

2012 – 2013

**Arkansas Department of Career Education
Model Framework**

Course Title: **Animal Science II**

Career Cluster: **Agriculture, Food & Natural Resources**

Secondary – Agriculture Science and Technology	
Course Number	491200
CIP Number	<i>(Program area responsibility to insert CIP code(s)/titles http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55)</i>
Grade Level	10-12
Prerequisite	Survey of Ag Systems and Animal Science 1
Course Type	Core
Teacher Certification	
CTSO	FFA
Facility Requirements	http://arkansasfacilities.arkansas.gov/SchoolFacManual.aspx
Industry Certifications	<i>(Program area responsibility to insert web address of certification site(s))</i>

Course Description

The course is structured to enable all students to have an overview of the Animal Industry. Topics covered in Animal Science 2 include Animal Reproduction, Genetics, Animal Health, Animal Products, and Marketing. Opportunities are provided for students to participate in FFA and supervised experience activities.

Program Purpose/Structure

3T

Laboratory Activities

3T

Special Notes

3T

Career and Technical Student Organization (CTSO)

FFA

Pilot Year 2013-14

Standard 1.0 Animal Reproduction				
Performance Indicator 1.1 Reproductive Systems	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
1.1.1 Analyze the male reproductive organs and their functions. (penis, testis, scrotum)	<ul style="list-style-type: none"> • Diagram and label male reproductive tract. • Obtain a reproductive tract and analyze the organs. 	SL9-10.1, SL9-10.1a, SL11-12.1, SL11-12.1a	AG-ANI6, CRP2	AS.05.01.01.a AS.05.01.01.b
1.1.2 Analyze the female reproductive organs and their functions. (vagina, cervix, uterus, ovary)	<ul style="list-style-type: none"> • Diagram and label female reproductive tract. • Obtain a reproductive tract and analyze the organs. 	SL9-10.1, SL9-10.1a, SL11-12.1, SL11-12.1a	AG-ANI6, CRP2	AS.05.01.01.a AS.05.01.01.b
1.1.3 Analyze the estrous cycle in common livestock. (cattle, sheep, goats, swine, horses, chickens and turkeys).	<ul style="list-style-type: none"> • Analyze the four stages of the estrous cycle and the effects on the reproductive system. • Compare and contrast the lengths of the estrous cycle for common livestock. • Monitor and discuss behavior of a live animal throughout the estrous cycle. 	SL9-10.4, SL11-12.4, SL9-10.1a, SL11-12.1a, R9-10.9, R11-12.9	AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI6, CRP4	
Performance Indicator 1.2 Breeding Methods	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
1.2.1 Compare and explain natural breeding methods in animals.(cattle, sheep, goats, swine, horses, chickens and turkeys)	<ul style="list-style-type: none"> • Identify species of livestock that are seasonal breeders. • Compare gestation period lengths between types of livestock. • Observe videos of natural mating in livestock. 	L9-10.4, L11-12.4, L9-10.6, L11-12.6	AG1, AG-ANI1, AG-ANI3, AG-ANI2, AG-ANI4, AG-ANI5, CRP2	AS.05.03.02.a AS.05.03.02.b

<p>1.2.2 Assess artificial breeding methods in animals.</p>	<ul style="list-style-type: none"> • Research types of livestock that commonly use artificial breeding methods. 	<p>R9-10.1, R11-12.1, R9-10.5, R11-12.5, R9-10.2, R11-12.2, W9-10.1, W11-12.1, R9-10.2, R11-12.2</p>	<p>AG1, AG-ANI1, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, CRP7</p>	<p>AS.05.03.02.a AS.05.03.02.b</p>
<p>1.2.3 Discuss the advantages and disadvantages of natural breeding and artificial breeding.</p>	<ul style="list-style-type: none"> • Debate the use of natural mating and artificial mating. • Analyze the economic cost of artificial mating compared to natural mating. • Create a list of advantages and disadvantages for each type of mating. 	<p>SL9-10.1c, SL11-12.1c, SL9-10.3, SL11-12.3</p>	<p>AG1, AG-ANI1, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, CRP8</p>	<p>AS.05.03.05.a</p>
<p>1.2.4 Assess and analyze the materials, methods and processes of artificial insemination.</p>	<ul style="list-style-type: none"> • Formulate the correct time during the estrous cycle to artificially inseminate. • Demonstrate the use of artificial insemination equipment. • Practice artificial insemination techniques on reproductive tracts. • Perform artificial insemination on live animal. 	<p>SL9-10.1, SL11-12.1</p>	<p>AG1, AG-ANI1, AG-ANI3, AG-ANI4, AG-ANI5, CRP6</p>	<p>AS.05.03.05.b</p>
<p>Performance Indicator 1.3 Reproductive Technology</p>	<p>Recommended Application/Activity</p>	<p>CCSS Standards</p>	<p>CCTC Standards</p>	<p>AFNR Standards</p>
<p>1.3.1 Assess the advantages of major reproductive management practices including estrous synchronization, superovulation, flushing and embryo transfer.</p>	<ul style="list-style-type: none"> • Determine the economic value and cost of reproductive management practices. • Invite a guest speaker to explain the benefits they have seen from reproductive technologies. • Research other reproductive technologies that are available to livestock producers. (Ex. Cloning, sexed semen) 	<p>R9-10.2, R11-12.2, R9-10.5, R11-12.5, W9-10.1b, W11-12.1b</p>	<p>AG1, AG-ANI1, AG-ANI3, AG-ANI4, AG-ANI5, CRP8</p>	<p>AS.05.03.04.a</p>

<p>1.3.2 Analyze the process of major reproductive management practices including estrous synchronization, superovulation, flushing and embryo transfer.</p>	<ul style="list-style-type: none"> • Describe the process of estrous synchronization in livestock. • Develop a plan to synchronize a given set of females. • Identify equipment necessary for embryo transfer. • Create a flow chart of steps necessary for embryo transfer. • Demonstrate or view the process of embryo transfer on a live animal or video. 	<p>SL9-10.4, SL11-12.4, SL9-10.5, W9-10.1c, W11-12.1c</p>	<p>AG1, AG-ANI1, AG-ANI3, AG-ANI4, AG-ANI5, CRP6</p>	<p>AS.05.03.04.b</p>
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Standard 2.0 Genetics				
Performance Indicator 2.1 Genetic Inheritance	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
2.1.1 Explain genetic inheritance in animals in terms of genes, chromosomes and DNA.	<ul style="list-style-type: none"> • Create a model illustrating the major components of a DNA strand. • Extract DNA from a given sample. 	SL9-10.4, SL11-12.4	AG-ANI6, CRP6	AS.05.03.01.a
2.1.2 Assess and analyze dominant and recessive traits in terms of alleles, genotype, phenotype, homozygous and heterozygous.	<ul style="list-style-type: none"> • Analyze the effects of dominant genes on recessive genes. • Compare and Contrast animals based on phenotype. • Elaborate on the phenotype of siblings (Ex. Litter of puppies, cloned animals) • Using a sire selection book, categorize sires based on genotype. (ex. Homozygous black) 	R9-10.9, R11-12.9, W9-10.1e, W11-12.1e, SL9-10.1b, SL11-12.1b	AG-ANI2, AG-ANI6, CRP7	
Performance Indicator 2.2 Genetics Applied	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
2.2.1 Predict possible offspring of matings by using the Punnett Square.	<ul style="list-style-type: none"> • Use a dice or coins to illustrate possible genetic combinations. • Illustrate possible outcomes of a mating using the Punnett Square. (one trait, multiple traits) • Calculate the ratios and percentages of genotypical and phenotypical outcomes of a mating. 	W9-10.9, W11-12.9, R9-10.7, R11-12.7	AG-ANI2, AG-ANI6, CRP8	
2.2.2 Explain the meaning and use of quantitative breeding values (e.g. EPDs)	<ul style="list-style-type: none"> • Use a given scenario to select a sire based on EPDs. • Evaluate animals from a livestock publication/website based on EPDs. • Analyze the environmental effects of genetic potential. (Ex. Poor nutrition = lower weaning weight) 	SL9-10.4, SL11-12.4, R9-10.1, R11-12.1	AG-ANI3, AG-ANI4, AG-ANI5, Ag-ANI6, CRP8	AS.05.03.03.a

Standard 3.0 Animal Health				
Performance Indicator 3.1 Animal Health	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
3.1.1 Explain methods of determining animal health. (heart rate, temperature, respiratory rate, physical appearance, behavior)	<ul style="list-style-type: none"> • Create a chart of vital signs for healthy animals. • Take vital signs of a live animal. • Observe live animals/video to determine an animal's health condition. • Discuss animal health as it relates to animal welfare. 	R9-10.7, R11-12.7	AG3, AG-ANI2, AG-ANI3, AG-ANI5, AG-ANI6, AG-ANI7, CRP2	AS.03.01.01.a
Performance Indicator 3.2 Disease/Disorder Prevention and Treatment	Recommended Application/Activity	CCSS Standards	CCTC Standards	
3.2.1 Identify different methods of administering medicines to animals, calculate dosage rates and withdrawal times. (oral, topical, injections (subcutaneous, intramuscular, intravenous)).	<ul style="list-style-type: none"> • Categorize medicines by method of administration. • Using a medicine bottle label, determine appropriate dosage rates and withdrawal times for a given scenario. • Demonstrate proper technique for using a syringe. • Practice giving different types of injections. (Ex. Oranges, bananas) • Administer medicine to live animal. • Create safety protocol for handling medicine, vaccines and administration instruments (ex. Syringes, drench gun). • Research quality assurance plans to determine appropriate injection sites for animals. 	SL9-10.4, SL11-12.4, R9-10.3, R11-12.3, R11-12.1, R9-10.1	AG1, AG2, AG3, AG-ANI1, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, AG-ANI6, AG-ANI7, CRP7	
3.2.2 Assess the importance of biosecurity to the animal industry.	<ul style="list-style-type: none"> • Research common biosecurity practices in local agricultural industries. (Ex. Poultry farms, swine operations, fish hatcheries) • Identify common biosecurity practices. (Ex. Quarantine, protective clothing, foot baths) • Develop a biosecurity plan for a local farmer or for a given 	R9-10.1, R11-12.1, W9-10.1d, W11-12.1d,	AG1, AG2,AG3, AG-ANI2, AG-ANI3, AG-ANI4,	AS.03.02.01.a

	scenario.	W9-10.1a, W11-12.1a	AG-ANI5, Ag-ANI6, AG-ANI7 CRP7	
Performance Indicator 3.3 Animal diseases and disorders	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
3.3.1 Identify common diseases that affect animals, the prevention and treatment of them. (blackleg, brucellosis, equine infectious anemia (coggins), parvo, scrapie, bovine spongiform encephalopathy (madcow))	<ul style="list-style-type: none"> Research diseases and make a presentation to class. Research laws that are related to specific livestock diseases. (Ex. Coggins testing, scrapie tags, bangs vaccination) Vaccinate a live animal for a specific disease. Analyze the economic impact of vaccinating and loss from disease. Research other diseases that affect local economy. (Ex. Lt in poultry, trichomoniasis in cattle) 	SL9-10.4, SL11-12.4, R9-10.3, R11-12.3, R9-10.1, R11-12.1	AG1, AG2, AG3, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, AG-ANI6, AG-ANI7, CRP4	AS.03.01.02.a
3.3.2 Assess common parasites that affect animals, the prevention and treatment of them. (flies, lice, brown stomach worms, heartworms, coccidian, ringworm)	<ul style="list-style-type: none"> Research parasites and make a presentation to class. Compare and contrast the effects of internal and external parasites. Treat a live animal for external parasite control. Treat a live animal for internal parasite control. Analyze the economic impact of parasite infestation and treatment. Research other parasites that affect local economy. (Ex. Ticks, fleas) 	R9-10.10, R11-12.10, R9-10.3, R11-12.2, W9-10.2, W11-12.2	AG1, AG2, AG3, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, AG-ANI6, AG-ANI7, CRP5	AS.03.01.02.a
3.3.3 Analyze common physiological disorders that affect animals, the	<ul style="list-style-type: none"> View the movie <i>Temple Grandin</i> and have class discussion on safe animal handling to reduce stress. Analyze a given animal handling facility and provide a recommendation to reduce stress while handling animals. Invite a guest speaker to address proper sanitation and facilities 	SL9-10.5, SL11-12.5, SL9-10.3, SL11-12.3, W9-10.3,	AG1, AG2, AG3, AG-ANI2, AG-ANI3,	AS.03.01.02.a

<p>treatment and prevention of them. (stress, poor nutrition, abuse, improper environment, sanitation)</p>	<p>in a local animal facility. (Ex. Veterinarian, Livestock Sale Barn Manager, Pet Groomer)</p> <ul style="list-style-type: none"> List possible diseases that could be a result of physical disorders in animals. 	<p>W11-12.3</p>	<p>AG-ANI4, AG-ANI5, AG-ANI6, AG-ANI7, CRP5</p>	
<p>3.3.5 Identify and describe zoonotic diseases. (rabies, lyme disease, brucellosis, ringworm)</p>	<ul style="list-style-type: none"> Research laws and safe handling practices in place to prevent the spread of zoonotic disease. (Ex. Rabies vaccination, Bangs vaccination, Personal Protective Equipment) Research and view the effects of zoonotic diseases on humans. 	<p>R9-10.1, R11-12.1, R11-12.9, R9-10.9, SL9-10.1b, SL11-12.1b</p>	<p>AG1 AG2 AG3 AG-ANI2, AG-ANI3 AG-ANI4, AG-ANI5 AG-ANI6, AG-ANI7 CRP7</p>	<p>AS.03.01.05.a</p>

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Standard 4.0 Animal Products and Marketing				
Performance Indicator 4.1 Animal Products	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
4.1.1 Evaluate the primary products obtained from animals. (cattle, sheep, goats, swine, chickens and turkeys)	<ul style="list-style-type: none"> • Research grade categories for animal products. (meat, eggs, milk, fiber) • Identify sample cuts of meat. • Grade sample cuts of meat based on quality and yield. • Conduct taste tests with various grades/qualities of meat, eggs and milk. 	R9-10.5, R11-12.5, W9-10.2, W11-12.2	AG6, AG-ANI1, AG-ANI2, AG-ANI3, AG-ANI4, AG-ANI5, AG-ANI6, CRP2	
Performance Indicator 4.2 Marketing of Animals and their products	Recommended Application/Activity	CCSS Standards	CCTC Standards	AFNR Standards
4.2.1 Analyze the marketing of agricultural animals. (terminal, auction, private treaty)	<ul style="list-style-type: none"> • View online/video auction and discuss trends in price. (Ex. www.dvauction.com, RFDTV) • Analyze market reports provided by cooperative extension. • List advantages/disadvantages of each type of marketing. • Research careers available in marketing of agricultural animals. (Ex. Order buyer, auctioneer, auction manager) • Explore opportunities in your area to purchase animals private treaty. 	SL9—10.5, SL11-12.5, L9-10.4, L11-12.4, R9-10.2, R11-12.2	AG1, AG2, AG6, AG-ANI1, AG-ANI2, AG-ANI5, AG-ANI6, CRP11	
4.2.2 Analyze the marketing of agricultural products. (Ex. Brand name recognition, niche and value added)	<ul style="list-style-type: none"> • Evaluate how brand name recognition, niche marketing and value-added products increase the value of a product. • Compare and contrast the price/quality of organic and non-organic products available locally. • Compare and contrast the price/quality of brand name and generic brand products. • Create a value-added product and develop a marketing plan. (Ex. Beef jerky, yogurt, cheese) 	R9-10.9, R11-12.9, W9-10.1, W11-12.1, SL9-10.4, SL11-12.4	AG1, AG2, AG6, AG-ANI1, AG-ANI2, AG-ANI5, AG-ANI6, CRP6	

Glossary

Standard 1.0 Animal Reproduction

1. artificial insemination- The injection of semen into the uterus other than by natural mating.
2. cervix- The narrow necklike passage forming the lower end of the uterus
3. copulation- the mating of a male and female
4. corpus luteum- a reddish-yellow mass that forms in a ruptured follicle in the ovary of mammals; the hormone progesterone is released by the corpus luteum
5. diestrus- A period of sexual inactivity between recurrent periods of estrus.
6. embryo transfer- moving an embryo from one female animal to another of the same species
7. estrogen- a hormone produced by the ovaries
8. estrous cycle-the time between periods of estrous
9. estrous synchronization-Using synthetic hormones to make a group of females come in heat at the same time.
10. estrus- the time during which the female will accept the male for copulation; also referred to as being "in heat"
11. follicle- a small blister-like development on the surface of the ovary that contains the developing ovum
12. follicle stimulating hormone- a hormone produced by the pituitary gland that promotes growth of ovarian follicles in the female and sperm in the male
13. gestation-the time during which the animal is pregnant
14. hormone- an organic material given off by a body gland that helps regulate body functions
15. metestrus-the luteal phase of the reproductive cycle in mammalian females, occurring after ovulation and characterized by development of the corpus luteum, increased progesterone secretion, and decreased estrogen secretion.
16. ovary- A female reproductive organ in which ova or eggs are produced
17. ovulation- the release of the egg from the ovary
18. oxytocin- a hormone that causes contractions of the uterus during breeding and parturition and causes milk letdown
19. parturition- the act of giving birth
20. penis- The male genital organ of higher vertebrates, carrying the duct for the transfer of sperm during copulation.
21. proestrus- The period immediately before estrus in most female mammals, characterized by development of the endometrium and ovarian follicles.
22. progesterone- a hormone produced by the ovaries that maintains pregnancy in the animal

- 23. scrotum- A pouch of skin containing the testicles
- 24. superovulation- the stimulation of more than the usual number of ovulations during a single estrous cycle due to the injection of certain hormones.
- 25. testis- An organ that produces spermatozoa
- 26. testosterone- a male hormone that controls the traits of the male animal
- 27. uterus- The organ in the lower body of a female mammal where offspring are conceived and in which they gestate before birth
- 28. vagina- The muscular tube leading from the external genitals to the cervix of the uterus
- 29. zygote- a cell formed by the union of two gametes

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Standard 2.0 Genetics

1. allele- matching genes on homologous chromosomes
2. chromosome- the part of a cell that contains information about genetic makeup and transmits that information to offspring
3. DNA- deoxyribonucleic acid; forms the basic material in the chromosomes of the cell nucleus
4. dominant- relating to one of a pair of allelic heredity factors that dominates the other and appears in the organism
5. gamete- the sex cell; either an egg or a sperm
6. gene- a unit of inheritance that is composed of DNA
7. genetics- the study of heredity in plants and animals
8. genotype- the genetic makeup of an organism; allele composition
9. heterozygous- having different alleles for a single trait, and therefore, producing two or more different kinds of gametes
10. homozygous- having identical alleles at one or more loci, and, therefore, producing identical gametes
11. phenotype- the physical appearance of an organism
12. recessive- an allele that is not expressed phenotypically when present in the heterozygous condition

Pilot Year 2013-14

Standard 3.0 Animal Health

1. antibiotic- a chemical agent that prevents the growth of a germ or bacteria
2. bacteria- one celled microorganisms; many species
3. biosecurity- procedures intended to protect humans or animals against disease or harmful biological agents.

4. disinfectant- a chemical that destroys microbes by breaking down cell proteins
5. disease—a condition of pain, deterioration, injury, or other condition that constrains normal body functions
6. drench gun- device used to administer medicine orally
7. health—the condition of an organism as related to normal life functions
8. intramuscular—injections placed in the muscle tissue
9. intravenous—injections placed in the vein
10. oral—taken by mouth
11. parasite- an organism that lives in or on a host
12. quarantine- a period of time livestock are held away from other animals
13. sanitation—aseptic clean condition
14. stress—a strain, or straining condition, that may be physical, chemical, or psychological and cannot be adjusted to satisfactorily
15. subcutaneous—an injection placed just under the skin but above muscle tissue
16. topical—medicine that is applied to the surface of the skin
17. vaccine—a substance that contains live, modified, or dead organisms or their products that is injected into an animal in an attempt to protect the host from disease caused by that particular organism
18. virus—a self-reproducing agent that is considerably smaller than a bacterium and can multiple only within the living cells of a suitable host
19. vital signs—an indication of the living condition of an animal, including breathing, pulse rate, and body temperature
20. zoonotic disease- an animal disease that can be transmitted to humans

Standard 4.0 Animal Products and Marketing

1. auction market—livestock are sold by public bidding with the animal going to the highest bidder
2. auctioneer-A person who conducts auctions by accepting bids and declaring goods sold.
3. buyer- a person who makes a purchase
4. byproduct—a product made from part of an animal that is not used for food
5. demand—the amount of product buyers will purchase at a given time for a given price
6. electronic marketing—a form of auction selling used mainly for feeder cattle
7. marketing—the processes and functions of moving animals and animal products from the producer to the consumer so that consumer demand is satisfied
8. niche marketing- the subset of the market on which a specific product is the focus.
9. options—a contract between producer and buyer conveying the right to sell within a specific time
10. organic- the form of agriculture that relies on techniques such as crop rotation, green manure, compost, and biological pes
11. Packers and Stockyards Act—a federal law that is administered by the USDA that deals with the movement of livestock across state lines
12. private treaty—a sale made directly between a producer and buyer
13. shrinkage—loss of weight that occurs when livestock are moved to market
14. supply—amount of product that producers will offer for sale at a given price at a given time
15. terminal market—livestock sold directly to the packer

Common Core State Standards Grades 9-12

ELA Speaking and Listening Standards Grades 9-10

1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively. **SL9-10.1**
 - 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. **SL9-10.1a**
 - b. Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed. **SL9-10.1b**
 - c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. **SL9-10.1c**
 - d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented. **SL9-10.1d**
2. Integrate multiple sources of information presented in diverse media or format(e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. **SL9-10.2**
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence. **SL9-10.3**
4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. **SL9-10.4**
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. **SL9-10.5**

ELA Speaking and Listening Standards Grades 11-12

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. **SL11-12.1**
 - 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. **SL11-12.1a**
 - b. Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed. **SL11-12.1b**

- 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. **SL11-12.1c**
 - 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. **SL11-12.1d**
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. **SL11-12.2**
 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. **SL11-12.3**
 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. **SL11-12.4**
 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. **SL11-12.5**

ELA Language Grades 9-10

4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, choosing flexibly from a range of strategies. **L9-10.4**
 - 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. **L9-10.4a**
 - b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., analyze, analysis, analytical; advocate, advocacy). **L9-10.4b**
 - 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, or its etymology. **L9-10.4c**
 - 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). **L9-10.4d**
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. **L9-10.6**

ELA Language Grades 11-12

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. **L11-12.4**

- 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. **L11-12.4a**
 - b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable). **L11-12.4b**
 - 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. **L11-12.4c**
 - 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) **L11-12.4d**
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. **L11-12.6**

Reading Standards for Literacy in Science and Technical Subjects Grades 9-10

1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **R9-10.1**
2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. **R9-10.2**
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. **R9-10.3**
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 9–10 texts and topics. **R9-10.4**
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). **R9-10.5**
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. **R9-10.6**
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. **R9-10.7**
8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. **R9-10.8**
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. **R9-10.9**
10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. **R9-10.10**

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

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. **R11-12.1**
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. **R11-12.2**
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. **R11-12.3**
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. **R11-12.4**
5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **R11-12.5**
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. **R11-12.6**
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. **R11-12.7**
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. **R11-12.8**
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. **R11-12.9**
10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently. **R11-12.10**

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects Grades 9-10

1. Write arguments focused on discipline-specific content. **W9-10.1**
 - a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. **W9-10.1a**
 - b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns. **W9-10.1b**
 - c. Use words, phrases, and clauses 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. **W9-10.1c**
 - 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. **W9-10.1d**
 - e. Provide a concluding statement or section that follows from or supports the argument presented. **W9-10.1e**
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **W9-10.2**

- a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. **W9-10.2a**
 - b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. **W9-10.2b**
 - c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. **W9-10.2c**
 - d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. **W9-10.2d**
 - 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. **W9-10.2e**
 - 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). **W9-10.2f**
3. Write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results. **W9-10.3**
 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **W9-10.4**
 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. **W9-10.5**
 6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. **W9-10.6**
 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. **W9-10.7**
 8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. **W9-10.8**
 9. Draw evidence from informational texts to support analysis, reflection, and research. **W9-10.9**
 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. **W9-10.10**

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

1. Write arguments focused on discipline-specific content. **W11-12.1**

- 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. **W11-12.1a**
 - 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. **W11-12.1b**
 - 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. **W11-12.1c**
 - 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. **W11-12.1d**
 - e. Provide a concluding statement or section that follows from or supports the argument presented. **W11-12.1e**
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **W11-12.2**
 - 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. **W11-12.2a**
 - 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. **W11-12.2b**
 - 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. **W11-12.2c**
 - 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. **W11-12.2d**
 - 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). **W11-12.2e**
 3. Write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results. **W11-12.3**
 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **W11-12.4**
 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. **W11-12.5**
 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. **W11-12.6**

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. **W11-12.7**
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. **W11-12.8**
9. Draw evidence from informational texts to support analysis, reflection, and research. **W11-12.9**
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. **W11-12.10**

Common Career and Technical Core Standards

Agriculture, Food, and Natural Resources Cluster

Agriculture, Food, & Natural Resources Career Cluster Standards (AG)

1. Analyze how issues, trends, technologies, and public policies impact systems in the Agriculture, Food, & Natural Resources (AFNR) Career Cluster. **AG1**
2. Evaluate the nature and scope of the AFNR cluster and the role AFNR plays in society and the economy. **AG2**
3. Examine and summarize importance of health, safety, and environmental management systems in AFNR organizations. **AG3**
4. Demonstrate stewardship of natural resources in AFNR activities. **AG4**
5. Describe career opportunities and means to achieve those opportunities in each of the AFNR career pathways. **AG5**
6. Analyze the interaction among ANFR systems in the production, processing and management of food, fiber, and fuel and sustainable use of natural resources. **AG6**

Agribusiness Systems Career Pathway (AG-BIZ)

1. Apply management planning principles in AFNR business enterprises. **AG-BIZ1**
2. Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations. **AG-BIZ2**
3. Manage cash budgets, credit budgets, and credit for an AFNR business using generally accepted accounting principles. **AG-BIZ3**
4. Develop a business plan for an AFNR enterprise or business unit. **AG-BIZ4**
5. Use sales and marketing principles common to agribusiness systems to accomplish AFNR business objectives. **AG-BIZ5**

Animal Systems Career Pathway (AG-ANI)

1. Analyze historic and current trends impacting the animal systems industry. **AG-ANI1**

2. Utilize best practice protocols for husbandry and welfare based upon animal behaviors. **AG-ANI2**
3. Design and provide proper animal nutrition given desired outcomes for performance, development, reproduction, and/or economic production. **AG-ANI3**
4. Apply principles of animal reproduction given desired outcomes for performance, development, and/or economic production. **AG-ANI4**
5. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health. **AG-ANI5**
6. Classify, evaluate and select animals based on anatomical and physiological characteristics. **AG-ANI6**
7. Apply principles of effective animal health care. **AG-ANI7**

Environmental Service Systems Career Pathway (AG-ENV)

1. Use analytical procedures and instruments to manage environmental service systems. **AG-ENV1**
2. Evaluate the impact of public policies and regulations on environmental service system operations. **AG-ENV2**
3. Develop proposed solutions to environmental issues, problems, and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology. **AG-ENV3**
4. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy conservation). **AG-ENV4**
5. Use tools, equipment, machinery, and technology common to tasks in environmental service systems. **AG-ENV5**

Food Products and Processing Systems Career Pathway (AG-FD)

1. Develop and implement procedures to ensure safety, sanitation, and quality in the food product and processing facilities. **AG-FD1**
2. Apply principles of nutrition, biology, microbiology, chemistry, and human behavior to development of food products. **AG-FD2**
3. Select and process food products for storage, distribution, and consumption. **AG-FD3**
4. Explain the scope of the food industry and the historical and current developments of food products and processing. **AG-FD4**

Natural Resources Systems Career Pathway (AG-NR)

1. Plan and conduct natural resource management activities that apply logical, reasoned, and scientifically based solutions to natural resource issues and goals. **AG-NR1**
2. Analyze the interrelationships between natural resources and humans. **AG-NR2**
3. Develop plans to ensure responsible and sustainable production and processing of natural resources. **AG-NR3**
4. Demonstrate responsible control and management procedures and techniques to protect or maintain natural resources. **AG-NR4**

Plant Systems Career Pathway (AG-PL)

1. Develop and implement a crop management plan for a given production goal that accounts for environmental factors. **AG-PL1**
2. Apply the principles of classification, plant anatomy, and plant physiology to plant production and management. **AG-PL2**
3. Propagate, culture, and harvest plants and plant products based on current industry standards. **AG-PL3**
4. Apply principles of design in plant systems to enhance an environment (e.g., floral, forest, landscape, and farm). **AG-PL4**

Power, Structural and Technical Systems Career Pathway (AG-PST)

1. Apply physical science principles and engineering applications related to mechanical equipment, structures, and biological systems to solve problems and improve performance in AFNR power, structural, and technical systems. **AG-PST1**
2. Operate and maintain AFNR mechanical equipment and power systems. **AG-PST2**
3. Service and repair AFNR mechanical equipment and power systems. **AG-PST3**
4. Plan, build, and maintain AFNR structures. **AG-PST4**
5. Use control, monitoring, geospatial, and other technologies in AFNR power, structural, and technical systems. **AG-PST5**

Common Career and Technical Core Career Ready Practices (CCTC CRP)

1. Act as a responsible and contributing citizen and employee. **CRP1**
2. Apply appropriate academic and technical skills. **CRP2**
3. Attend to personal health and financial well-being. **CRP3**
4. Communicate clearly, effectively, and with reason. **CRP4**
5. Consider the environmental, social and economic impacts of decisions. **CRP5**
6. Demonstrate creativity and innovation. **CRP6**
7. Employ valid and reliable research strategies. **CRP7**
8. Utilize critical thinking to make sense of problems and persevere in solving them. **CRP8**
9. Model integrity, ethical leadership, and effective management. **CRP9**
10. Plan education and career path aligned to personal goals. **CRP10**
11. Use technology to enhance productivity. **CRP11**
12. Work productively in teams while using cultural/global competence. **CRP12**