



**PLANT & SOIL  
SOILS SPECIALIST  
SKILLS STANDARDS  
OD46302**

## ***Competency-Based Education: OKLAHOMA'S RECIPE FOR SUCCESS***

### ***BY THE INDUSTRY FOR THE INDUSTRY***

Oklahoma's *CareerTech* system of competency-based education uses industry professionals and certification standards to identify the knowledge and abilities needed to master an occupation. This industry input provides the foundation for development of instructional materials that help prepare the comprehensively trained, highly skilled employees demanded by our workplace partners.

### ***TOOLS FOR SUCCESS***

*CareerTech* relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction in Oklahoma's *CareerTech* system. The skills standards outline the knowledge, skills, and abilities needed to perform related jobs within an industry. Skills standards are aligned with national skills standards; therefore, a student trained to the skills standards possesses technical skills that make him/her employable in both state and national job markets.

**Curriculum materials** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources provide supplemental activities to enhance learning and provide hands-on training experiences.

**Competency Assessments** test the student over material outlined in the skills standards and taught using the curriculum materials. When used with classroom performance evaluations, written competency assessments provide a means of measuring occupational readiness.

Although each of these components satisfy a unique purpose in competency-based education, they work together to reinforce the skills and abilities students need to gain employment and succeed on the job.

### ***MEASURING SUCCESS***

Written competency assessments are used to evaluate student performance. Results reports communicate competency assessment scores to students and provide a breakdown of assessment results by duty area. The results breakdown shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

Group analysis of student results also provides feedback to instructors seeking to improve the effectiveness of career and technology training. Performance patterns in individual duties indicate opportunities to evaluate training methods and customize instruction.

### ***TRUE TO OUR PURPOSE***

"Helping Oklahomans succeed in the workplace" defines the mission of Oklahoma *CareerTech* and its competency-based system of instruction. Skills standards, curriculum, and assessments that identify and reinforce industry expectations provide accountability for programs and assure *CareerTech*'s continued role in preparing skilled workers for a global job market

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**PLANT & SOIL SCIENCES  
SOIL SPECIALIST  
SKILLS STANDARDS  
Frequency and Criticality Ratings**

- Duty A: Understand Basic Concepts of Plant Nutrition
- Duty B: Understand Basic Concepts of Soil Fertility
- Duty C: Demonstrate Knowledge of Soil Testing and Plant Analysis
- Duty D: Recognize Nutrient Sources and Applications
- Duty E: Understand Soil pH and Soil Amendments
- Duty F: Demonstrate Knowledge of Nutrient Management Planning
- Duty G: Understand Basic Soil Properties
- Duty H: Recognize Characteristics of Soil Erosion
- Duty I: Understand Restrictive Soil Layers
- Duty J: Utilize Skills Related to Site Characterization
- Duty K: Understand Processes Involving Water and Solute (Soil Solution) Movement
- Duty L: Understand Plant/Water Relations
- Duty M: Demonstrate Knowledge of Irrigation and Drainage
- Duty N: Understand Basic Concepts of Water Quality

**Frequency:** represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

- 1 = less than once a week
- 2 = at least once a week
- 3 = once or more a day

**Criticality:** denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

- 1 = slight
- 2 = moderate
- 3 = extreme

**DUTY A: Understand Basic Concepts of Plant Nutrition**

CODE	TASK	F/C
A.01	List the 16 elements essential for plant nutrition	3/3
A.02	Classify the essential elements as primary, secondary, or micronutrient	2/3
A.03	Recognize the function of primary nutrients in plants	2/2
A.04	List chemical uptake forms of Nitrogen, Phosphorus, and Potassium	2/2
A.05	Specify how Nitrogen, Phosphorus and Potassium needs change according to plant growth stages	2/3

**DUTY B: Understand Basic Concepts of Soil Fertility**

CODE	TASK	F/C
B.01	Recognize and define nutrient sources in the soil <ul style="list-style-type: none"> <li>• Soil solution</li> <li>• Cation exchange sites</li> <li>• Organic matter</li> <li>• Soil minerals</li> </ul>	2/2
B.02	Define nutrient transformations and interactions <ul style="list-style-type: none"> <li>• Mineralization</li> <li>• Immobilization</li> </ul>	1/2
B.03	Describe how the processes of mass flow, diffusion, and root interception affect nutrient uptake	1/1
B.04	Describe the cation exchange process	1/2
B.05	Distinguish each primary and secondary nutrient as mobile or immobile in the soil	2/2
B.06	Describe how soil characteristics affect nutrient availability <ul style="list-style-type: none"> <li>• Texture</li> <li>• Structure</li> <li>• Drainage/aeration</li> <li>• Soil moisture</li> </ul>	1/1
B.07	Recognize how different crops and cropping systems affect soil fertility and fertilization strategies	2/2

**DUTY C: Demonstrate Knowledge of Soil Testing and Plant Analysis**

CODE	TASK	F/C
C.01	Demonstrate how to take a soil sample for nutrient analysis	2/3
C.02	Recognize the relationship of soil test results to expect crop response	2/3
C.03	Demonstrate how to take a soil sample for nutrient analysis	3/3
C.04	Demonstrate how to take a soil sample for site assessment	2/3
C.05	Understand the chain of custody procedures with regard to soil samples	2/3

**DUTY D: Recognize Nutrient Sources and Applications**

CODE	TASK	F/C
D.04	Define application methods of fertilizer placement methods <ul style="list-style-type: none"> <li>• Injection</li> <li>• Broadcast</li> <li>• Band</li> <li>• Fertigation</li> <li>• Foliar</li> <li>• Sidedress</li> <li>• Topdress</li> </ul>	2/3
D.05	Convert fertilizer analysis from elemental to oxide form and vice versa	1/2
D.06	Recognize soil contaminants	3/3

**DUTY E: Understand Soil pH and Soil Amendments**

CODE	TASK	F/C
E.01	Define terms associated with soil pH	2/2

	<ul style="list-style-type: none"> <li>• Soil pH</li> <li>• Buffer pH</li> <li>• Acidity</li> <li>• Alkalinity</li> </ul>	
E.02	Determine how climate affects soil pH	2/2
E.03	Determine how fertilizer application affects soil pH	
E.04	Determine how soil texture and soil organic matter affect soil buffering	
E.05	Determine how soil pH affects the availability of the primary nutrients	
E.06	List common soil amendments that can raise or lower soil pH <ul style="list-style-type: none"> <li>• Calcite</li> <li>• Dolomite</li> <li>• Ammonium sulfate</li> </ul>	
E.07	Calculate lime amounts to achieve recommended lime requirements	

**DUTY F: Demonstrate Knowledge of Nutrient Management Planning**

CODE	TASK	F/C
F.01	Construct a yield goal based on production history, soil productivity, and level of management	3/3
F.02	Define terms associated with crop nutrient needs <ul style="list-style-type: none"> <li>• Crop nutrient demand</li> <li>• Crop rotation sequence</li> <li>• Soil productivity</li> <li>• Soil test information</li> </ul>	2/2
F.03	Recognize the components of a nutrient management plan	3/3
F.04	Describe how nutrient loss from soil by erosion, runoff, volatilization, or leaching affects the environment	2/3

**DUTY G: Understand Basic Soil Properties**

CODE	TASK	F/C
	<b>Chemical</b>	
G.01	Define anion and cation	2/3
G.02	Define cation exchange capacity (CEC)	1/2
G.03	List the factors that influence CEC <ul style="list-style-type: none"> <li>• Percent clay</li> <li>• Type of clay</li> <li>• Percent organic matter</li> <li>• PH</li> </ul>	2/3
G.04	Define saline, sodic, calcareous, and acid soils	2/2
	<b>Physical</b>	
G.05	Define soil texture	1/2
G.06	Use the textural triangle to identify soil textural class	2/2
G.07	Describe how particle size affects surface area	1/2
G.08	Describe how soil texture affects the water holding capacity, available water, and wilting point of soils	2/3
G.09	Define soil structure	1/2
G.10	Differentiate types of soil structure	2/2

	<ul style="list-style-type: none"> <li>• Blocky</li> <li>• Granular</li> <li>• Platy</li> <li>• Massive</li> </ul>	
G.11	Describe how soil organisms affect soil structure	2/2
	<b>Biological</b>	
G.12	List sources of soil organic matter	2/2
G.13	Describe properties of soil organic matter	2/2
G.14	Describe beneficial effects of soil organic matter	2/3
G.15	Describe how to maintain or increase soil organic matter levels	2/3
G.16	Describe soil microbial activity	2/3
G.17	Explain factors influencing soil microbial activity <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Moisture</li> <li>• Soil pH</li> <li>• Organic matter</li> <li>• Salinity</li> <li>• Fertilizer application</li> </ul>	2/2
G.18	Explain how the C:N ratio affects organic matter decomposition	2/2

#### DUTY H: Recognize Characteristics of Soil Erosion

CODE	TASK	F/C
H.01	Describe the erosion processes of detachment, transport, and deposition	2/3
H.02	Define water erosion <ul style="list-style-type: none"> <li>• Sheet</li> <li>• Rill</li> <li>• Gully</li> </ul>	2/2
H.03	Define wind erosion <ul style="list-style-type: none"> <li>• Surface creep</li> <li>• Saltation</li> <li>• Suspension</li> </ul>	2/2
H.04	Explain how factors affect the rate of erosion by water <ul style="list-style-type: none"> <li>• Duration and intensity of rainfall</li> <li>• Soil texture</li> <li>• Slope length</li> <li>• Slope percentage</li> <li>• Vegetative and residue cover</li> </ul>	3/3
H.05	Explain how factors affect the rate of erosion by wind <ul style="list-style-type: none"> <li>• Vegetative and residue cover</li> <li>• Wind velocity</li> <li>• Unsheltered distance</li> <li>• Soil surface roughness</li> </ul>	3/3
H.06	Describe how erosion decreases: <ul style="list-style-type: none"> <li>• Crop yield potential</li> <li>• Water holding capacity</li> <li>• Nutrient content</li> <li>• Organic matter content</li> <li>• Infiltration</li> <li>• Water quality</li> </ul>	3/3

	<ul style="list-style-type: none"> <li>• Air quality</li> </ul>	
H.07	Recognize and define types of conservation practices that decrease wind erosion <ul style="list-style-type: none"> <li>• Strip cropping</li> <li>• Surface residue</li> <li>• Cover crops</li> </ul>	3/3
H.08	Recognize and define types of conservation practices that decrease water erosion <ul style="list-style-type: none"> <li>• Strip cropping</li> <li>• Contouring</li> <li>• Terraces</li> <li>• Grassed waterways</li> <li>• Surface residue</li> <li>• Cover crops</li> <li>• Row spacing</li> </ul>	2/3

**DUTY I: Understand Restrictive Soil Layers**

CODE	TASK	F/C
I.01	Describe characteristics of restrictive soil layers <ul style="list-style-type: none"> <li>• Subsurface compaction</li> <li>• Surface compaction</li> <li>• Crusting</li> </ul>	2/2
I.02	List causes of restrictive soil layers <ul style="list-style-type: none"> <li>• Subsurface compaction</li> <li>• Surface compaction</li> <li>• Crusting</li> </ul>	2/3
I.03	Explain how restrictive soil layers hinder plant growth	2/2
I.04	Describe methods for preventing and alleviating restricting soil layers	2/2

**DUTY J: Utilize Skills Related to Site Characterization**

CODE	TASK	F/C
J.01	Locate a tract of land using a legal land description	2/3
J.02	Use a soil survey to locate a tract of land	2/3
J.03	Use a soil survey to determine soil characteristics of a field	2/3
J.04	Identify sources of information used to determine field limitations <ul style="list-style-type: none"> <li>• Leaching potential</li> <li>• Setback requirements for land applications</li> <li>• Highly erodible land</li> </ul>	2/3

**DUTY K: Understand Processes Involving Water and Solute (Soil Solution) Movement**

CODE	TASK	F/C
K.01	Describe how soil texture, soil structure, and soil organic matter affect infiltration	2/3
K.02	Define factors that influence surface runoff <ul style="list-style-type: none"> <li>• Infiltration</li> <li>• Landscape position</li> <li>• Permeability</li> <li>• Surface residue cover</li> </ul>	1/2

K.03	Define factors that influence leaching <ul style="list-style-type: none"> <li>• Infiltration</li> <li>• Permeability</li> <li>• Soil depth</li> <li>• Evapotranspiration</li> </ul>	2/2
K.04	Define preferential flow	2/2
K.05	Describe management practices that affect the potential for solute (soil solution) movement <ul style="list-style-type: none"> <li>• Timing and application</li> <li>• Rate of application</li> <li>• Erosion and runoff</li> <li>• Irrigation</li> <li>• Type of tillage operation</li> </ul>	2/2
K.06	Label a soil water cycle	2/2
K.07	Define terms that influence the soil water cycle <ul style="list-style-type: none"> <li>• Precipitation</li> <li>• Irrigation</li> <li>• Runoff</li> <li>• Soil water storage</li> <li>• Evapotranspiration</li> <li>• Deep percolation</li> </ul>	2/2
K.08	List the processes that can transport phosphorus from a field	2/2
K.09	List management practices that reduce phosphorus transport from a field	2/2
K.10	Describe how lateral flow contributes to surface water contamination	2/2

**DUTY L: Understand Plant/Water Relations**

CODE	TASK	F/C
L.01	Define soil water terms <ul style="list-style-type: none"> <li>• Saturation</li> <li>• Field capacity</li> <li>• Permanent wilting point</li> <li>• Gravitational water</li> <li>• Plant available water</li> <li>• Evapotranspiration</li> </ul>	2/2
L.02	Describe how factors influence evapotranspiration <ul style="list-style-type: none"> <li>• Wind</li> <li>• Temperature</li> <li>• Solar radiation</li> <li>• Relative humidity</li> <li>• Soil water status</li> <li>• Plant canopy</li> <li>• Crop residue surface cover</li> </ul>	2/2
L.03	Describe the effects of excessive soil moisture on plant nutrient availability and uptake	1/2
L.04	Describe the effects of soil moisture deficiency on plant nutrient availability and uptake	3/2

**DUTY M: Demonstrate Knowledge of Irrigation and Drainage**

CODE	TASK	F/C
M.01	Define irrigation methods <ul style="list-style-type: none"><li>• Furrow</li><li>• Sprinkler</li><li>• Drip/trickle</li><li>• LEPA system</li><li>• Flood</li><li>• Sub-surface</li></ul>	1/2
M.02	Define drainage methods <ul style="list-style-type: none"><li>• Tile</li><li>• Open ditch</li><li>• Beds</li></ul>	1/2

**DUTY N: Understand Basic Concepts of Water Quality**

CODE	TASK	F/C
N.01	List contaminants in water that come from agriculture	2/3
N.02	Describe how agricultural practices affect drinking water quality	2/2
N.03	Describe how agricultural chemicals and sediments move to off-site areas	2/2
N.04	Identify sources of information that provide drinking water standards	2/2
N.05	Distinguish between nitrogen analysis expressed as nitrate or nitrate-oxygen	2/2
N.06	Identify nitrate and nitrate-oxygen drinking water standards	2/2
N.07	Identify the health effects of drinking water containing nitrate-nitrogen above the drinking water standard	2/2
N.08	Describe how water contamination occurs at a wellhead	1/2
N.09	Explain the purpose of anti-back-siphoning devices	1/2
N.10	Explain how high sediment levels affect surface water quality	2/2
N.11	Explain how nitrogen and phosphorus affect surface and ground water quality	2/2
N.12	Explain the purposes of filter/buffer strips and riparian areas/tree plantings on water quality	2/2