

End of Course Assessment Blueprint

Agricultural Power and Technology EoC

The **End of Course Assessment Blueprint** aligns CASE 4 Learning (CASE) Concepts and Performance Objectives to the National AFNR Content standards and performance indicators developed by the National Council for Agricultural Education (The Council). The concepts and performance objectives listed in this blueprint are assessed in the **Agricultural Power and Technology End-of-Course Assessment**. The assessment is available through **NOCTI**, serving as a CASE partner for third-party delivery. Teachers should use this blueprint to prepare their students for the comprehensive **Agricultural Power and Technology Animal End-of-Course Assessment**.

In the CASE learning model, Concepts are key elements of understanding that students are expected to learn. Concepts are developed by a curriculum committee of content experts comprised of industry representatives, post-secondary educators, and secondary teachers. Performance Objectives are how students will demonstrate their understanding of the concept. All Concepts and Performance Objectives measure student competency of the AFNR Content Standards. The AFNR Content Standards provide state agricultural education leaders and educators with a high-quality, rigorous set of standards to guide what students should know and be able to do after completing a program of study in each of the following AFNR Career Pathways.

- Career Ready Practices (Integrated)
- Foundational Pathway Skills (Integrated)
- Agribusiness Systems
- Animal Systems
- Biotechnology Systems
- Education, Communication, and Leadership
- Environmental Sustainability Systems
- Food Products and Processing Systems
- Natural Resource Systems
- Plant Systems
- Power, Structural, and Technical Systems

DEFINITIONS: Within each pathway, the standards are organized and aligned to the CASE curriculum as follows:

- **Standards** – These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and CASE measurements.
- **Performance Indicators** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.
- **CASE Measurements** – These are CASE Concepts with bulleted Performance Objectives. Students carry out the Performance Objectives to show understanding of the Concept, which indicates attainment of each performance indicator. The beginning CASE measurements require students to remember, understand, identify, explain, and summarize information. The intermediate CASE measurements require students to apply, analyze, compare, distinguish, and examine information and scenarios. The advanced CASE measurements require students to assess, evaluate, justify, improve, and create.

The **Agricultural Power and Technology End-of-Course Assessment** measures student competencies in the AFNR Pathways included in this blueprint. For more information about the National AFNR Content Standards, visit The National Council for Agricultural Education's website at <https://www.thencae.org/afnr-standards>.

POWER, STRUCTURAL, AND TECHNICAL SYSTEMS STANDARD

PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.01.01. Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural, and technical systems.	APT 5.1 Concept 1 Chemical reactions release and absorb thermal energy.	APT 5.1 Concept 4 Agriculture is a producer of renewable forms of fuel.	
	• Make a hand warmer using elements that chemically react.	• Make ethanol from agricultural products.	
		APT 5.1 Concept 5 Fossil and bio-fuels release energy and chemical bi-products when they combust.	
		• Model the combustion of hydrocarbons and ethanol.	
		APT 5.3 Concept 1 Electromagnetic fields are a source of mechanical energy used to produce rotational movement.	
		• Construct an electric motor and identify the parts and their functions.	
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.01.02. Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.	APT 1.1 Concept 3 Power and technology increase the efficiency of agriculture, food, and natural resource production.	APT 1.2 Concept 3 Work and power calculations are used to determine efficiencies in agricultural systems.	APT 6.1 Concept 4 The power and speed of a <i>machine</i> is dependent upon proper design.
	• Calculate and compare the efficiency of different tools.	• Calculate the work completed by a machine. • Calculate and compare power in English and SI units	• Use ratios to calculate the speed and torque of multiple systems of gears.
	APT 1.1 Concept 4 People in agricultural power and technology use the engineering design process to increase agricultural productivity and solve problems.	APT 6.1 Concept 2 Simple machines provide a mechanical advantage.	
	• Identify how an entrepreneur in agricultural mechanics used the engineering process to improve production of food, fiber, and fuel. • Design a prototype using the engineering design process to solve a problem.	• Measure the mechanical advantage of different classes of levers and identify where levers are used in agriculture.	
	APT 1.2 Concept 1 Many forms of potential and kinetic energy are used in agriculture to complete tasks or work.	APT 6.1 Concept 3 The amount of work to operate a machine will be greater than the work done by the machine.	

	Identify types of energy used and managed in agriculture.	Calculate the efficiency of work completed by a pulley system to lift an object.	
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.01.03. Apply physical science and engineering principles to metal fabrication using a variety of welding and cutting processes and equipment (e.g., SMAW, GMAW, GTAW, Oxy-fuel, CNC, and plasma arc torch, etc.).	APT 3.1 Concept 4 Metals will physically change based upon environmental factors.	APT 4.3 Concept 3 A variety of welding processes are used to fuse metal.	
	- Measure the thermal conductivity and thermal expansion of different metals. - Treat metal with heat and compare the physical changes.	Research and present basic techniques for different welding processes.	

POWER, STRUCTURAL, AND TECHNICAL SYSTEMS STANDARD			
PST.02. Operate and maintain AFNR mechanical equipment and power systems.			
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.	APT 3.1 Concept 3 Mechanical properties of metal will determine its service life and applications.	APT 6.2 Concept 2 Preventive maintenance requires a systematic periodic schedule.	
	Compare and contrast tensile strength, ductility, brittleness, and hardness of common metals used in agriculture.	Use a technical manual to develop a maintenance schedule for a small engine.	
		APT 6.2 Concept 3 Troubleshooting includes identifying the problem, researching solutions, and applying the possible solutions.	
		Develop a flow chart for solving a problem for a machine and use the chart for troubleshooting.	
		APT 6.2 Concept 4 Machines are calibrated to perform a specified task.	
		- Calibrate a water pump to perform a task at a specific rate. - Design a model of a windmill that produces electricity used to pump water at a specified rate.	

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.	APT 2.1 Concept 3 Personal protective equipment is the last line of defense against injury.	APT 2.2 Concept 1 Tools are designed for specific applications.	APT 2.2 Concept 3 Operating procedures for machines and tools keep the operator safe and the machine or tool in good working order. • Write an operating procedure for using a power tool safely.
	• Identify types of PPE and their uses in the shop.	• Select correct hand tools for a specific job.	
		APT 2.2 Concept 2 The function of tools and machines will affect how they are operated. • Identify the components of a power tool and determine any hazards present by using a safety evaluation form.	

POWER, STRUCTURAL, AND TECHNICAL SYSTEMS STANDARD			
PST.03. Service and repair AFNR mechanical equipment and power systems.			
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	APT 5.2 Concept 1 Electricity must flow in a complete loop from the source and to the source with no breaks for a circuit to operate correctly.	APT 5.2 Concept 2 The relationship between amps, volts, and ohms can be defined using Ohm’s Law.	
	• Build a complete electrical circuit • Define an open and closed circuit	• Calculate amps, volts, and ohms in a circuit using Ohm’s Law.	
		APT 5.2 Concept 3 Two types of electrical circuits used in agriculture are series and parallel.	
		• Construct a parallel and series circuit.	
		APT 5.2 Concept 4 The use of electricity requires a knowledge and understanding of relationships between voltage, current, and resistance.	
		• Demonstrate how a resistor affects the electrical current in circuit.	
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.03.03. Utilize manufacturers’ guidelines to diagnose and troubleshoot malfunctions in machinery, equipment, and power		APT 3.3 Concept 1 Fluids cool and lubricate agricultural machines and equipment.	APT 5.3 Concept 4 Controlled movements of fluids under pressure produce mechanical energy.
		• Determine how lubrication can reduce the friction produced in a machine.	• Construct a hydraulic lift that can perform a specified amount of work.

source systems (e.g., hydraulic, pneumatic, transmission, steering, powertrain, suspension, etc.).		APT 3.3 Concept 3 Temperature can change the physical properties of fluids.	
		• Calculate the viscosity of different oils at varying temperatures.	
		APT 5.3 Concept 3 The force produced in a fluid power system is measured using Pascal's Law.	
		• Calculate the force of fluids under pressure.	

POWER, STRUCTURAL, AND TECHNICAL SYSTEMS STANDARD

PST.04. Plan, build and maintain AFNR structures.

PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.04.01. Create plans for AFNR structures.	APT 4.2 Concept 1 A variety of tools are used to process bulk materials into useable parts.	APT 4.1 Concept 1 Concept Accurate plans and scaled drawings are essential for project success.	
	• Identify different types of cutting tools and blades. Fabricate a nut and bolt with a tap and die.	• Draw a floor plan of a shop to scale. • Draw isometric and orthographic depictions of three-dimensional objects.	
		APT 4.2 Concept 2 Proper measurements and efficient use of materials are essential when manufacturing useable parts.	
		• Demonstrate how the kerf must be considered when cutting material.	
		APT 6.3 Concept 2 Concept Structures provide a controlled environment to protect agricultural commodities and equipment.	
		• Measure and compare the insulation properties of building materials.	
		APT 6.3 Concept 3 Concept Agricultural structures contain joints and assemblies that withstand multiple types of forces. • Construct and test truss designs for strength.	
PERFORMANCE INDICATOR	CASE MEASUREMENTS		
	Beginning	Intermediate	Advanced
PST.04.04. Follow architectural and mechanical plans to construct,	APT 2.3 Concept 3 Estimation is used for completing a project or activity.	APT 2.3 Concept 4 The Pythagorean Theorem can be used to determine if a corner is square.	

maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, surveying, electrical, plumbing, concrete/masonry, etc.).	• Use pacing to estimate the distance between two points.	• Use the Pythagorean Theorem to determine if an area is square and square a corner using a 3-4-5 triangle.	
	APT 3.2 Concept 1 Wood is selected based upon their physical and mechanical properties.	APT 2.3 Concept 5 Areas are calculated using mathematical formulas.	
	• Determine the relationship between density and tensile strength of species of wood.	• Use mathematical formulas to measure an area of land.	
	APT 4.3 Concept 1 Torque is a factor considered when fastening material together.	APT 3.1 Concept 1 Metals used in agriculture can be identified using physical properties.	
	• Observe the effect of torque on fastener performance.	• Identify metals based upon their physical properties.	
		APT 3.1 Concept 2 Chemical properties of metal will determine how it reacts with other metals in the environment.	
		• Explain how metals chemically react in certain environmental conditions. Explain how metals react with each other.	
		APT 3.2 Concept 4 Concept The chemical makeup of plastics will determine their mechanical properties.	
		• Make plastics with varying mechanical properties.	
		APT 3.4 Concept 1 Water and land are material that are mechanically managed and conserved.	
		• Measure the relationship between slope and velocity of water and observe management techniques to control erosion on sloped land.	
		APT 3.4 Concept 3 The strength of concrete is dependent upon proper mixing and curing of materials.	
		• Mix concrete and observe the chemical and physical changes. • Test the compression strength of different mixtures of concrete.	
		APT 4.3 Concept 2 Fasteners are selected based upon strength and durability when joining machine and structural parts.	
		• Test the strength and durability of different fasteners and determine where they should be used.	