Agriscience Course Standards with Aligned Activities

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	Standard Description	*Activity Description
1.1	Safety: Identify and explain **general laboratory safety procedures** including, but not limited to, prevention and control procedures in agriscience laboratories and agriculture workplaces. Demonstrate safety procedures and complete safety tests with 100 percent accuracy.	Divide the class into groups of two students to do a safety inspection of the agriculture laboratories including all tools and equipment. Have the students develop a written safety inspection report of their findings and include recommendations to correct any safety issues and present their findings to the class for discussion.
1.2	1.1 Careers: Explore and compare **local, regional, state, national, and global career opportunities** in the agriscience industry. Use multiple print, online, and/or personal interview sources, to capture at a minimum the following: a. Job description b. Essential knowledge and skills c. d. Program or path of study to reach occupational goals, starting with high school through postsecondary and/or military options e. Credentialing and/or licensure requirements f. Non-educational job requirements such as minimum age, experience in the field, physical fitness tests, background checks, or other notable evaluations g. Resume writing	Have students choose a career in agriculture that is interesting to them and research the profession. Have students write an informative essay on a job title including the type of work, skills, knowledge requirements, job availability, and average salary in their field of work, citing 3 courses of labor data, charts, or graphs to support text. The text should answer the question: why it is important to the agriculture industry as a whole. Have the student orally summarize their findings to the class.

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2.1	Overview: Articulate important **historical and current events** impacting the **agricultural industry and agricultural youth development**. Include landmark laws, theories, and practices such as, but not limited to, the Morrill Act, the Smith-Lever Act, the Smith-Hughes Act, and influential figures such as John Deere, Henry Groseclose, Booker T. Washington, and important government agencies in the promotion of knowledge and technology of agricultural science, biotechnology, and key technological developments.	Have each student research a different event in the National FFA History write an explanatory essay, citing at least 3 sources in an annotated bibliography, about how the event impacted the FFA Organization, and/or American Agriculture. Students will orally present their research in chronological order to the class.
2.2	Economic Impact: Analyze information to summarize the **agricultural industry's economic impact**. Explain the **major agriculture commodities produced in Tennessee** and their importance to Tennessee, the United States, and the global economy. Develop a **foundational Supervised Agricultural Experience program** that provides growth into an immersion SAE with an opportunity to implement multiple science and engineering practices:	Once students have decided on an SAE program, have the students determine a goal for their SAE program, hypothesize an outcome in a narrative text, apply the concepts of the scientific investigation process as a method to evaluate the outcome, and cite specific textual evidence to support analysis. Have students further their research by developing and conducting an Agriscience Fair project. For more information on the scientific process, review TN Biology standards.
2.3	Solutions: Define the criteria for successful **solutions** to common agricultural problems and identify **relevant constraints** (including social and political constraints). Include problems at the local, state, national, and global levels. Evaluate solutions to these problems and how the solutions meet the defined **criteria** and **constraints**. For example, how to efficiently and profitably grow larger quantities of safe high-quality food on less land to feed the growing population	Write an informative essay, citing multiple sources in an annotated bibliography, to compare and contrast current issues in breeding and genetics Compare natural selection versus genetic modification versus selective breeding and the economic, ethical, and agricultural impact associated with these processes. Have students revise, edit, and rewrite their essay before orally presenting their research.

TN Department of Education | College, Career and Technical Education

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3.1	Systems: Research a variety of **controlled environment systems** including, but not limited to, aquaponic systems, hydroponic systems, wildlife habitats, greenhouses, etc. Design a controlled environment that accounts **for the inputs, outputs, and stability of flows of matter** within the major biogeochemical cycles – such as carbon, nitrogen, phosphorus, and water.	Divide classroom into groups and assign each group a biochemical cycle to research, citing at least 3 references, and prepare an illustrative model and informative text that explains the steps, functions, and purpose of their cycle to present to their classmates as a group presentation.
3.2	Models: Develop **models for the flow of energy and matte**r (inorganic forms and overall biomass) in various ecosystems impacting agricultural and environmental systems. Using these models, calculate rates of productivity by analyzing the major components of a food chain. Employ **mathematical models** to explain growth patterns and rates, both density-dependent and density-independent **factors, observed in ecosystems energy and nutrients flow.**	Have students to visit a local or state park or natural area to catalog the observable biotic and abiotic factors, plant and animal populations, producer, consumers, decomposers, etc. Have students present an informative report including collected information, drawings and pictures taken to document findings from their visit.
3.3	Biodiversity: Evaluate the impact of **habitat fragmentation, destruction, and other environmental pressures,** such as invasive species, overharvesting, pollution, and climate change on local and global biodiversity (genetic, species, and ecosystems.) Distinguish between **types of pollution (point and not-point sources)** and their sources to predict the **effects on environmental conditions** (e.g., water, soil, and air), animal populations, and plant populations from various kinds of human activity.	Create different scenarios where pollution could occur (Ex: Farmer's applying chemicals, factory or machine exhaust, waste products being removed, etc.) and have students research laws and conservation practices, citing multiple sources, that are in place to prevent these common causes of pollution.
4.1	Cell Structures: Explain the major events of the **eukaryotic cell cycle** which accounts for a single cell growing into a multicellular plant or animal that may have its own reproductive capacity. Compare and contrast **cell division in various eukaryotic cell types** in plants and animals.	After researching cell organelles and their functions have students create models with all the organelles properly labeled and explain their function within the cell. Some examples of construction materials could be: play-doh, household items, food/candy.

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4.2	Processes: Gather evidence to support the arrangement of cells into **tissues, organs, and systems that** meet the needs of an entire organism. For example, the distribution of water and nutrients to all cells in plants and animals.	Have students design a graphic organizer to compare and contrast proteins, carbohydrates, lipids, and nucleic acid, citing textual evidence. Conduct a lab to detect their presence in certain foods and record findings in their notebook.
5.1	Role of Genetics and Genomics: Evaluate the **roles of genetics and genomics** in understanding health and disease. Describe the **impact genomics has made in the food and fiber industry**. Compare and contrast the important connections between these	After researching the role of genetic makeup have students identify how genetic variations and selection can be fruitful in establishing disease resistance in livestock.
5.2	Genetic Data: Analyze and interpret data (e.g., pedigrees, genetic markers, birth weights) that supports how **sexual and asexual reproduction** in plants and animals contributes or limits genetic variation in populations.	After properly covering the Punnett Square and its function, students will research, citing at least 3 sources, and prepare an informative text explaining genetic characteristics associated with cattle. Have students interpret an Expected Progeny Difference chart (EPDs) and discuss the genetic information listed and its benefit to potential buyers and breeders. Students may then use these genetic qualities outlined in the EPDs and integrate them into a Punnett Square model to determine genetic ratios of certain traits.
6.1	Animal Systems: Identify and describe the major **animal body systems (skeletal, muscular, respiratory, digestive, nervous, circulatory, and reproductive)**. Develop explanations for the **relationships between the structure of individual parts and their function in the larger system** for common livestock, companion animal, and wildlife species. (e.g., Tendons transfer muscle movements to the skeletal system by attaching bones and	Use play-doh, or other modeling material, to map out the digestive systems in domestic animals to compare and contrast monogastric and polygastric digestive systems. Use pins to label the different parts.
6.2	Form and Function: Apply the **selection for specific traits** to common animal breeds with different **intended or domesticated uses**, such as but not limited to draft horse versus light horse and meat cattle versus dairy cattle. Relate the **form of domestic and wild animals** to their intended uses or their adaptive	Divide students into groups and assign them an animal body system. Have groups research each system and teach the class what they have learned about the purpose, structure, and function of the system through a group presentation.

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7.1	Digestion: Explain the sequential organization of the different **types of digestive systems** in domestic animals and compare and contrast **anatomical and physiological differences** between monogastric versus ruminants and herbivores versus carnivores. Analyze the **stages of digestion and associated processes**,	Use play-doh, or other modeling material, to map out the digestive systems in domestic animals to compare and contrast monogastric and polygastric digestive systems. Use pins to label the different parts.
7.2	Nutritional Deficiencies: Develop a solution to eliminate dietary **deficiencies** identified through the **analysis of feedstuffs**. Solutions should adhere to specified criteria for proper nutrition based on animal purpose, age, lifespan, and relevant constraints such as environmental factors and expense.	Interview or invite an animal nutritionist to speak to the class on the importance of nutrition based on life stage and activity level. Drawing from informative texts and the animal nutritionist's comments, write a report on how an animal's health affects their metabolism, digestion, and energy production, citing textual evidence.
8.1	Fundamentals of Plant Growth: Apply concepts related to basic **cellular and biochemical process** to accomplish the following: a. Create a graphic illustration of the parts and functions of plant cells. b. Use quantitative reasoning to balance chemical equations related to plant processes. c. Interpret the role of physics within the cohesion/tension theory and its significance to plant life. d. Examine the roles of photopigments and the effects of different colors of light on plant growth.	Working with your schools biology teacher, attain or prepare slides of a monocot and dicot root, stem, and leaf sample for a plant anatomy lab. While viewing the slides, have students draw what they see, label all major parts, and identify their functions.
8.2	Fundamentals of Soil Science: Analyze models to explain the correlation between **plant nutrient deficiencies and soil composition**. Conduct basic soil analysis to determine the **chemical elements and nutritional levels available in various soils** that are essential for plant growth. Predict the ability of soils to meet the nutritional requirements of plants based on chemical	Conduct a soil lab where students analyze different soil samples to determine and record the physical characteristics of the soil (fine, medium, course, clay, sand, silt, etc.) in a graphic illustration. Research the yield rates, limitations, and practices associated with their soil samples and present a written recommendation for the best use of the soil to the class.

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9.1	Fundamentals of Plant Reproductive Systems: Compare and contrast the basic **reproductive structures of plants**, drawing out key differences between **sexual and asexual reproductive** processes.	Have students create a graphic organizer comparing and contrasting sexual and asexual reproduction and include plant examples for each reproductive process. These could be posted in the room for a gallery walk to allow students to review/clarify work through peer discussion.
9.2	Seed Anatomy: Using various seed models, analyze the **structure and function** of each to predict their roles in **plant reproduction and propagation**.	Prior to learning about the seed parts and plant growth of monocot and dicot plants, have students plant several corn and bean seeds and document the growth in a journal. Have students identify the cotyledon, hypocotyl, coleoptile, and true leaves as the plant is emerging, as well as measure growth and development of the plants and root systems. Chart the results at the end.
9.3	Fundamentals of Animal Reproduction Systems: Identify and describe the organs of the **male and female animal reproductive systems** that provide **physiological function**. Compare and contrast the **differences** in the reproductive systems **small and**	Develop graphical illustrations to map out the male and female reproductive system in animals. Use pins to label the different parts and develop a key that explains the functions of each part identified.
10.1	Energy: Use models to evaluate the **changes in energy** that occur in agricultural applications. a. Define types of energies and objects present in a system. b. Analyze the relations between changes in energy and work done on/by the system. c. Use evidence to support that simple machines use a tradeoff in force for distance to accomplish the same amount of work, while obeying the law of conservation of energy. d. Evaluate inefficiencies in designed systems that result from energy transfers to the surroundings. e. Explain energy transfers through radiation and how energy transferred from the sun can be stored and transferred for later use.	After teaching the lesson on the relationship between speed, distance, and time, have the students to develop a hieroglyphics moment to help them remember parts of the mathematical equations to determine mechanical horsepower to operate a variety of simple machines. (A hieroglyphic moment is to have the students to divide a blank sheet of paper into six sections and write the different mathematical components at the top of each section such as: speed, distance, time, energy, power and watts.) Have students share and explain how the picture or icon relates to each mathematical topic. Have students solve several different equations to calculate horsepower problems with or without hieroglyphic moments.

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10.2	Safety: Identify different models of producing **electrical energy**. Discuss **safety hazards** as well as prevention and control methods relevant to electrical power models. Predict **strategies to prevent or manage electrical hazards** and evaluate the efficacy of the prevention measures.	Divide students into groups according to the different methods for producing electrical energy. Have students to brainstorm and develop a list of safety hazards and how prevention or control methods prevent injury for their method. Have students research multiple resources and use their original list to justify the use of different precautions for the prevention or control of electrical hazards and present their findings to the class.
10.3	Energy Consumption: Summarize methods and compare units used to benchmark **energy use**. Utilize the **appropriate instruments needed** to calculate and measure voltage, amperage, resistance, and calculate wattage.	In groups, have students gather relevant information from multiple sources to develop a "User Guide for Dummy's" for instruments used to measure voltage, amperage, resistance and wattage. Have the students exchange guides to build additional clarification to increase the accuracy of the guide.
11.1	Engine cycles: Develop models that explain how **changes in chemical energy, thermal energy, and states of matter** allow the operation of small gasoline and diesel engines.	After defining the first law of thermodynamics and identifying the cycles and major parts of the engine, have students develop their own theory of how each part of a gasoline and diesel engine relates to the first law of thermodynamics. Then group the students into groups of four to compare theories to develop a group theory for a gas or diesel engine. Post the group theories on the wall to do a gallery walk to build on each group's theory. In a class discussion, have students explain why their additions helped to explain the first law of thermodynamics.
11.2	Horsepower: Using mathematical models, calculate **horsepower and thermal efficiency** for a variety of internal combustion engines.	After teaching the method to calculate horsepower, thermal efficiency, and the uses of simple machines, divide students into groups to determine what formula to use for given scenarios. Example: How much force or horsepower is required to move a 70 pound bale of hay up a hay elevator into the barn loft that is 12 feet high? Note: change the weight, item, and equipment that is used within your program or community.