

Agricultural Technology & Mechanical Systems CDE (2026)

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I. Purpose

To challenge FFA members to prepare for agricultural mechanics workplace expectations by developing skills and knowledge in applied physical sciences. This event allows students and teams to demonstrate subject matter and skill mastery, effective communication, problem solving techniques and the ability to function individually and as a team.

II. Overview

The 2024 area topics listed below will be followed for the CDE held in December 2023:

- A. Compact Engines – String Trimmer
- B. Machinery & Equipment – Grain Drills
- C. Electrical Systems – DC Load and Distribution
- D. Welding – SMAW – Fillet, Lap, or Pipe to plate
- E. Environmental – Surveying
- F. Team Activity – (Electrical) Wiring a wall and estimation.
- G. Written Exam – 25 written questions

III. Rules

The rules governing the West Virginia FFA ATMS CDE are as follows:

- A. All parts of the CDE will be completed at the December State CDE competition
 - 1. Participants shall report to the event site 30 minutes prior to posted start time so students can be placed in their rotational groups.
- B. Teams will consist of four members. Team ranking is determined by combining the scores of all students from each team. Team members must all be from the same chapter.
- C. Team ranking will include all four student scores and the team problem.
- D. Each participant will participate in all phases of the event.
- E. Students will be allowed to use a non-programmable calculator and will need a #2 pencils. Clipboards will be provided at the needed stations.
- F. **Participants must supply and wear** Industrial Quality Eye Protection (Z87.1), or goggles during the skill phases of the event. Coveralls or a shop coat may be worn during the skill phases of the event. Appropriate closed-toed footwear is required. (Work boots or work shoes are recommended. No sandals or cloth shoes are allowed.)
- G. Necessary equipment such as basic welding helmets or goggles as required for welding, shields, gloves, welding leathers, hearing protection devices, etc., will be provided by event host.
- H. Failure to wear appropriate safety protection or working in an unsafe manner could result in removal from that CDE area or disqualification from the CDE.
- I. No cell phones will be permitted in the contest. Anyone found using one during the contest will be removed and will receive no scores.

IV. Event Activities

Three types of activities will be included in the ATMS event. These include: A) individual problem-solving/skill development activities and B) written exam questions and C) team activity.

J. Individual Problem-Solving/Skills – Each student is individually evaluated in each of the five systems areas. The specific activities occurring in each event are not publicized prior to the event. Each student is allowed 20 minutes to complete each of the five activities. Each activity is worth 30 points.

K. Written Examination – Each student completes an examination that consists of 25 multiple-choice questions. Each question is worth two points. There are 5 questions from each of the five agricultural mechanics systems areas. Students will have 60 minutes to complete this portion of the career development event. Written exam is worth 50 points.

L. Team Activity – Each team will work together and be evaluated as a team while solving complex, multi-system agricultural problems. The problem scenario is presented to the team on the day of the event and members utilize the materials and equipment provided to undertake and prepare a written solution. Teams organize themselves, assign duties and complete tasks together or separately depending on individual skills and abilities. The team activity will be evaluated as follows:

- Teamwork process: 125 points
- Problem solving, activity, and written report: 275 points combined.
- **Total for team activity: 400 points**

V. Event Scoring

The team score will be a combination of all individual scores and the team activity. Each individual receives 25.0% of the total team activity score and will be rounded to the nearest whole number.

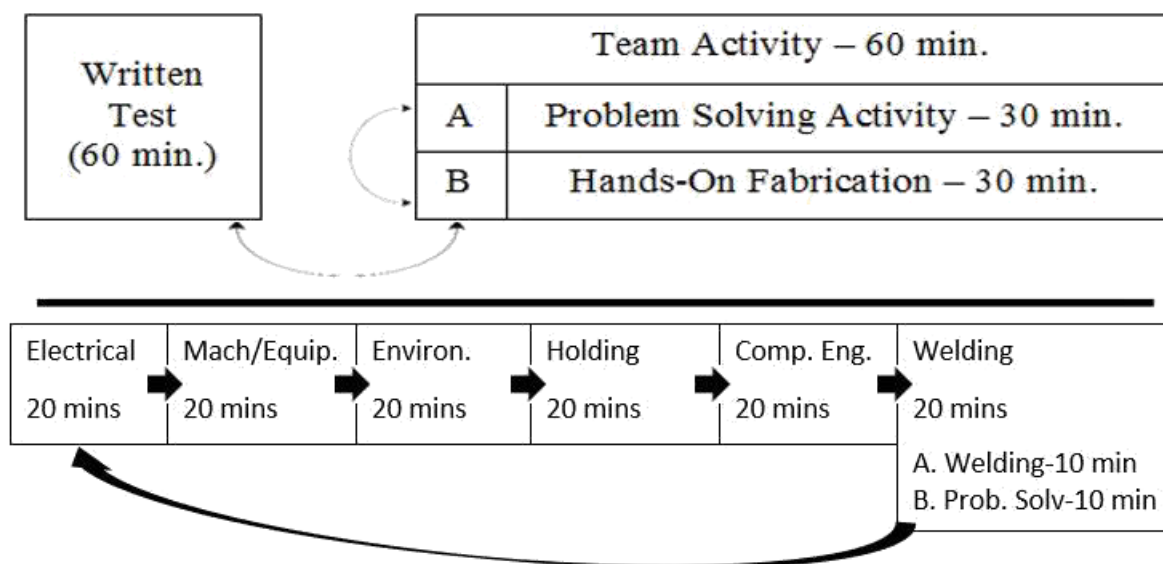
INDIVIDUAL SCORING	
Written examination (25 questions at 2 points each)	50
Individual activities (5 at 30 points each)	150
Team activity (1/4 of total team activity score)	100
<i>Total Possible Individual Score</i>	<i>300</i>
TEAM SCORING	
All Written Examinations	200
All individual activities	600
Team activity	400
<i>Total Possible Team Score</i>	<i>1200</i>

VI. Event Format

- A. Team members will work independently on problem solving and skill development activities and on the written test. Individual scores and rankings will be based on these areas.
- B. Team members will work together on a team problem solving activity. The team score will be a combination of all individual scores and the team activity. Each individual receives 25.0% of the total team activity score.

VII. Event Rotation

The following diagram is an example rotation scheme for the West Virginia ATMS CDE.



VIII. Tiebreakers

- A. The team activity score will be used to break a tie in team ranking. If the tie remains, the combined written exam scores will be used.
- B. Individual ties will be broken using written exam scores. If a tie still exists, the problem-solving/skill scores will be used (in the order identified in section X of this document).

IX. Resource Information

- A. Suggested internet website links and text references for the West Virginia ATMS CDE will follow those of the National ATMS CDE and can be found at: <http://web.missouri.edu/~schumacherl/natcon.html>

X. Tentative Topics for Future West Virginia ATMS CDEs

**Year refers to the National Convention year that the winning team would compete*

CDE Area	2027	2028	2029
Electrical Systems	Service Entrance	TBD	TBD
Environmental/ Natural Resource Systems	Surveying	TBD	TBD
Machinery & Equipment Systems	Hay Baler	TBD	TBD
Welding	GMAW/FCAW	TBD	TBD
Compact Engines	Valve Train	TBD	TBD
Team Activity	ENR	TBD	TBD

XI. Resources for West Virginia ATMS CDEs: The following is an expanded detail of resources made available for the individual/team problem-solving/skills activities.

Electrical Systems Skill Activity - Electrical systems are widely used in agricultural systems, including applications in structures and machinery. Thus, agricultural technicians must be able to interpret manufacturers' schematics, plan and install, and troubleshoot these systems. With basic service entrance panels being pivotal components in electrical systems, technicians must be familiar with these and their accompanying switches. pivotal components in electrical systems, technicians must be familiar with these and their accompanying switches. Students will be required to provide his/her own personal protective safety equipment and clothing. Students will need to provide their own basic measuring tools and protective attire from head to toe. Students must be able to read plans. Use appropriate tools safely, take measurements, calculate load, voltage, amperage, resistance, wattage,

Specific competencies for this event may include:

1. Determining Watts, Amps, Volts, and Ohms.
2. Understanding of three-way switches that control light receptacles.
3. Troubleshooting electrical circuits, identification of electrical components.
4. Use appropriate standards for agricultural applications, including the National Electric Code (NEC).
5. Troubleshooting and general knowledge competencies of general electrical applications in agriculture industry including but not limited to solar applications, current conversion systems, load distribution and more

Metals and Welding Systems Skill Activity –Simple repairs/metal fabrication are often required

when dealing with agricultural production. The Metals and Welding Systems Skill Activity will be a hands-on and problem-solving based activity. Students will be allowed to use a basic calculator at this station, but no cell phone calculators will be allowed. **Participants will need to provide their own protective welding attire.** Welding - May include: flat, fillet, lap, butt &/or pipe on plate, using GMAW, SMAW or other industry relevant method. Students will use one of the following; 6010, 6011, 6013, 7018 or E70S-6 electrodes. Shielding gasses will be C25 if GMAW. Practice metal will be available for students to use to set his/her welder. Students will have to be able to set-up the machine. Students will be given a drawing with symbols and expected to complete the weld as drawn

Environment and Natural Resource Systems Skill Activity – When dealing with the management and production of agricultural products, it is important to have a comprehensive understanding of the land systems around them. Tasks may include describing principles involved in appropriate conservation and/or land use planning; reading legal land descriptions; determining land area; determining the percent of slope or grade; measuring distances with tapes or instruments; calculating area, percentages, erosion levels, volume, etc...

Machine and Equipment Systems Skill Activity – The student is required to identify parts, pieces, and or usage of machinery (either in person or from photograph). The contestants will make decisions and calculations about pieces of appropriate machinery. This will consist of problem solving based on a scenario, power requirements for pumps and pressures, HP requirements for PTO driven equipment, identification of parts, repair, maintenance, processing, materials handling, adjustments, reading manuals, specs, and test results

Compact Engines Skill Activity – The participant will complete a 25 question multiple choice test that focuses on compact equipment. Compact equipment is defined as being 30 horsepower or less. Interpreting horsepower, torque and other power measurement criteria. Comparing costs of alternative machine uses. Properly troubleshooting a compact engine to determine the cause of a failure. Select and use engine overhaul equipment pertaining to: Ignition, Cylinder, and Piston tools. Service and maintain compression system, ignition systems, and cooling and lubrication systems

Team Activity – All team members must wear safety glasses during the team event. To enter the CDE area, students must have safety glasses in their possession. Team members will work together to complete the activity in one hour. This team event is worth 400 points (100 points for the teamwork process and 250 points for the finished product). If a team member exhibits or performs any unsafe practice, points will be deducted from the total team score. Teams will need to provide their own basic measuring tools and protective attire. Student will be asked to identify the source, set up materials, use tools to take measurements, perform necessary calculations, trouble shoot, and compose a report. Laptops will not be needed. Team activity will be based in the section noted for that year.

XII. Sample Rubric, Scantrons, and Score Cards

All rubrics will align as closely as possible to the national contest, at the discretion of the contest coordinator.

The following rubric will be used to guide the grading of the welding component of the contest.

	Needs Improvement (2Pt)	Average (4Pts)	Excellent (6 Pts)	# of Pts.
Weld Size: Weld is uniform in width throughout the entire weld.	Weld has little to no consistency in diameter.	Majority of the weld is narrower or wider than the specified size.	Weld is uniform in width throughout the entire weld.	
Weld Contour: Weld is uniform in contour shape throughout the entire length of the weld.	Weld has little to no consistency in contour.	Majority of the weld is too convex or concave in shape with lack of fusion on the toes of the weld.	Weld is uniform in contour shape throughout the entire length of the weld.	
Weld Crater: Weld crater is filled.	Weld crater is not filled.	Weld crater is slightly filled.	Weld crater is filled.	
Weld Bead Area: Surrounding weld bead are free of spatter or slag.	Bead is mostly spatter lack of actual bead.	Weld bead area has excessive amounts of spatter.	Surrounding weld bead are free of spatter or slag.	
Weld Bead Discontinuities: Weld is free of undercut, overlap, porosity.	Little to no bead present.	Majority of the bead has discontinuities listed below.	Weld is free of undercut, overlap, porosity.	
Total (out of 30)				

Team Activity Process Rubric:125 Points

	Very strong	Moderate	Weak evidence of	Points	Weight	Total
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	evidence of skill 5–4 points	evidence of skill 3–2 points	skill 1–0 points Points	Earned		Points
Communication	All team members effectively communicate with each other throughout the entire activity	Most team members communicate fairly effectively with each other during most of the activity.	Communication between team members is ineffective and sporadic during the activity.		X4	
Work Distribution	Work was evenly distributed between all team members and all team members were employed at all times	Work was distributed between two to three team members, and these members were employed most of the time.	Work was completed by only one team member with little employment of the other members.		X8	
Time Management	All team members managed their time efficiently	Most team members managed their time fairly efficiently.	One (or no) team member managed their time efficiently.		X4	
Team Organization	Team started right away, had no down time, was not rushed at the end of the task	Team was delayed in starting, had down time and was somewhat rushed at the end of the task.	Team delayed starting, had long down times and did not complete all tasks during the time allotted.		X4	
Safety glasses	Safety glasses are worn by all team members at all times with one or no reminders.	Safety glasses are worn by team members most of the time with two to three reminders.	Safety glasses are worn rarely by team members with four or more reminders.		X2	
Safety Practices	Safety practices used at all times.	Safety practices used most of the time with minor violations.	Moderate to major violations of safety practices observed.		X1	
Injuries	No injuries occurred during the activity.	Minor injuries occurred during the activity requiring no medical attention.	Moderate to severe injuries occurred during the activity.		X2	
					Total	

 West Virginia University
Agricultural Technology and Mechanical Systems
2025 State CDE
Guidelines

Written Exam A

1	A B C D E	21	A B C D E	41	A B C D E	61	A B C D E	81	A B C D E
2	A B C D E	22	A B C D E	42	A B C D E	62	A B C D E	82	A B C D E
3	A B C D E	23	A B C D E	43	A B C D E	63	A B C D E	83	A B C D E
4	A B C D E	24	A B C D E	44	A B C D E	64	A B C D E	84	A B C D E
5	A B C D E	25	A B C D E	45	A B C D E	65	A B C D E	85	A B C D E
6	A B C D E	26	A B C D E	46	A B C D E	66	A B C D E	86	A B C D E
7	A B C D E	27	A B C D E	47	A B C D E	67	A B C D E	87	A B C D E
8	A B C D E	28	A B C D E	48	A B C D E	68	A B C D E	88	A B C D E
9	A B C D E	29	A B C D E	49	A B C D E	69	A B C D E	89	A B C D E
10	A B C D E	30	A B C D E	50	A B C D E	70	A B C D E	90	A B C D E
11	A B C D E	31	A B C D E	51	A B C D E	71	A B C D E	91	A B C D E
12	A B C D E	32	A B C D E	52	A B C D E	72	A B C D E	92	A B C D E
13	A B C D E	33	A B C D E	53	A B C D E	73	A B C D E	93	A B C D E
14	A B C D E	34	A B C D E	54	A B C D E	74	A B C D E	94	A B C D E
15	A B C D E	35	A B C D E	55	A B C D E	75	A B C D E	95	A B C D E
16	A B C D E	36	A B C D E	56	A B C D E	76	A B C D E	96	A B C D E
17	A B C D E	37	A B C D E	57	A B C D E	77	A B C D E	97	A B C D E
18	A B C D E	38	A B C D E	58	A B C D E	78	A B C D E	98	A B C D E
19	A B C D E	39	A B C D E	59	A B C D E	79	A B C D E	99	A B C D E
20	A B C D E	40	A B C D E	60	A B C D E	80	A B C D E	100	A B C D E

Written Exam B

1	A B C D E	21	A B C D E	41	A B C D E	61	A B C D E	81	A B C D E
2	A B C D E	22	A B C D E	42	A B C D E	62	A B C D E	82	A B C D E
3	A B C D E	23	A B C D E	43	A B C D E	63	A B C D E	83	A B C D E
4	A B C D E	24	A B C D E	44	A B C D E	64	A B C D E	84	A B C D E
5	A B C D E	25	A B C D E	45	A B C D E	65	A B C D E	85	A B C D E
6	A B C D E	26	A B C D E	46	A B C D E	66	A B C D E	86	A B C D E
7	A B C D E	27	A B C D E	47	A B C D E	67	A B C D E	87	A B C D E
8	A B C D E	28	A B C D E	48	A B C D E	68	A B C D E	88	A B C D E
9	A B C D E	29	A B C D E	49	A B C D E	69	A B C D E	89	A B C D E
10	A B C D E	30	A B C D E	50	A B C D E	70	A B C D E	90	A B C D E
11	A B C D E	31	A B C D E	51	A B C D E	71	A B C D E	91	A B C D E
12	A B C D E	32	A B C D E	52	A B C D E	72	A B C D E	92	A B C D E
13	A B C D E	33	A B C D E	53	A B C D E	73	A B C D E	93	A B C D E
14	A B C D E	34	A B C D E	54	A B C D E	74	A B C D E	94	A B C D E
15	A B C D E	35	A B C D E	55	A B C D E	75	A B C D E	95	A B C D E
16	A B C D E	36	A B C D E	56	A B C D E	76	A B C D E	96	A B C D E
17	A B C D E	37	A B C D E	57	A B C D E	77	A B C D E	97	A B C D E
18	A B C D E	38	A B C D E	58	A B C D E	78	A B C D E	98	A B C D E
19	A B C D E	39	A B C D E	59	A B C D E	79	A B C D E	99	A B C D E
20	A B C D E	40	A B C D E	60	A B C D E	80	A B C D E	100	A B C D E

Guidelies

Team activity- surveying/ map reading – In addition to the general references specified for the Agricultural Technology and Mechanical Systems CDE, the following references may be useful in preparing for the Environment and Natural Resource Systems skills activity. Note: Specific references are listed below, but others may be added later.

1. <https://viva.pressbooks.pub/physicalgeologylab/chapter/scale-and-slope/>
2. <https://viva.pressbooks.pub/physicalgeologylab/part/topographic-maps/>

Electrical systems

1. Agricultural Mechanics: Fundamentals and Applications (6th) Ed. By Ray V. Herren (2010).
2. 2017 NFPA 70 National Electrical Code (NEC) Wiring Handbook (ISBN-10: 1455912794).
3. Sample handbook: [HD Supply Solutions](#)

Metal/ Welding systems

Suggested References for Activity – In addition to the general references specified for the Agricultural Technology and Mechanical Systems CDE, the following references may be useful in preparing for the Metals and Welding Systems Skill Activity. Note: Specific references are listed below, but others may be added at a later date.

1. <http://www.lincolnelectric.com/assets/US/EN/literature/WC475.pdf>
2. <http://www.lincolnelectric.com/en-us/support/process-and-theory/Pages/aws-classifications-detail.aspx>
3. <http://www.lincolnelectric.com/en-us/education-center/welding-safety/Pages/welding-safety.aspx>
4. <https://www.millerwelds.com/resources/weld-setting-calculators>