippi Department of Education, Jackson, MS
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Standards

Standards are superscripted in each unit and are referenced in the appendices. Standards in the Food Products (Meats) *Curriculum Framework and Supporting Materials* are based on the following:

National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards

The National AFNR Career Cluster Content Standards were developed by the National Council on Agricultural Education to serve as a guide for what students should know or be able to do through a study of agriculture in grades 9–12 and 2-year postsecondary programs. The standards were extensively researched and reviewed by leaders in the agricultural industry, secondary and postsecondary instructors, and university specialists. The standards consist of a pathway content standard for each of the eight career pathways. For each content standard, performance elements representing major topic areas with accompanying performance indicators were developed. Measurements of assessment of the performance elements and performance indicators were developed at the basic, intermediate, and advanced levels. A complete copy of the standards can be accessed at https://aged.learn.com. The National AFNR Career Cluster Content Standards are copyrighted to the National Council for Agricultural Education and are used by permission.

Common Core State Standards Initiative

The Common Core State Standards© provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy. Copyright 2010. National Governors Association Center for Best Practices and Council of Chief State School Officers. All rights reserved. States and territories of the United States as well as the District of Columbia that have adopted the Common Core State Standards in whole are exempt from this provision and no attribution to the National Governors Association Center for Best Practices and Council of Chief State School Officers is required. Reprinted from http://www.corestandards.org/.

National Educational Technology Standards for Students

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21st Century Skills and Information and Communication Technologies Literacy Standards

In defining 21st century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and Information and Communication Technology (ICT) literacy.

Preface

Secondary career and 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 IV, 2007; and No Child Left Behind Act of 2001).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers.

Curriculum, Assessment, Professional Learning, and other program resources can be found at The Research and Curriculum Unit's website: http://www.rcu.msstate.edu

Learning Management System: An online resource

Learning Management System information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, please call 662.325.2510.

My PLC: An online registration for all professional-development sessions

To register for any session, teachers will need an account in the registration system, MyPLC, https://myplc.rcu.msstate.edu. To create an account, click on the link and navigate to the "Request a Guest ID" link. The ID should be the teacher's first initial and last name and the last four (4) digits of the social security number. Teachers should complete the entire form, which will then be sent to a secure server. Upon activation of the teacher's account, he or she will receive an e-mail with login instructions. The teacher may then browse for the available sessions and register for the desired courses.

Should you need additional instructions, please call 662.325.2510.

Executive Summary

Pathway Description

Food Products (Meats) is an instructional program that orients an individual to the field of meat processing, marketing, and merchandising. This course allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include careers, leadership, and orientation; safety, sanitation, equipment, and facility maintenance; livestock slaughter procedures; and pricing, wrapping, and marketing meats.

Industry Certification

Competencies and suggested performance indicators in the Food Products (Meats) course have been correlated, to the National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards. The AFNR standards have been reviewed and endorsed at the national level by the National Council on Agricultural Education.

Assessment

The latest assessment blueprint for the curriculum can be found at http://www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Student Prerequisites

In order for students to be able to experience success in the Food Products (Meats) program, the following student prerequisites are suggested:

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)
3. Instructor Approval and TABE Reading Score (eighth grade or higher)

or

1. TABE Reading Score (eighth grade or higher)
2. Instructor Approval

or

1. Instructor Approval

Teacher Licensure

The latest teacher licensure information can be found at

http://www.mde.k12.ms.us/educator-licensure

Professional Learning

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 One-Carnegie-Unit Courses

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

1. **Food Products (Meats): Fundamentals—Course Code: 991202**
2. **Food Products (Meats): Custom Operations—Course Code: 991203**
3. **Food Products (Meats): Basic Meats Processing—Course Code: 991204**
4. **Food Products (Meats): Advanced Meats Processing—Course Code: 991205**

Course Description: **Food Products (Meats): Fundamentals**

This option allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include orientation to meat processing, safety, sanitation, equipment, and facility maintenance.

Course Description: **Food Products (Meats): Custom Operations**

This option allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include custom livestock slaughter, pricing, wrapping, and marketing.

Course Description: Food Products (Meats): Basic Meats Processing

This option allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include identification and fabrication of carcass beef, box pork, carcass lamb and goat.

Course Description: Food Products (Meats): Advanced Meats Processing

This option allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include identification and fabrication of

poultry and fish wild game, automated processing of meats quality and yield grading, curing, smoking, and sausage making.

Food Products (Meats): Fundamentals—Course Code: 991202

Unit	Unit Name	Hours
1	Careers and Leadership	35
2	Orientation to Meat Processing	15
3	Safety, Sanitation, Equipment, and Facility Maintenance	75
Total		125

Food Products (Meats): Custom Operations—Course Code: 991203

Unit	Unit Name	Hours
4	Custom Livestock Slaughter	40
5	Pricing, Wrapping, and Marketing	23
6	Special Topics in Food Products (Meats) I	32
Total		95

Food Products (Meats): Basic Meats Processing—Course Code: 991204

Unit	Unit Name	Hours
7	Identification and Fabrication of Carcass and Box Beef	60
8	Identification and Fabrication of Carcass and Box Pork	37
9	Identification and Fabrication of Carcass Lamb and Goat	15
Total		112

Food Products (Meats): Advanced Meats Processing—Course Code: 991205

Unit	Unit Name	Hours
10	Identification and Fabrication of Poultry and Fish	10
11	Identification and Fabrication of Wild Game	20
12	Automated Processing of Meats	10
13	Quality and Yield Grading	20
14	Curing, Smoking, and Sausage Making	20
15	Special Topics in Food Products (Meats) II	20
Total		100

Option 2—Two Two-Carnegie-Unit Courses

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

1. **Food Products (Meats) I—Course Code: 991200**
2. **Food Products (Meats)II—Course Code: 991201**

Course Description: **Food Products (Meats) I**

Food Products (Meats) I is an instructional program that orients an individual to the field of meat processing, marketing, and merchandising. This course allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include careers, leadership, and orientation, safety, sanitation, equipment, and facility maintenance, livestock slaughter procedures, and pricing, wrapping, and marketing meats.

Course Description: **Food Products (Meats) II**

Food Products (Meats) II is a continuation of Food Products (Meats) I. This course allows an individual to prepare for employment or continued education in the meat cutting, packing, and processing professions. Topics include meat cutting, automated processing, quality and yield grading, and curing, smoking, and sausage making.

Food Products (Meats) I—Course Code: 991200

Unit	Unit Name	Hours
1	Careers and Leadership	35
2	Orientation to Meat Processing	15
3	Safety, Sanitation, Equipment, and Facility Management	75
4	Custom Livestock Slaughter	40
5	Pricing, Wrapping, and Marketing	23
6	Special Topics in Food Products (Meats) I	32
Total		220

Food Products (Meats) II—Course Code: 991201

Unit	Unit Name	Hours
7	Identification and Fabrication of Carcass and Box Beef	60
8	Identification and Fabrication of Carcass and Box Pork	37
9	Identification and Fabrication of Carcass Lamb and Goat	15
10	Identification and Fabrication of Poultry and Fish	10
11	Identification and Fabrication of Wild Game	20
12	Automated Processing of Meats	10
13	Quality and Yield Grading	20
14	Curing, Smoking, and Sausage Making	20
15	Special Topics in Food Products (Meats) II	20
Total		212

Research Synopsis

Introduction

The Food Products (Meats) Cluster curriculum prepares students for various occupations involving food science and meat processing. The occupations listed below are all projected to grow by at least 10% by 2020 (US Bureau of Labor Statistics, 2010). Within the Manufacturing industry sector, Meat, Poultry, and Fish Cutters and Trimmers is listed as the fastest growing occupation while Slaughterers and Meat Packers is listed as the third fastest growing occupation (US Bureau of Labor Statistics, 2010). Food Preparation Workers is also listed in the top ten fastest growing occupations in the Accommodation and Food Services industry sector (US Bureau of Labor Statistics, 2010).

Needs of the Future Workforce

These statistics bode well for students who are preparing to enter the workforce after completion of this program. This industry offers competitive and growing job opportunities for the incoming workforce within the state of Mississippi. Not only are these occupations growing within the state, but they are all projected to grown nationwide, as well.

Source: US Bureau of Labor Statistics, 2010

Description	Current Jobs (2010)	Projected Jobs (2020)	Change (Number)	Change (Percent)	Median Hourly Earning
Butchers and Meat Cutters	13	15	2	15.00	$12
Food Preparation Workers	11,410	12,563	1,153	10.00	$8
Food Scientists and Technologists	40	48	8	20.00	$22
Meat, Poultry, Fish Cutters and Trimmers	185	216	31	17.00	$10
Slaughterers and Meat Packers	4,030	4,719	689	17.00	$9

Perkins IV Requirements

The Food Products (Meats) curriculum meets Perkins IV requirements of high-skill, high-wage, and/or high-demand occupations by introducing students to and preparing students for occupations. It also offers students a program of study including secondary, postsecondary, and IHL courses that will prepare them for occupations in these fields. Additionally, the Food Products (Meats) curriculum is integrated with academic common core standards. Lastly, the Food Products (Meats) curriculum focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Curriculum Content

Summary of Standards

The standards to be included in the Food Products (Meats) curriculum are the Common Core Standards for Mathematics and Science, 21st Century Skills, and the National Educational Technology Standards (NETS) for Students. Combining these standards to create this document will result in highly skilled, well-rounded students who are prepared to enter a secondary academic or career and technical program of study. They will also be prepared to academically compete nationally as the Common Core Standards are designed to prep students for success in community colleges, Institutions of Higher Learning and careers.

Academic Credit

If academic credit is awarded, please review the Research and Curriculum Unit link at https://www.rcu.msstate.edu/MDE/PathwaystoSuccess.aspx.

Click "*Curriculum Enhancement List"*. Check this site often as it is updated frequently.

Transition to Postsecondary Education

The latest articulation information for Secondary to Postsecondary can be found at the Mississippi Community College Board (MCCB) website http://www.mccb.edu/

Best Practices

Experiential Learning (SAE)

The Experiential Learning (SAE) has long been and continues to be the backbone of every agriculture program. The experiential learning projects can be used in a variety of situations to reinforce and compliment classroom theory and content. The experiential learning project consists of entrepreneurship, placement, research/experimentation and exploratory.

Innovative Instructional Technologies

Recognizing that today's students are digital learners, the classroom should be equipped with tools that will teach them in the way they need to learn. The Food Products (Meats) teacher's goal should be to include teaching strategies that incorporate current technology. It is suggested that each classroom house a classroom set of desktop student computers and one teacher laptop. To make use of the latest online communication tools such as wikis, blogs, and podcasts, the classroom teacher is encouraged to use a learning management system, for example, the Agriculture Teacher Learning Content Management System, that introduces students to education in an online environment and places the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways. Some are visual learners, needing only to read information and study it to succeed. Others are auditory learners, thriving best when information is read aloud to them. Still others are tactile learners, needing to participate actively in their learning experiences. Add the student's background, emotional health, and circumstances, and a very unique learner emerges. Many activities are graded by rubrics that allow students to choose

the type of product they will produce. By providing various teaching and assessment strategies, students with various learning styles can succeed.

Career and Technical Education Student Organizations

Teachers should investigate opportunities to sponsor a student organization. There are several here in Mississippi that will foster the types of learning expected from the Food Products (Meats) curriculum. The FFA is the student's organization for Food Products (Meats). The FFA provides students with growth opportunities and competitive events. It also opens the doors to the world of agriculture and scholarships opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Food Products (Meats) curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Food Products (Meats) curriculum provides opportunities for students to work together and help each other to complete complex tasks.

Conclusions

Students that complete the Food Products (Meats) programs are well equipped for a variety of endeavors. Instructors are urged to encourage Food Products (Meats) students to pursue educational opportunities at community colleges and universities in Mississippi.

Professional Organizations

American Association for Agricultural Education. May be found at http://aaaeonline.org/

Mississippi ACTE. May be found at http://www.mississippiacte.com/

Mississippi FFA/ Mississippi Association of Vocational Agriculture Teachers (MAVAT).May be found at www.mississippiffa.org

National FFA Organization
P.O. Box 68960, 6060 FFA Drive
Indianapolis, IN 46268
317-802-6060
http://www.ffa.org

National Association of Agricultural Educators
300 Garrigus Building- University of Kentucky
Lexington, KY 40546
800 - 509 - 0204
http://www.naae.org/

Using this Document

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% 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.

Integrated Academic Topics, 21st Century Skills and Information and Communication Technology Literacy Standards, ACT College Readiness Standards, and Technology Standards for Students
This section identifies related academic topics as required in the Subject Area Testing Program (SATP) in Algebra I, Biology I, English II, and U.S. History from 1877, which are integrated into the content of the unit. Research-based teaching strategies also incorporate ACT College Readiness standards. This section also identifies the 21st Century Skills and Information and Communication Technology Literacy skills. In addition, national technology standards for students associated with the competencies and suggested objectives for the unit are also identified.

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.

Unit 1: Careers and Leadership

Competencies and Suggested Objectives
1. Identify career opportunities in meat cutting, packing, and processing professions. DOK1, AF a. Define meat cutter. b. Research the major categories of job classifications in the meat cutting, packing, and processing profession.
2. Identify the leadership opportunities and activities which are beneficial to students in meat cutting, packing, and processing. DOK1, AF a. Identify and describe leadership opportunities available from student youth organizations in the school and community, including FFA and 4-H. b. Describe activities available to students in meat cutting, packing, and processing programs including leadership development, competitions, club meetings, fund raisers, field trips, elected office leadership positions, and service projects.

Scenario

Unit 1

The Future President

You are the FFA president and need to present to a group of junior- high students on the FFA. Prepare a 2-3 minute speech on the benefits of FFA. Prepare the speech according to the FFA guidelines for speeches (impromptu, extemporaneous, etc.) The class will peer review the speech and discuss clarity and content.

Attachments for Performance Task

Use Oral Report Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 2: Orientation to Meat Processing

Competencies and Suggested Objectives
1. Explain trends in slaughtering and processing in the past and in the future. DOK2, AF a. Compare trends in slaughtering and processing in the past 20 years and in the future. b. Discuss emerging technologies related to slaughtering and meat processing.
2. Describe factors affecting consumer food spending. DOK2, AF a. Describe factors affecting consumer food spending to include income, geographic area, ethnic group, and religious group. b. Discuss biological health hazards affecting consumer spending.

Scenario

Unit 2

Market Street

You just bought a retail meat market that is outdated. You need to research current trends and technologies in order to meet consumer demands and make your shop successful.

Attachments for Performance Task

Use Written Report Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 3: Safety, Sanitation, Equipment, and Facility Maintenance

Competencies and Suggested Objectives
1. Explain general meat laboratory safety requirements. DOK2, AF a. List and practice safety rules and procedures. b. Use meat processing equipment safely.
2. Discuss sanitation as it applies to a meat cutting facility. DOK2, AF a. Describe sanitary operations of a meat cutting facility. b. Describe state and federal inspection guidelines as they apply to meat processing facilities, including ways to avoid fecal contamination. c. Identify correct temperatures for meat processing and storage and explain the importance of each. d. Describe the benefits of a rail system. e. Select and use proper aprons, disposable gloves, hard hats, eye protection, hair nets, rubber boots, etc. f. Disinfect aprons and rubber boots after each use.
3. Discuss federal regulations relating to meat processing. DOK2, AF a. Discuss HACCP (Hazards Analysis Critical Control Point) as a method to prevent foodborne illness. b. Discuss the role of the USDA Food Safety and Inspection Service relating to quality assurance.
4. Identify and use equipment for meat cutting, packing, and processing. DOK2, AF a. Identify equipment used in a meat laboratory including a band saw, grinder, mixer, tenderizer, slicing machine, stuffer, and pickle pump. b. Assemble and disassemble equipment including band saw, grinder, mixer, tenderizer, slicing machine, stuffer, and pickle pump. c. Identify, use, and sanitize other meat cutting equipment including knives, knife sharpener, steel and hone, stockinette, dead lock and tag, scales and weighing items, vacuum packer, salinometer, squeegee equipment, patty machine, heat seal, cooler, freezer, rail system, tables, immobilizer, hoist, dehairing machine, skinning knife, and carcass split saw. d. Use sterilizer for knives and steel.
5. Demonstrate equipment maintenance used in a meat cutting facility. DOK2, AF a. Maintain a sharp knife including boning and butcher knives. b. Perform equipment and maintenance procedures for grinder, slicer, and band saw. c. Use proper disinfection procedures for cleaning tables after use. d. Demonstrate proper hand washing procedure before and after working in the meat cutting laboratory.
6. Maintain a safe and sanitary facility. DOK2, AF

a. Wash and disinfect walls and floors.
b. Maintain a safe environment by wiping up spills, keeping aisles clear, and performing other tasks.

Scenario

Unit 3

Safety and Sanitation

As the owner of a new meat market, the meat inspectors are giving you a hard time because you do not have any safety or sanitation plans in place. You need to develop a HACCP plan to ensure your shop is safe and clean to get the meat inspectors off your back!

Attachments for Performance Task

See the Written Report Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 4: Custom Livestock Slaughter

Competencies and Suggested Objectives
1. Explain terms and procedures associated with livestock slaughter. DOK2, AF a. Define terms and procedures associated with the slaughter of beef. b. Define terms and procedures associated with the slaughter of swine. c. Define terms and procedures associated with the slaughter of lamb and goat. d. Define terms and procedures associated with the slaughter of poultry. e. Define terms and procedures associated with the slaughter of fish. f. Define terms and procedures associated with dressing of wild game. g. Discuss the difference between antemortem and postmortem inspection.
2. Discuss types, cleaning, use, and maintenance of slaughter facility and equipment. DOK2, AF a. Identify equipment including immobilizer, skinning knives, rails and rail hooks, scales, dehairing machine, hoist, and carcass split saw. b. Discuss maintenance of a safe and sanitary facility. c. Identify what constitutes contamination from biologic and toxic sources.
3. Discuss procedures for slaughtering livestock and dressing wild game. DOK2, AF a. Discuss procedures for slaughtering a beef. b. Discuss procedures for slaughtering a swine. c. Discuss procedures for slaughtering a lamb and goat. d. Discuss procedures for dressing wild game. e. Discuss procedures for slaughtering livestock and recognize when to condemn part of a carcass. f. Describe methods of disposing of offal.

Scenario

Unit 4

Why Buy By Products?

As a new owner of a beef slaughter house, you need to find out what you can sell of animal by-products. You need to research what by-products you can sell and the price of their by-products.

Attachments for Performance Task

See the Presentation Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 5: Pricing, Wrapping, and Marketing

Competencies and Suggested Objectives
1. Compare and contrast consumer trends, supply and demand, and the effects on meat prices. DOK2, AF a. Discuss supply and demand and its effects on meat prices. b. Identify current consumer trends.
2. List the steps and perform a cutting test. DOK1, AF a. List the steps in a cutting test. b. Perform a cutting test.
3. Discuss techniques and wrap retail meat. DOK2, AF a. Discuss techniques of wrapping retail meats. b. Wrap and label meat for home freezing. c. Wrap, weigh, label, and price meat for retail sale. d. Describe the proper temperatures for maximum storage life of retail meats using a cooler, display case, or freezer. e. Vacuum seal various cuts of meat.
4. Describe marketing principles related to the display of meat. DOK2, AF a. Describe marketing principles related to the display of meat. b. Describe the effects vacuum sealing has on shelf life of meat.

Scenario

Unit 5

Meat Market-ing

You are working for a large grocery chain in the advertising department. The chain is planning a big sales event next month and they expect you to develop the marketing plan for the meat departments.

Attachments for Performance Task

See the Presentation or Poster Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 6: Special Topics in Food Products (Meats) I

Competencies and Suggested Objectives
1. Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats). DOK3, AF a. Prepare a report on a new and emerging technology associated with Food Products (Meats). b. Prepare a report on a current trend or issue associated with Food Products (Meats).
2. Complete school-to-careers activities related to Food Products (Meats). DOK2, AF a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to Food Products (Meats). b. Investigate educational opportunities related to Food Products (Meats) at the postsecondary level. c. Describe national standards and certification/licensing procedures related to Food Products (Meats). d. Describe the role of trade organizations, associations, and unions as related to Food Products (Meats).
3. Demonstrate related academic skills and workplace skills associated with Food Products (Meats). DOK2, AF a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and Food Products (Meats). b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to Food Products (Meats). c. Research work ethics and employer expectations of employees in Food Products (Meats).
4. Investigate the concepts of quality assurance as related to Food Products (Meats). DOK3, AF a. Describe quality concepts and methods for measuring quality related to Food Products (Meats). b. Apply quality concepts in the Food Products (Meats) laboratory.
5. Examine trends and changes related to Food Products (Meats) and global economic factors. DOK2, AF a. Define and discuss the concept of global economics and competition. b. Describe global economic factors and competition as related to Food Products (Meats). c. Identify regions and other countries which compete in Food Products (Meats).

Scenario

Unit 6

Beef Trends

As a food science worker with a major livestock board, your job is to keep up with current trends affecting the beef industry. You will give a presentation to the group on current trends, technologies, and jobs available in today's market.

Attachments for Performance Task

See the Present Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 7: Identification and Fabrication of Carcass and Box Beef

Competencies and Suggested Objectives
1. Identify and fabricate cuts of beef. DOK2, AF a. Identify carcass break cuts of beef. b. Make retail cuts of round. c. Make retail cuts of loin. d. Make retail cuts of rib. e. Make retail cuts of chuck. f. Make retail cuts of foreshank. g. Make retail cuts of brisket. h. Make retail cuts of plate. i. Make retail cuts of flank.
2. Identify and fabricate variety cuts of beef. DOK2, AF a. Make retail cuts of tongue. b. Make retail cuts of heart. c. Make retail cuts of liver. d. Make retail cuts of kidney. e. Make retail cuts of brain.

Scenario

Unit 7

Poster Worker

You are the market manager at the local grocery store. You have just hired a new meat cutter, but you need to know how much she knows about cutting meat. You will need to develop a poster of retail cuts of beef to ensure your new butcher knows these cuts.

Attachments for Performance Task

See the Poster Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 8: Identification and Fabrication of Carcass and Box Pork

Competencies and Suggested Objectives
1. Identify and fabricate cuts of pork. DOK2, AF a. Identify carcass break cuts of pork. b. Make retail cuts of ham. c. Make retail cuts of loin. d. Make retail cuts of shoulder (Boston butt and picnic). e. Make retail cuts of side.
2. Identify and fabricate retail variety cuts of pork. DOK2, AF a. Make retail cuts of tongue. b. Make retail cuts of liver. c. Make retail cuts of chitterlings. d. Make retail cuts of stomach. e. Make retail cuts of kidneys. f. Make retail cuts of snouts.

Scenario

Unit 8

Poster Worker

You are the market manager at the local grocery store. You have just hired a new meat cutter, but you need to know how much she knows about cutting meat. You will need to develop a poster of retail cuts of beef to ensure your new butcher knows these cuts.

Attachments for Performance Task

See the Poster Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 9: Identification and Fabrication of Carcass Lamb and Goat

Competencies and Suggested Objectives
1. Identify and fabricate cuts of lamb and goat. DOK2, AF a. Identify carcass break cuts of lamb and goat. b. Identify retail cuts of leg. c. Identify retail cuts of loin. d. Identify retail cuts of rib. e. Identify retail cuts of shoulder. f. Identify retail cuts of foreshank and breast.

Scenario

Unit 9

Poster Worker

You are the market manager at the local grocery store. You have just hired a new meat cutter, but you need to know how much she knows about cutting meat. You will need to develop a poster of retail cuts of beef to ensure your new butcher knows these cuts.

Attachments for Performance Task

See the Poster Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 10: Identification and Fabrication of Poultry and Fish

Competencies and Suggested Objectives
1. Identify and fabricate cuts of poultry. DOK2, AF a. Identify carcass break cuts of poultry. b. Make retail cuts of breast quarter. c. Make retail cuts of leg quarter. d. Make retail cuts of back quarter.
2. Identify variety cuts of poultry. DOK2, AF a. Identify retail cuts of heart. b. Identify retail cuts of liver. c. Identify retail cuts of gizzard. d. Identify retail cuts of neck.
3. Identify retail cuts of fish. DOK2, AF

Scenario

Unit 10

Fry Cook

You have been asked to demonstrate the correct way of cutting up a chicken for frying. You will be presenting this to a local home economist group. Develop a presentation using visuals.

Attachments for Performance Task

See the Presentation Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 11: Identification and Fabrication of Wild Game

Competencies and Suggested Objectives
1. Identify and fabricate cuts of wild game. DOK2, AF a. Make cuts of top round. b. Make cuts of bottom round. c. Make cuts of tip roast. d. Make cuts of eye round. e. Make cuts of loin eye. f. Make cuts of ribs. g. Debone front shoulders.
2. Prepare wild game specialty products. DOK2, AF a. Prepare various sausage products. b. Prepare ground products. c. Prepare jerky products.

Scenario

Unit 11

Deer John

The local wildlife department is making health checks on the local deer herd. They want to take twenty deer out of the population and donate these deer to a local charity. They have asked your meats class to help process these deer. They want you to process as many different products as possible, for example: steaks, roast, and ground products. Please demonstrate how to prepare their deer for this project.

Attachments for Performance Task

See the Presentation Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 12: Automated Processing of Meats

Competencies and Suggested Objectives
1. Observe the automated processing of various types of meat. DOK2, AF a. Observe step-by-step procedures for the automated slaughtering and fabrication processing of beef, pork, lamb, poultry, and fish. b. Observe step-by-step procedures for the automated canning processing of beef, pork, poultry, and fish.

Scenario

Unit 12

Proper Process Plan

You are searching for ways to automate your custom processing plant. As you watch the presentation, keep a journal of how you could incorporate the various systems in your plant. To help, draw diagrams along with your writings.

Attachments for Performance Task

See the Journal Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 13: Quality and Yield Grading

Competencies and Suggested Objectives
1. Explain quality and yield grades for beef and determine classifications of beef. DOK2, AF a. Explain quality grades for beef. b. Explain yield grades of beef. c. Determine classification of beef. d. Estimate amount of kidney fat, pelvic fat, and age. e. Estimate amount of marbling in a ribeye.
2. Explain quality grades and determine classification of pork. DOK2, AF a. Explain quality grades for pork. b. Determine classification of pork.
3. Explain quality and yield grades for lamb and determine classifications of sheep. DOK2, AF a. Explain quality grades of lamb. b. Explain yield grades of lamb. c. Determine classification of sheep.
4. Explain grades in poultry. DOK2, AF a. Explain grades of poultry. b. Discuss poultry classifications.

Scenario

Unit 13

Grade My Ribeye Please

You are the food buyer for a major restaurant chain. You are presented four different high end ribeye steaks to select from for the business. You will evaluate each ribeye, determine the quality grade, and select the best ribeye for your order.

Attachments for Performance Task

See the Job Sheet/Performance Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 14: Curing, Smoking, and Sausage Making

Competencies and Suggested Objectives
1. Explain and demonstrate meat curing and smoking processes. DOK2, AF a. Define curing, smoking, and sausage making terms. b. Describe the functions of curing and smoking. c. Describe meat curing ingredients and calculate correct amount of each. d. Explain methods of meat curing. e. Identify and use equipment used in smoking and curing process. f. Cure bacon in brine solution. g. Cure jowl in brine solution. h. Pump shoulders. i. Pump hams. j. Pump loin. k. Smoke shoulder, ham, loins, bacon, and jowls in smoker.
2. Explain and demonstrate sausage making. DOK2, AF a. Mix and grind sausage with cure and seasoning. b. Read a salinometer. c. Prepare a brine solution. d. Stuff sausage in casing. e. Smoke sausage in smoker.

Scenario

Unit 14

Simply Sausage

You are a well-known sausage maker. Your company is very profitable because of your knowledge and skills. You have decided to take your claim to fame a step farther by creating a "How-to" sausage recipe book. You will need to include: safety, sanitation, curing, stuffing, and smoking procedures.

Attachments for Performance Task

See the Written Report Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Unit 15: Special Topics in Food Products (Meats) II

Competencies and Suggested Objectives
1. Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats). DOK3, AF a. Prepare a report on a new and emerging technology associated with Food Products (Meats). b. Prepare a report on a current trend or issue associated with Food Products (Meats).
2. Complete school-to-careers activities related to Food Products (Meats). DOK2, AF a. Participate in a school-to-careers activity (shadowing, mentoring, career fair, etc.) related to Food Products (Meats). b. Investigate educational opportunities related to Food Products (Meats) at the postsecondary level. c. Describe national standards and certification/licensing procedures related to Food Products (Meats). d. Describe the role of trade organizations, associations, and unions as related to Food Products (Meats).
3. Demonstrate related academic skills and workplace skills associated with Food Products (Meats). DOK2, AF a. Complete a cooperative project (paper, presentation, or demonstration) associated with an academic subject and Food Products (Meats). b. Practice human relations skills (team participation, client/customer service, leadership, negotiation, working with culturally diverse groups, etc.) related to Food Products (Meats). c. Research work ethics and employer expectations of employees in Food Products (Meats).
4. Investigate the concepts of quality assurance as related to Food Products (Meats). DOK3, AF a. Describe quality concepts and methods for measuring quality related to Food Products (Meats). b. Apply quality concepts in the Food Products (Meats) laboratory.
5. Examine trends and changes related to Food Products (Meats) and global economic factors. DOK2, AF a. Define and discuss the concept of global economics and competition. b. Describe global economic factors and competition as related to Food Products (Meats). c. Identify regions and other countries which compete in Food Products (Meats).

Scenario

Unit 15

Trending Now

As a food science worker with a major livestock board, your job is to keep up with current trends affecting the meat industry. You will give a presentation to this board (your peers) on current trends, technologies and jobs available in today's market.

Attachments for Performance Task

See the Presentation Rubric in the teacher resources document found on the RCU Curriculum Download page: www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Careers and Leadership		
	1.	Identify career opportunities in meat cutting, packing, and processing professions.
	2.	Identify the leadership opportunities and activities which are beneficial to students in meat cutting, packing, and processing.
Unit 2: Orientation to Meat Processing		
	1.	Explain trends in slaughtering and processing in the past and in the future.
	2.	Describe factors affecting consumer food spending.
Unit 3: Safety, Sanitation, Equipment, and Facility Maintenance		
	1.	Explain general meat laboratory safety requirements.
	2.	Discuss sanitation as it applies to a meat cutting facility.
	3.	Discuss federal regulations relating to meat processing.
	4.	Identify and use equipment for meat cutting, packing, and processing.
	5.	Demonstrate equipment maintenance used in a meat cutting facility.
	6.	Maintain a safe and sanitary facility.
Unit 4: Custom Livestock Slaughter		
	1.	Explain terms and procedures associated with livestock slaughter.
	2.	Discuss types, cleaning, use, and maintenance of slaughter facility and equipment.
	3.	Discuss procedures for slaughtering livestock and dressing wild game.
Unit 5: Pricing, Wrapping, and Marketing		
	1.	Compare and contrast consumer trends, supply and demand, and the effects on meat prices.
	2.	List the steps and perform a cutting test.
	3.	Discuss techniques and wrap retail meat.
	4.	Describe marketing principles related to the display of meat.
Unit 6: Special Topics in Food Products (Meats) I		
	1.	Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats).

	2.	Complete school-to-careers activities related to Food Products (Meats).
	3.	Demonstrate related academic skills and workplace skills associated with Food Products (Meats).
	4.	Investigate the concepts of quality assurance as related to Food Products (Meats).
	5.	Examine trends and changes related to Food Products (Meats) and global economic factors.
Unit 7: Identification and Fabrication of Carcass and Box Beef		
	1.	Identify and fabricate cuts of beef.
	2.	Identify and fabricate variety cuts of beef.
Unit 8: Identification and Fabrication of Carcass and Box Pork		
	1.	Identify and fabricate cuts of pork.
	2.	Identify and fabricate retail variety cuts of pork.
Unit 9: Identification and Fabrication of Carcass Lamb and Goad		
	1.	Identify and fabricate cuts of lamb and goat.
Unit 10: Identification and Fabrication of Poultry and Fish		
	1.	Identify and fabricate cuts of poultry.
	2.	Identify variety cuts of poultry.
	3.	Identify retail cuts of fish.
Unit 11: Identification and Fabrication of Wild Game		
	1.	Identify and fabricate cuts of wild game.
	2.	Prepare wild game specialty products.
Unit 12: Automated Processing of Meats		
	1.	Observe the automated processing of various types of meat.
Unit 13: Quality and Yield Grading		
	1.	Explain quality and yield grades for beef and determine classifications of beef.
	2.	Explain quality grades and determine classification of pork.
	3.	Explain quality and yield grades for lamb and determine classifications of sheep.
	4.	Explain grades in poultry.
Unit 14: Curing, Smoking, and Sausage Making		
	1.	Explain and demonstrate meat curing and smoking processes.
	2.	Explain and demonstrate sausage making.
Unit 15: Special Topics in Food Products (Meats) II		
	1.	Investigate new and emerging technologies, practices, trends, and issues associated with Food Products (Meats).
	2.	Complete school-to-careers activities related to Food Products (Meats).

	3.	Demonstrate related academic skills and workplace skills associated with Food Products (Meats).
	4.	Investigate the concepts of quality assurance as related to Food Products (Meats).
	5.	Examine trends and changes related to Food Products (Meats) and global economic factors.

Appendix A: Unit References

Many of the Food Products (Meats) units use the same resources for each unit. You will find suggested resources listed below.

Unit 1

Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2001). *Principles of meat science* (4th ed.). Dubuque, IA: Kendall/Hunt.

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Unit 2

Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2001). *Principles of meat science* (4th ed.). Dubuque, IA: Kendall/Hunt.

Oklahoma Department of Vocational and Technical Education. (1992). *Meat and poultry processing*. Stillwater, OK: Curriculum Instructional Materials Center.

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Weiss, E., & Weiss, H. (1991). *Catering handbook*. New York: John Wiley & Sons.

Unit 3

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Unit 4

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Hofer, L. (n.d). *Processing wild game the easy way* [Video]. (Available from Lee's Meats & Sausages, Tea, SD, 1-888-368-6644, www.leesmeats.com)

Mississippi Department of Agriculture and Commerce Regulatory Services. (n.d.). Retrieved January 4, 2013, from http://www.mdac.state.ms.us/departments/regulatory_services/index.html

Ohio Department of Natural Resources Division of Wildlife. (2005). *Field dressing deer*. Retrieved January 4, 2013, from http://www.dnr.state.oh.us/Portals/9/pdf/pub111.pdf

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Unit 5

Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2001). *Principles of meat science* (4th ed.). Dubuque, IA: Kendall/Hunt.

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Unit 10

Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2001). *Principles of meat science* (4th ed.). Dubuque, IA: Kendall/Hunt.

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Unit 11

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Unit 14

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Appendix C: Industry Standards

AGRICULTURE, FOOD, AND NATURAL RESOURCES (AFNR) PATHWAY CONTENT STANDARDS AND PERFORMANCE ELEMENTS

Crosswalk for Food Products (Meats)											
	Units	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
AFNR											
AF -FOOD PRODUCTS AND PROCESSING SYSTEMS		X	X	X	X	X	X	X	X	X	X
AFNR											
		Unit 12	**Unit 12**	**Unit 13**	**Unit 14**	**Unit 15**					
		X	X	X	X	X					

AF - FOOD PRODUCTS AND PROCESSING SYSTEMS

The AFNR Pathway Content Standards and Performance Elements are adapted from *National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards.* Reprinted with permission from the National Council for Agricultural Education, 1410 King Street, Suite 400, Alexandria, VA 22314, 800.772.0939. Copyright © 2009. A complete copy of the National Standards can be downloaded from the Team Ag Ed Learning Center at https://aged.learn.com.

Pathway Content Standard: The student will demonstrate competence in the application of scientific principles, practices, and techniques in the processing, storage, and development of food products.

FPP.01. Examine components of the food industry and historical development of food products and processing.

- FPP.01.01. Evaluate the significance and implications of changes and trends in the food products and processing industry.
- FPP.01.02. Work effectively with industry organizations, groups, and regulatory agencies affecting the food products and processing industry.

FPP.02. Apply safety principles, recommended equipment, and facility management techniques to the food products and processing industry.

- FPP.02.01. Manage operational procedures, and create equipment and facility maintenance plans.
- FPP.02.02. Implement Hazard Analysis and Critical Control Point (HACCP) procedures to establish operating parameters.
- FPP.02.03. Apply safety and sanitation procedures in the handling, processing, and storing of food products.

FPP.02.04. Demonstrate worker safety procedures with food product and processing equipment and facilities.

FPP.03. Apply principles of science to the food products and processing industry.

FPP.03.01. Apply principles of science to food processing to provide a safe, wholesome, and nutritious food supply.

FPP.04. Select and process food products for storage, distribution, and consumption.

FPP.04.01. Utilize harvesting, selection, and inspection techniques to obtain quality food products for processing.

FPP.04.02. Evaluate, grade, and classify processed food products.

FPP.04.03. Process, preserve, package, and present food and food products for sale and distribution.

Appendix C: 21st Century Skills[1]

21st Century Crosswalk for Food Products (meats)											
	Units	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
21st Century Standards											
CS1		X	X	X	X	X	X	X	X	X	X
CS2		X	X	X	X	X	X	X	X	X	X
CS3		X	X	X	X	X	X	X	X	X	X
CS4		X	X	X	X	X	X	X	X	X	X
CS5		X	X	X	X	X	X	X	X	X	X
CS6		X	X	X	X	X	X	X	X	X	X
CS7		X	X	X	X	X	X	X	X	X	X
CS8		X	X	X	X	X	X	X	X	X	X
CS9		X	X	X	X	X	X	X	X	X	X
CS10		X	X	X	X	X	X	X	X	X	X
CS11		X	X	X	X	X	X	X	X	X	X
CS12		X	X	X	X	X	X	X	X	X	X
CS13		X	X	X	X	X	X	X	X	X	X
CS14		X	X	X	X	X	X	X	X	X	X
CS15		X	X	X	X	X	X	X	X	X	X
CS16		X	X	X	X	X	X	X	X	X	X
		Unit 11	**Unit 12**	**Unit 13**	**Unit 14**	**Unit 15**					
21st Century Standards											
CS1		X	X	X	X	X					
CS2		X	X	X	X	X					
CS3		X	X	X	X	X					
CS4		X	X	X	X	X					
CS5		X	X	X	X	X					
CS6		X	X	X	X	X					
CS7		X	X	X	X	X					
CS8		X	X	X	X	X					
CS9		X	X	X	X	X					
CS10		X	X	X	X	X					
CS11		X	X	X	X	X					
CS12		X	X	X	X	X					
CS13		X	X	X	X	X					
CS14		X	X	X	X	X					
CS15		X	X	X	X	X					
CS16		X	X	X	X	X					

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

[1] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

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 toward 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 D: Common Core Standards

Common Core Crosswalk for English/Language Arts (11-12)											
	Units	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
Common Core Standards											
RL.11.1.		X									
RL.11.2.											
RL.11.3.											
RL.11.4.											
RL.11.5.											
RL.11.6.											
RL.11.7.											
RL.11.8.											
RL.11.9.											
RL.11.10.											
RI.11.1.											
RI.11.2.											
RI.11.3.											
RI.11.4.											
RI.11.5.											
RI.11.6.											
RI.11.7.				X							
RI.11.8.											
RI.11.9.											
RI.11.10.											
W.11.1.											
W.11.2.			X	X							
W.11.3.											
W.11.4.											
W.11.5.											
W.11.6.			X	X							
W.11.7.											
W.11.8.											
W.11.9.											
W.11.10.											
SL.11.1.							X				
SL.11.2.											
SL.11.3.											
SL.11.4.											X
SL.11.5.											
SL.11.6.											
L.11.1.											
L.11.2.											
L.11.3.											
L.11.4.											
L.11.5.											
L.11.6.											
RH.11.1.											
RH.11.2.											
RH.11.3.											
RH.11.4.											
RH.11.5.											
RH.11.6.											
RH.11.7.											
RH.11.8.											
RH.11.9.											
RH.11.10.											
RST.11.1.											
RST.11.2.											
RST.11.3.											

RST.11.4.			X	X							X
RST.11.5.											
RST.11.6.											
RST.11.7.											
RST.11.8.											
RST.11.9.											
RST.11.10.											
WHST.11.1.											
WHST.11.2.											
WHST.11.3.											
WHST.11.4.											
WHST.11.5.											
WHST.11.6.											
WHST.11.7.											
WHST.11.8.											
WHST.11.9.											
WHST.11.10.											

	Units	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Common Core Standards						
RL.11.1.						X
RL.11.2.						
RL.11.3.						
RL.11.4.						
RL.11.5.						
RL.11.6.						
RL.11.7.						
RL.11.8.						
RL.11.9.						
RL.11.10.						
RI.11.1.						
RI.11.2.						
RI.11.3.						
RI.11.4.						
RI.11.5.						
RI.11.6.						
RI.11.7.						
RI.11.8.						
RI.11.9.						
RI.11.10.						
W.11.1.						
W.11.2.						
W.11.3.			X		X	
W.11.4.		X			X	X
W.11.5.						
W.11.6.					X	
W.11.7.						X
W.11.8.						
W.11.9.						X
W.11.10.						
SL.11.1.						X
SL.11.2.						
SL.11.3.						
SL.11.4.		X				
SL.11.5.						
SL.11.6.						
L.11.1.						
L.11.2.						
L.11.3.						
L.11.4.						
L.11.5.						
L.11.6.						
RH.11.1.						
RH.11.2.						
RH.11.3.						
RH.11.4.						
RH.11.5.						
RH.11.6.						
RH.11.7.						
RH.11.8.						
RH.11.9.						
RH.11.10.						
RST.11.1.						
RST.11.2.						
RST.11.3.						
RST.11.4.						
RST.11.5.						
RST.11.6.						
RST.11.7.						
RST.11.8.						
RST.11.9.						

RST.11.10.						
WHST.11.1.						
WHST.11.2.						
WHST.11.3.						
WHST.11.4.						
WHST.11.5.						
WHST.11.6.						
WHST.11.7.						
WHST.11.8.						
WHST.11.9.						
WHST.11.10.						

Reading Standards for Literature (11-12)

College and Career Readiness Anchor Standards for *Reading Literature*

Key Ideas and Details

RL.11.1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RL.11.2. Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.

RL.11.3. Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).

Craft and Structure

RL.11.4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)

RL.11.5. Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.

RL.11.6. Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, or understatement).

Integration of Knowledge and Ideas

RL.11.7. Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

RL.11.8. (Not applicable to literature)

RL.11.9. Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.

Range of Reading and Level of Text Complexity

RL.11.10. By the end of grade 11, read and comprehend literature, including stories, dramas, and poems, in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.
By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at the high end of the grades 11–CCR text complexity band independently and proficiently.

Reading Standards for Informational Text (11-12)

College and Career Readiness Anchor Standards for *Informational Text*

Key Ideas and Details

RI.11.1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RI.11.2. Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.

RI.11.3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.

Craft and Structure

RI.11.4. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines

the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RI.11.5. Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.

RI.11.6. Determine an author's point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness, or beauty of the text.

Integration of Knowledge and Ideas

RI.11.7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

RI.11.8. Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., The Federalist, presidential addresses).

RI.11.9. Analyze seventeenth-, eighteenth-, and nineteenth-century foundational U.S. documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln's Second Inaugural Address) for their themes, purposes, and rhetorical features.

Range of Reading and Level of Text Complexity

RI.11.10. By the end of grade 11, read and comprehend literary nonfiction in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.
By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11–CCR text complexity band independently and proficiently.

College and Career Readiness Anchor Standards for *Writing*

Text Types and Purposes

W.11.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.

b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.

c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from and supports the argument presented.

W.11.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

W.11.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.

b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters

c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).

d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.
e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

Production and Distribution of Writing

W.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

W.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12 on page 54.)

W.11.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

W.11.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.11.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

W.11.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

a. Apply grades 11–12 Reading standards to literature (e.g., "Demonstrate knowledge of eighteenth-, nineteenth- and early-twentieth-century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics").

b. Apply grades 11–12 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., The Federalist, presidential addresses]").

Range of Writing

W.11.10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

College and Career Readiness Anchor Standards for *Speaking and Listening*

Comprehension and Collaboration

SL.11.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.

c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

d. Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

SL.11.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

SL.11.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.

Presentation of Knowledge and Ideas

SL.11.4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

SL.11.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

SL.11.6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11–12 Language standards 1 and 3 on page 54 for specific expectations.)

College and Career Readiness Anchor Standards for *Language*

Conventions of Standard English

L.11.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.

b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed.

L.11.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

a. Observe hyphenation conventions.

b. Spell correctly.

Knowledge of Language

L.11.3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

a. Vary syntax for effect, consulting references (e.g., Tufte's Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.

Vocabulary Acquisition and Use

L.11.4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.

a. Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.

b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).

c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.

d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

L.11.5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.
b. Analyze nuances in the meaning of words with similar denotations.

L.11.6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Reading Standards for Literacy in History/Social Studies (11-12)

Key Ideas and Details

RH.11.1 Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

RH.11.2. Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas

RH.11.3. Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain

Craft and Structure

RH.11.4. Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).

RH.11.5. Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.

RH.11.6. Evaluate authors' differing points of view on the same historical event or issue by assessing the
authors' claims, reasoning, and evidence.

Integration of Knowledge and Ideas

RH.11.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.

RH.11.8. Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.

RH.11.9. Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

Range of Reading and Level of Text Complexity

RH.11.10. By the end of grade 12, read and comprehend history/social studies texts in the grades 11–CCR text complexity band independently and proficiently.

Reading Standards for Literacy in Science and Technical Subjects (11-12)

Key Ideas and Details

RST.11.1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11.2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

RST.11.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.

RST.11.5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

RST.11.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas

RST.11.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

RST.11.10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes

WHST.11.1. Write arguments focused on discipline-specific content.

a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

e. Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

WHST.11.3. (Not applicable as a separate requirement)

Production and Distribution of Writing

WHST.11.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.11.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

WHST.11.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.11.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.11.9. Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

WHST.11.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Common Core Crosswalk for Mathematics (11-12)

	Units	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	
Common Core Standards											
N-RN.1.											
N-RN.2.											
N-RN.3.											
N-Q.1.					X		X				
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	Units	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Common Core Standards						
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Mathematics (High School)

Number and Quantity

The Real Number System

N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

N-RN.3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Quantities

N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.

N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

The Complex Number System

N-CN.1. Know there is a complex number i such that i2= –1, and every complex number has the form a + bi with a and b real.

N-CN.2. Use the relation i2= –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

N-CN.3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

N-CN.4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.

N-CN.5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(–1 + \sqrt{3}\ i)3= 8$ because $(–1 + \sqrt{3}\ i)$ has modulus 2 and argument 120°.

N-CN.6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.

N-CN.8. (+) Extend polynomial identities to the complex numbers. For example, rewrite x2+ 4 as (x + 2i)(x – 2i).

N-CN.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Vector and Matrix Quantities

N-VM.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|,||v||, v).

N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.

N-VM.4. (+) Add and subtract vectors

N-VM.4.a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

N-VM.4.b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

N-VM.4.c. Understand vector subtraction $v – w$ as $v + (–w)$, where $–w$ is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

N-VM.5. (+) Multiply a vector by a scalar.

N-VM.5.a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(vx, vy) = (cvx, cvy)$.

N-VM.5.b. Compute the magnitude of a scalar multiple cv using $||cv|| = |c|v$. Compute the direction of cv knowing that when $|c|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$).

N-VM.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

N-VM.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

N-VM.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties

N-VM.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the realnumbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

N-VM.11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.

N-VM.12. (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Algebra

Seeing structure in expressions

A-SSE.1. Interpret expressions that represent a quantity in terms of its context.

A-SSE.1.a. Interpret parts of an expression, such as terms, factors, and coefficients.

A-SSE.1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)nas the product of P and a factor not depending on P.

A-SSE.2. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-SSE.3.a. Factor a quadratic expression to reveal the zeros of the function it defines.

A-SSE.3.b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A-SSE.3.c. Use the properties of exponents to transform expressions for exponential functions.

A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

Arithmetic with Polynomials and Rational Expressions

A-APR.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials

A-APR.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

A-APR.4. Prove polynomial identities and use them to describe numerical relationships.

A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of (x+ y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

A-APR.6. Rewrite simple rational expressions in different forms; write a(x)/b(x)in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

A-APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

A-CED.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V =IR to highlight resistance R.

Reasoning with Equations and Inequalities

A-REI.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4. Solve quadratic equations in one variable.

A-REI.4.a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2= q that has the same solutions. Derive the quadratic formula from this form.

A-REI.4.b. Solve quadratic equations by inspection (e.g., for x2= 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2+y2= 3.

A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

A-REI.12.Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Interpreting Functions

F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.7.a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.7.b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-IF.7.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F-IF.7.d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

F-IF.7.e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.8.a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F-IF.8.b. Use the properties of exponents to interpret expressions for exponential functions.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Building Functions

F-BF.1. Write a function that describes a relationship between two quantities.

F-BF.1.a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF.1.b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

F-BF.1.c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

F-BF.3. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

F-BF.4. Find inverse functions.

F-BF.4.a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.

F-BF.4.b. (+) Verify by composition that one function is the inverse of another.

F-BF.4.c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

F-BF.4.d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Linear, Quadratic, and Exponential Models

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE.1.a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

F-LE.1.b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F-LE.1.c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another

F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F-LE.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F-LE.4. For exponential models, express as a logarithm the solution to ab ct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.

Trigonometric Functions

F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.

F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

F-TF.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Geometry

Congruence

G-CO.1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

G-CO.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

G-CO.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

G-CO.9. Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11. Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

G-CO.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G-CO.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Similarity, Right Triangles, and Trigonometry

G-SRT.1. Verify experimentally the properties of dilations given by a center and a scale factor:

G-SRT.1.a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

G-SRT.1.b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

G-SRT.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

G-SRT.4. Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

G-SRT.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G-SRT.7. Explain and use the relationship between the sine and cosine of complementary angles.

G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

G-SRT.9. (+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

G-SRT.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles

G-C.1. Prove that all circles are similar.

G-C.2. Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

G-C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

G-C.4. (+) Construct a tangent line from a point outside a given circle to the circle.

G-C.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations

G-GPE.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

G-GPE.2. Derive the equation of a parabola given a focus and directrix.

G-GPE.3. (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

G-GPE.4. Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point (0, 2).

G-GPE.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Geometric Measurement and Dimension

G-GMD.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

G-GMD.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

G-GMD.4. Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry

G-MG.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

G-MG.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Statistics and Probability

Interpreting Categorical and Quantitative Data

S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate.
Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S-ID.6.a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

S-ID.6.b. Informally assess the fit of a function by plotting and analyzing residuals.

S-ID.6.c. Fit a linear function for a scatter plot that suggests a linear association.

S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9. Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions

S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

S-IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S-IC.6. Evaluate reports based on data.

Conditional Probability and the Rules of Probability

S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

S-CP.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

S-CP.3. Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

S-CP.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

S-CP.6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

S-CP.7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

Using Probability to Make Decisions

S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?

S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

S-MD.5.a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.

S-MD.5.b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Appendix E: National Educational Technology Standards for Students (NETS-S)

NETS Crosswalk for Food Products: Meats											
	Course	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit 10**
NETS Standards											
T1											
T2											
T3											
T4											
T5											
T6											

	Course	**Unit 11**	**Unit 12**	**Unit 13**	**Unit 14**	**Unit 15**					
T1											
T2											
T3											
T4											
T5											
T6											

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.