



## PURPOSE

To evaluate each competitor's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of automotive service technology.

First, download and review the General Regulations at: <http://updates.skillsusa.org>.

## ELIGIBILITY

Open to active SkillsUSA members enrolled in career and technical programs with automotive technician or automotive service technology as an occupational objective.

## CLOTHING REQUIREMENT

### **Class D: Competition Specific – Blue Attire**

- Official SkillsUSA light blue work shirt
- Navy pants
- Black, brown, or tan work safety shoes (with protective toe cap)

**Note:** Safety glasses must have side shields or goggles. (Prescription glasses may be used only if they are equipped with side shields. If not, they must be covered with goggles.)

These regulations refer to clothing items that are pictured and described at [www.skillsusastore.org](http://www.skillsusastore.org). If you have questions about clothing or other logo items, call 1-888-501-2183.

**Note:** Competitors must wear their official competition clothing to the competition orientation meeting.

## EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
  - a. All necessary tools and equipment for the competition
  - b. All necessary service publications for the competitors
2. Supplied by the competitor:
  - a. All competitors must create a one-page resume. See “Resume Requirement” below for guidelines.

### RESUME REQUIREMENT

Competitors must create a one-page resume to submit online. SkillsUSA national competitors should submit their resume by the deadline published on the competition updates page of our website. The deadline and link for resume submission will be published on <http://updates.skillsusa.org>. Failure to submit a resume will result in a 10-point penalty.

**Your resume must be saved as a PDF file type using file name format of “Last Name\_First Name.”** For example, “Amanda Smith” would save her resume as **Smith\_Amanda**. If you need assistance with saving your file as a PDF, visit [the Adobe website](#) for more information.

**Note:** Check the Competition Guidelines and/or the updates page on the SkillsUSA website at <http://updates.skillsusa.org>.

### PROHIBITED DEVICES

Cellphones, electronic watches and/or other electronic devices not approved by a competition’s national technical committee are **NOT** allowed in the competition area. Please follow the guidelines in each technical standard for approved exceptions. Technical committee members may also approve exceptions onsite during the SkillsUSA Championships if deemed appropriate.

#### Penalties for Prohibited Devices

If a competitor’s electronic device makes noise or if the competitor is seen using it at any time during the competition, an official report will be documented for review by the Director of the SkillsUSA Championships. If confirmed that the competitor used the device in a manner which compromised the integrity of the competition, the competitor’s scores may be removed.

## SCOPE OF THE COMPETITION

The competition will be consistent with the automobile technician task list outlined in guidelines published by the National Institute for Automotive Service Excellence (ASE) and the ASE Education Foundation at: [www.aseeducationfoundation.org](http://www.aseeducationfoundation.org).

Competitors will demonstrate their ability to perform jobs or skills selected from the standards mentioned above as determined by the SkillsUSA Championships technical committee. Committee membership includes American Honda Motor Co. Inc., ATech, ConsuLab, Gates Corp., General Motors, Hunter Engineering Co., Megatech Corp., National Institute for

Automotive Service Excellence, Pittsburg State University, Snap-on Inc., S/P2, Toyota Motor North America, Inc., CCAR, Stellantis North America, Nissan North America, Lucas-Nuelle, Subaru of America and Mercedes-Benz, USA.

## **KNOWLEDGE PERFORMANCE**

The competition will include a written knowledge test provided by ASE covering all eight automobile areas identified in the ASE Education Foundation Automobile Program Standards and the Official ASE Study Guide — Automobile Tests. The test for these high school and college/postsecondary competitions will be comprised of diagnostic and repair content from these skill areas: engine repair, automatic transmission/transaxle, manual drivetrain and axles, suspension and steering, brakes, electrical/electronic steering, heating and air conditioning and engine performance.

## **SKILL PERFORMANCE**

The competition will include a series of workstations. Workstations consist of a vehicle and/or simulator, components, service publications, and interpersonal skills stations (such as Customer Service and Job Interview).

## **COMPETITION GUIDELINES**

1. A variety of vehicles sold in the United States will be used in the competition. This will include both domestic and imported vehicles.
2. Some or all of the high school workstations may be different from the college/postsecondary workstations.
3. Safety, quality, ability to follow instructions and procedures, accuracy (in comparison with factory specifications), workmanship, and other skills representative of the trades identified by industry leaders will be judged.
4. A total of eight (8) to 15 stations will be assigned. Each station must be broken down into specific task criteria and separate steps based on the task. For example:

### **Station No. 1 Wire test and repair segments**

Identify faulty circuit = x points

Repair condition = x points

Assemble/retest = x points

Resistor board tests = x points

Compare values to specs = x points

Workmanship = x points

Safety practices = x points

5. The points allowed for each station will be assigned by the national technical committee and will be based on the difficulty of each assigned task.
6. Time limits will be assigned for each task, but no bonus points will be awarded for early completion.
7. Stations and equipment to be used in the national competition will be published annually on to the updates page on the SkillsUSA website at: <http://updates.skillsusa.org>.

## **STANDARDS AND COMPETENCIES: HIGH SCHOOL**

### **AST-HS 1.0 — Perform vehicle HVAC system diagnosis and testing to related tasks in the ASE Education Foundation Automobile Program Standards — Automobile Heating and Air Conditioning Task List (ASE Test A7)**

- 1.1. Diagnose and repair an inoperative HVAC system on a current model vehicle.
- 1.2. Use a provided factory scan tool for current model vehicle
- 1.3. Read DTC with scan tool
- 1.4. Read data with scan tool
- 1.5. Perform actuator test with scan tool
- 1.6. Use factory service information provided
- 1.7. Identify correct test procedures
- 1.8. Follow the correct test procedure
- 1.9. Identify connector pin-outs
- 1.10. Identify component locations
- 1.11. Read and interpret wiring schematics
- 1.12. Identify correct refrigerant/oil/fluid type
- 1.13. Use provided test equipment
- 1.14. Use a DVOM or DMM
- 1.15. Use A/C service gauges
- 1.16. Use a repair order
- 1.17. Verify complaint
- 1.18. Repair vehicle
- 1.19. Verify repair was successful
- 1.20. Identify components in the system
- 1.21. Document diagnostic steps and repair process
- 1.22. Demonstrate awareness of the need to recover, recycle, and handle refrigerants using proper equipment and procedures.

### **AST-HS 2.0 — Perform vehicle engine performance diagnosis and testing to related tasks in the ASE Education Foundation Automobile Program Standards — Automobile Engine Performance Task List (ASE Test A8)**

- 2.1. Diagnose and repair an engine performance issue on a current model vehicle
- 2.2. Use a provided factory scan tool for the current model vehicle
- 2.3. Read DTC with scan tool
- 2.4. Read data with scan tool
- 2.5. Perform actuator test with scan tool
- 2.6. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM), digital storage oscilloscope (DSO), and/or scan tool; determine needed action.
- 2.7. Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).
- 2.8. Identify fuel, air induction, and exhaust system components and configurations.
- 2.9. Verify proper idle speed; determine needed action.
- 2.10. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.
- 2.11. Use factory service information provided

- 2.12. Identify correct test procedures
- 2.13. Follow the correct test procedure
- 2.14. Identify connector pin-outs
- 2.15. Identify component locations
- 2.16. Use wiring schematics
- 2.17. Use provided test equipment
- 2.18. Use a DVOM or DMM
- 2.19. Use a fuel pressure gauge 2.5
- 2.20. Use a repair order
- 2.21. Verify complaint
- 2.22. Repair vehicle
- 2.23. Verify repair was successful
- 2.24. Identify components in the system
- 2.25. Document diagnostic steps and repair process

**AST-HS 3.0 — Perform vehicle body electrical diagnosis and testing to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Electrical/Electronic Systems Task List (ASE Test A6)**

- 3.1. Diagnose and repair a body electrical issue on a current model vehicle
- 3.2. Use a provided factory scan tool for the current model vehicle
- 3.3. Read DTC with scan tool
- 3.4. Read data with scan tool
- 3.5. Perform actuator test with scan tool
- 3.6. Use factory service information provided
- 3.7. Identify correct test procedures
- 3.8. Follow the correct test procedure
- 3.9. Identify connector pin-outs
- 3.10. Identify component locations
- 3.11. Use wiring schematics
- 3.12. Use provided test equipment
- 3.13. Use a DVOM or DMM
- 3.14. Use a battery or charging system tester
- 3.15. Use a repair order
- 3.16. Verify complaint
- 3.17. Repair vehicle
- 3.18. Verify repair was successful
- 3.19. Identify components in the system
- 3.20. Document diagnostic steps and repair process

**AST-HS 4.0 — Demonstrate application of environment, health and safety knowledge in auto service situations to related OSHA section 1910 standards and EPA standards**

- 4.1. Identify and explain the use of personal protective equipment
- 4.2. Recall information about automotive-related EPA and OSHA requirements
- 4.3. Identify and explain the use of blood borne pathogens kits.
- 4.4. Answer questions from a provided Safety Data Sheet (SDS)
- 4.5. Describe proper use of a fire extinguisher
- 4.6. Demonstrate knowledge of automotive lift safety best-practices

- 4.7. Demonstrate knowledge of automotive battery safety best-practices
- 4.8. Demonstrate knowledge of automotive high-voltage system safety best-practices

**AST-HS 5.0 — Complete a mock job interview for an automotive service technology related position**

- 5.1. Conduct a mock job interview with appropriate professional behavior
- 5.2. Communicate clearly and effectively
- 5.3. Clearly and completely fill out a job application
- 5.4. Submit a copy of resume as directed in “Resume Requirement” above

**AST-HS 6.0 — Perform electronic circuit diagnosis, testing and wire repair to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Electrical/Electronic Systems Task List (ASE Test A6)**

- 6.1. Construct an electrical circuit from supplied material and a wiring diagram.
  - 6.1.1. Check electrical circuit operation
  - 6.1.2. Take electrical readings on the circuit with a DVOM. Note: A shunt may be used when measuring current
  - 6.1.3. Diagnose and repair the circuit
  - 6.1.4. Confirm the repair of the circuit
- 6.2. Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits
  - 6.2.1. Check electrical circuits with a test light and determine necessary action
- 6.3. Repair connectors and terminal ends
  - 6.3.1. Repair wiring harness
  - 6.3.2. Perform solder repair of electrical wiring

**AST-HS 7.0 — Perform steering, suspension and wheel alignment to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Suspension and Steering Task List (ASE Test A4)**

- 7.1. Identify wheel alignment tools
- 7.2. Explain practical application of tools
- 7.3. Identify OEM alignment products
  - 7.3.1. Explain practical application or use of OEM products
  - 7.3.2. Identify aftermarket alignment products
  - 7.3.3. Explain practical application or use of aftermarket products
- 7.4. Identify steering suspension components
- 7.5. Explain alignment theory
- 7.6. Explain diagnosis of alignment conditions
- 7.7. Use reference materials provided

**AST-HS 8.0 — Perform manual drive train service, testing and diagnosis to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Manual Drive Train and Axles Task List (ASE Test A3)**

- 8.1. Identify components of manual drive trains, axles, drivelines and transfer cases
- 8.2. Clutch Systems
  - 8.2.1. Check and adjust clutch master cylinder fluid levels, determine the correct fluid for the application

- 8.2.2. Inspect clutch operating components for wear/damage: determine necessary action
- 8.2.3. Measure flywheel runout and crankshaft endplay; determine necessary action
- 8.3. Manual Transmission/Transaxle
  - 8.3.1. Inspect manual transmission/transaxle components for wear/damage; determine necessary action
  - 8.3.2. Measure endplays/preloads on manual transmission/transaxle shafts and determine necessary action
  - 8.3.3. Inspect, measure, reassemble and/or reinstall synchronizer assemblies
  - 8.3.4. Inspect, measure, adjust and/or reassemble transaxle final drives assemblies
  - 8.3.5. Inspect, measure, adjust and/or reassemble 4WD/AWD Transfer Cases
- 8.4. Driveshafts
  - 8.4.1. Check driveshaft phasing, measure driveshaft runout and/or measure driveshaft operating angles, determine necessary action
  - 8.4.2. Measure transmission and/or drive axles companion flange runout and determine necessary action
- 8.5. Front and Rear Drive Axles
  - 8.5.1. Inspect differential components for wear and determine necessary action
  - 8.5.2. Measure and adjust drive pinion depth and drive pinion bearing preload
  - 8.5.3. Measure and adjust side bearing preload, ring and pinion gear backlash and determine backlash variation
  - 8.5.4. Check ring and pinion gear contact patterns; determine necessary action
  - 8.5.5. Measure rotating torque on a limited slip differential and determine necessary action
  - 8.5.6. Disassemble, inspect and reassemble limited slip clutch components
- 8.6. Use factory service information provided to complete tasks
- 8.7. Use tools provided to complete task
- 8.8. Determine which components need replaced or repaired in a given situation

**AST-HS 9.0 — Perform brake service, testing and diagnosis to related tasks identified in the ASE Education Foundation Automobile Program Standards–Automobile Brakes Task List (ASE Test A5)**

- 9.1. Identify different brake components
- 9.2. Diagnose pressure concerns in the brake system using hydraulic principles
  - 9.2.1. Fabricate brake lines (double flare and ISO types)
  - 9.2.2. Inspect and measure brake drums and determine necessary action
  - 9.2.3. Remove, inspect and install brake shoes, springs, pins, clips, levers, adjusters and other brake hardware
  - 9.2.4. Remove, inspect and install wheel cylinders
  - 9.2.5. Pre-adjust brake shoes and parking brake before installing brake drums
  - 9.2.6. Remove, inspect and install caliper, pads and related hardware and determine necessary action
  - 9.2.7. Clean, inspect and measure rotor with a dial indicator and a micrometer and determine necessary action
  - 9.2.8. Check parking brake components; clean, lubricate, adjust or replace as necessary
  - 9.2.9. Inspect brake booster and determine necessary action

- 9.2.10. Remove, clean, inspect, repack and install wheel bearings; install hub and adjust wheel bearings
- 9.3. Identify and inspect ABS components and determine necessary action
  - 9.3.1. Diagnose ABS electronic controls and components
  - 9.3.2. Test, diagnose and service ABS speed sensors, toothed ring and circuits using an oscilloscope
- 9.4. Use factory service information provided to complete the above tasks
- 9.5. Use tools provided to complete the above tasks

**AST-HS 10.0 — Perform automatic transmission service, testing and diagnosis to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Automatic Transmission/Transaxle Task List (ASE Test A2)**

- 10.1. Identify components on a transmission
- 10.2. Diagnose and inspect a transmission
  - 10.2.1. Check input or output shaft endplay
  - 10.2.2. Check clutch clearances
  - 10.2.3. Perform air checks on the clutches
  - 10.2.4. Measure pump clearances
  - 10.2.5. Diagnose electrical components on a transmission
- 10.3. Perform adjustments on a transmission
  - 10.3.1. Perform valve body adjustments
  - 10.3.2. Perform input or output shaft adjustments
  - 10.3.3. Perform clutch pack adjustments
  - 10.3.4. Perform range sensor adjustments
- 10.4. Disassemble and assemble components of a transmission
  - 10.4.1. Disassemble and assemble the planetary gear train
  - 10.4.2. Disassemble and assemble the front pump
  - 10.4.3. Disassemble and assemble the valve body
  - 10.4.4. Disassemble and assemble clutch packs
- 10.5. Use factory service information provided to complete tasks
- 10.6. Use tools provided to complete tasks

**AST-HS 11.0 — Perform engine measuring, inspecting, service and diagnosis on the head or block of an engine to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Engine Repair Task List (ASE Test A1)**

- 11.1. Measure and inspect the pistons and connecting rods
- 11.2. Measure and inspect cylinder diameter
- 11.3. Measure and inspect cylinder taper and bore with a dial bore gauge
- 11.4. Measure and inspect the cylinder head
- 11.5. Measure and inspect valve guides
- 11.6. Measure and inspect the valves
- 11.7. Measure and inspect valve stem to guide clearance
- 11.8. Measure and inspect the camshaft or crankshaft
- 11.9. Measure and inspect the valve springs
- 11.10. Measure and inspect valve timing
- 11.11. Measure and inspect the timing chain or belt
- 11.12. Identify the clearance specifications for any item requiring measuring and inspecting



- 11.13. Use the factory service information provided
- 11.14. Determine which components need to be replaced or repaired on a given engine head or block
- 11.15. Use the precision engine measurement tools required for measuring or inspecting

**AST-HS 12.0 — Use electrical service information resources**

- 12.1. Locate specifications and other service information using electronic service information resources

**AST-HS 13.0 — SkillsUSA Framework**

The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these Essential Elements. Please reference the graphic, as you may be scored on specific elements applied to your project. For more, visit: [www.skillsusa.org/who-we-are/skillsusa-framework/](http://www.skillsusa.org/who-we-are/skillsusa-framework/).



**STANDARDS AND COMPETENCIES: COLLEGE/POSTSECONDARY**

**AST-CPS 1.0 — Perform vehicle HVAC system diagnosis and testing to related tasks in the ASE Education Foundation Automobile Program Standards — Automobile Heating and Air Conditioning Task List (ASE Test A7)**

- 1.1. Diagnose and repair an inoperative HVAC system on a current model vehicle
  - 1.1.1. Use a provided factory scan tool for current model vehicle
  - 1.1.2. Read DTC with scan tool
  - 1.1.3. Read data with scan tool
  - 1.1.4. Perform an actuator test with scan tool
  - 1.1.5. Use factory service information provided
  - 1.1.6. Identify correct test procedures
  - 1.1.7. Follow the correct test procedure
  - 1.1.8. Identify connector pin-outs
  - 1.1.9. Identify component locations
  - 1.1.10. Use wiring schematics
  - 1.1.11. Identify correct refrigerant/oil/fluid type
  - 1.1.12. Use provided test equipment correctly
  - 1.1.13. Use a DVOM or DMM
  - 1.1.14. Use A/C service gauges and interpret readings
  - 1.1.15. Use a repair order
  - 1.1.16. Verify complaint
  - 1.1.17. Repair vehicle
  - 1.1.18. Verify repair was successful
  - 1.1.19. Document diagnostic steps and repair process
  - 1.1.20. Identify hybrid vehicle A/C system electrical circuits and service/safety precautions

- 1.1.21. Demonstrate awareness of the need to recover, recycle, and handle refrigerants using proper equipment and procedures.

**AST-CPS 2.0 — Perform vehicle engine performance diagnosis and testing on a current model vehicle to related tasks in the ASE Education Foundation Automobile Program Standards — Automobile Engine Performance Task List (ASE Test A8)**

- 2.1. Diagnose and repair an engine performance issue on a current model vehicle.
  - 2.1.1. Read data with scan tool
  - 2.1.2. Perform an actuator test with scan tool
  - 2.1.3. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM), digital storage oscilloscope (DSO), and/or scan tool; determine needed action.
  - 2.1.4. Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).
  - 2.1.5. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes (DTC); obtain, graph, and interpret scan tool data.
  - 2.1.6. Identify fuel, air induction, and exhaust system components and configurations.
  - 2.1.7. Diagnose emissions or driveability concerns without stored or active diagnostic trouble codes; determine needed action.
  - 2.1.8. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, HVAC, automatic transmissions, non-OEM installed accessories, or similar systems); determine needed action.
  - 2.1.9. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor fuel economy, and emissions concerns; determine needed action.
  - 2.1.10. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine needed action.
  - 2.1.11. Test the operation of turbocharger/supercharger systems; determine needed action.
  - 2.1.12. Use factory service information provided
  - 2.1.13. Identify correct test procedures
  - 2.1.14. Follow the correct test procedure
  - 2.1.15. Identify connector pin-outs
  - 2.1.16. Identify component locations
  - 2.1.17. Use wiring schematics
  - 2.1.18. Use provided test equipment correctly
  - 2.1.19. Use a DVOM or DMM
  - 2.1.20. Use a fuel pressure gauge
  - 2.1.21. Use a repair order
  - 2.1.22. Verify complaint
  - 2.1.23. Repair vehicle
  - 2.1.24. Verify repair was successful
  - 2.1.25. Document diagnostic steps and repair process

**AST-CPS 3.0 — Perform steering, suspension and wheel alignment to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Suspension and Steering Task List (ASE Test A4)**

- 3.1. Prepare to complete a wheel alignment
  - 3.1.1. Read and interpret a repair order
  - 3.1.2. Perform complete pre-alignment inspection
  - 3.1.3. Evaluate vehicle condition and readiness for alignment
  - 3.1.4. Identify vehicle suspensions system and components
  - 3.1.5. Identify vehicle steering system and components
  - 3.1.6. Identify alignment procedure required
  - 3.1.7. Take alignment measurements using alignment system provided
  - 3.1.8. Record alignment measurements
  - 3.1.9. Recall and record vehicle alignment specifications
  - 3.1.10. Evaluate vehicle alignment condition
  - 3.1.11. Explain vehicle alignment adjustment procedures
  - 3.1.12. Explain advanced alignment diagnostic procedures
  - 3.1.13. Explain use of aftermarket alignment products
  - 3.1.14. Identify hybrid vehicle power steering system electrical circuits and safety precautions

**AST-CPS 4.0 — Demonstrate application of environment, health and safety knowledge in auto service situations to related OSHA section 1910 standards and EPA standards**

- 4.1. Identify and explain the use of personal protective equipment
- 4.2. Recall information about automotive-related EPA and OSHA requirements
- 4.3. Identify and explain the use of blood borne pathogens kits
- 4.4. Answer questions from a provided Safety Data Sheet (SDS)
- 4.5. Describe proper use of a fire extinguisher
- 4.6. Demonstrate knowledge of automotive lift safety best-practices
- 4.7. Demonstrate knowledge of automotive battery safety best-practices
- 4.8. Demonstrate knowledge of automotive high-voltage system safety best-practices

**AST-CPS 5.0 — Demonstrate customer service skills to commonly accepted standards of performance**

- 5.1. Answer questions posed by a customer
- 5.2. Use appropriate and professional manner in customer meeting
- 5.3. Clearly and effectively communicate with the customer information on the diagnosis and repair of the vehicle

**AST-CPS 6.0 — Perform electronic circuit diagnosis, testing and wire repair to related tasks identified in Automobile Test A6 (Electrical/Electronic Systems) of “The Official ASE Study Guide of Automobile Tests”**

- 6.1. Construct an electrical circuit from supplied material and a wiring diagram
- 6.2. Check electrical circuit operation
- 6.3. Take electrical readings on the circuit with a DVOM. Note: A shunt may be used when measuring current.
- 6.4. Diagnose and repair the circuit
- 6.5. Confirm the repair of the circuit

**AST-CPS 7.0 — Perform electronic circuit diagnosis and testing, and hybrid vehicle test and safety precautions to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Electrical/Electronic Systems Task List (ASE Test A6)**

Electrical circuit diagnosis through oscilloscope pattern interpretation

Use a provided oscilloscope

Answer questions based on oscilloscope readings

Explain basic oscilloscope operation

Identify high-voltage circuits of an electric or hybrid electric vehicle and related safety precautions.

Identify hybrid vehicle auxiliary (12 v) battery service, repair, and test procedures.

**AST-CPS 8.0 — Perform service, testing and diagnosis of manual drive trains, axles, drive trains and transfer cases to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Manual Drive Train and Axles Task List (ASE Test A3)**

- 8.1. Identify components of manual drive trains, axles, drive trains and transfer cases
- 8.2. Inspect clutch operating components for wear/damage and determine necessary action
  - 8.2.1. Measure flywheel run-out and crankshaft endplay and determine necessary action
  - 8.2.2. Inspect transmission/transaxle components for wear/damage and determine necessary action
  - 8.2.3. Measure endplay/preloads on transmission/transaxle shafts and determine necessary action
  - 8.2.4. Inspect, measure, reassemble and/or reinstall synchronizer assemblies
  - 8.2.5. Inspect, measure, adjust and/or reassemble transaxle final drive assemblies
  - 8.2.6. Check driveshaft phasing, measure driveshaft run out and measure driveshaft operating angles
  - 8.2.7. Measure companion flange run- out and determine necessary action
  - 8.2.8. Inspect ring gear and measure run-out and determine necessary action
  - 8.2.9. Measure and adjust drive pinion depth and drive pinion bearing preload
  - 8.2.10. Measure and adjust side bearing preload, ring and pinion gear backlash and backlash variation
  - 8.2.11. Check ring and pinion gear contact patterns and determine necessary action
  - 8.2.12. Measure rotating torque on a limited slip differential and determine necessary action
  - 8.2.13. Inspect and reinstall limited slip clutch components
- 8.3. Use factory service information provided to complete tasks
- 8.4. Use tools provided to complete tasks
- 8.5. Determine which components need to be replaced or repaired in a given situation

**AST-CPS 9.0 — Perform brake service, testing and diagnosis on a brake system on a bench to related tasks identified in the ASE Education Foundation Automobile Program Standards — Automobile Brakes Task List (ASE Test A5)**

- 9.1. Identify brake components
- 9.2. Diagnose pressure concerns in the brake system using hydraulic principles
  - 9.2.1. Fabricate brake lines (double flare and ISO types)
  - 9.2.2. Inspect and measure brake drums and determine necessary action

- 9.2.3. Remove, inspect and install brake shoes, springs, pins, clips, levers, adjusters and other brake hardware
- 9.2.4. Remove, inspect and install wheel cylinders
- 9.2.5. Re-adjust brake shoes and parking brake before install brake drums
- 9.2.6. Remove, inspect, install caliper, pads and related hardware and determine necessary action
- 9.2.7. Clean, inspect and measure rotor with a dial indicator and a micrometer and determine necessary action
- 9.2.8. Check parking brake components; clean, lubricate, adjust or replace as necessary
- 9.2.9. Inspect brake booster and determine necessary action
- 9.2.10. Remove, clean, inspect, repack and install wheel bearings; install hub and adjust wheel bearings
- 9.3. Identify and inspect ABS components and determine necessary action
  - 9.3.1. Diagnose ABS electronic controls and components
  - 9.3.2. Test, diagnose and service ABS speed sensors, toothed rings and circuits using an oscilloscope or DVOM
- 9.4. Use factory service information provided to complete the above task
- 9.5. Use tools provided to complete the above task

**AST-CPS 10.0 — Perform automatic transmission service, testing and diagnosis to related tasks identified in the ASE Education Foundation Automobile Program Standards— Automobile Automatic Transmission/Transaxle Task List (ASE Test A2)**

- 10.1. Identify different components on the transmission
- 10.2. Diagnose and inspect a transmission on a bench
  - 10.2.1. Check input or output shaft endplay and determine necessary action
  - 10.2.2. Check clutch clearances and determine necessary action
  - 10.2.3. Perform air checks on the clutches and determine necessary action
  - 10.2.4. Measure pump clearances and determine necessary action
- 10.3. Diagnose electrical components on the transmission and determine necessary action
- 10.4. Adjust components of an automatic transmission
  - 10.4.1. Perform valve body adjustments
  - 10.4.2. Perform input or output shaft adjustments
  - 10.4.3. Perform clutch pack adjustments
  - 10.4.4. Perform range sensor adjustments
- 10.5. Disassemble and assemble components of an automatic transmission
  - 10.5.1. Disassemble, assemble and inspect the planetary gear train and determine necessary action
  - 10.5.2. Disassemble, assemble and inspect the front pump and determine necessary action
  - 10.5.3. Disassemble, assemble and inspect the valve body and determine necessary action
  - 10.5.4. Disassemble, assemble and inspect clutch packs and determine necessary action
- 10.6. Use factory service information provided to complete tasks
- 10.7. Use tools provided to complete tasks
- 10.8. Describe the operational characteristics of a hybrid vehicle drivetrain.

**AST-CPS 11.0 — Perform engine measuring, inspecting, service and diagnosis on the head or block of an engine to related tasks in the ASE Education Foundation Automobile Program Standards — Automobile Engine Repair Task List (ASE Test A1)**

- 11.1. Measure and inspect the pistons and connecting rods and determine necessary action
- 11.2. Measure and inspect cylinder diameter and determine necessary action
- 11.3. Measure and inspect cylinder taper and bore with a dial bore gauge and determine necessary action
- 11.4. Measure and inspect the cylinder head and determine necessary action
- 11.5. Measure and inspect valve guides and determine necessary action
- 11.6. Measure and inspect the valves and determine necessary action
- 11.7. Measure and inspect valve stem to guide clearance and determine necessary action
- 11.8. Measure and inspect the camshaft of crankshaft and determine necessary action
- 11.9. Measure and inspect the valve springs and determine necessary action
- 11.10. Measure and inspect valve timing and determine necessary action
- 11.11. Measure and inspect the timing chain or belt and determine necessary action
- 11.12. Identify the clearance specifications for any item requiring measuring and inspecting
- 11.13. Use the factory service information provided
- 11.14. Determine which components need to be replaced or repaired in a given situation
- 11.15. Use the precision engine measurement tools required for measuring or inspecting
- 11.16. Identify hybrid vehicle internal combustion engine service precautions

**AST-CPS 12.0 — Use electrical service information resources**

- 12.1. Locate specifications and other service information using electronic service information resources

**AST-CPS 13.0 — SkillsUSA Framework**

The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these Essential Elements. Please reference the graphic, as you may be scored on specific elements applied to your project. For more, visit: [www.skillsusa.org/who-we-are/skillsusa-framework/](http://www.skillsusa.org/who-we-are/skillsusa-framework/).



**COMMITTEE IDENTIFIED ACADEMIC SKILLS**

The technical committee has identified that the following academic skills are embedded in this competition.

**Math Skills**

- Use fractions to solve practical problems
- Use proportions and ratios to solve practical problems
- Use scientific notation
- Solve practical problems involving percentages
- Measure angles
- Find surface area and perimeter of two- dimensional objects

- Find volume and surface area of three- dimensional objects
- Apply transformations (rotate or turn, reflect or flip, translate or slide and dilate or scale) to geometric figures
- Solve problems using proportions, formulas and functions
- Use laws of exponents to perform operations

### **Science Skills**

- Use the knowledge of potential and kinetic energy
- Use the knowledge of mechanical, chemical and electrical energy
- Use the knowledge of temperature scales, heat and heat transfer
- Use the knowledge of principles of electricity and magnetism
- Use the knowledge of static electricity, current electricity and circuits
- Use the knowledge of magnetic fields and electromagnets
- Use the knowledge of motors and generators

## **CONNECTIONS TO NATIONAL STANDARDS**

State-level academic curriculum specialists identified the following connections to national academic standards.

### **Math Standards**

- Numbers and operations
- Algebra
- Geometry
- Measurement
- Data analysis and probability
- Problem solving
- Communication
- Connections
- Representation

*Source: NCTM Principles and Standards for School Mathematics. NCTM Principles and Standards for School Mathematics. For more information, visit: <http://www.nctm.org>.*

### **Science Standards**

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific inquiry
- Understands the scientific enterprise

*Source: McREL Compendium of National Science Standards. To view and search the compendium, visit: <http://www2.mcrel.org/compendium/>.*

## **Language Arts Standards**

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts.
- Students conduct research on issues and interests by generating ideas and questions and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts and people) to communicate their discoveries in ways that suit their purpose and audience.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

*Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: [www.ncte.org/standards](http://www.ncte.org/standards).*