

# Automotive

## Study Guide

### Assessment:

- 2101 Automatic Transmission/Transaxle Technician
- 2102 Brakes Technician
- 2103 Electrical/Electronic Systems Technician
- 2104 Engine Performance Technician
- 2105 Heating, Ventilation, and  
Air Conditioning Technician
- 2106 Suspension and Steering  
Technician
- 2107 Engine Repair Technician

Aligned with the ASE/  
NATEF standards



## Overview

This study guide is designed to help students prepare for the Automotive assessments. It not only includes information about the assessments, but also the skills standards upon which the assessments are based, resources that can be used to prepare for the assessments and test taking strategies.

Each of the four sections in this guide provides useful information for students preparing for the Automotive assessments.

- CareerTech and Competency-Based Education: A Winning Combination
- Automotive assessments
  - ▶ Assessment Information
  - ▶ Standards and Test Content
  - ▶ Sample Questions
  - ▶ Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

These assessments are aligned with the 2024 Automotive Service Excellence (ASE) Education Foundation standards and endorsed by the Oklahoma Automobile Dealers Association (OADA). The assessments measure a student's ability to apply knowledge of the skills necessary for success in the Automotive sector.

The ASE Education Foundation task list was reviewed and updated in February 2024. A national committee was assembled in person to review the standards used in automobile accreditation programs. The committee consisted of individuals representing the major automobile manufacturers, automobile repair shop owners and technicians, automobile instructors and trainers, and automobile equipment and parts suppliers.

The committee reviewed the task list, tools and equipment list, program hours, and instructor qualifications. The committee was also provided with the most current National Institute for Automotive Service Excellence (ASE) Automobile Technician Tests Task Lists for reference purposes.

For more information about the ASE Education Foundation, go to [www.aseeducation.org](http://www.aseeducation.org).

The OADA (405-521-1295) is an association of new car and heavy-duty truck dealers in Oklahoma. Its primary purpose is to promote the common business interests of those engaged in the automotive industry.

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## CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the work force.

### Tools for Success

CareerTech education 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 and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

**Curriculum materials and textbooks** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

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

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

### Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Certification assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also 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.

# Automotive Assessment Information

## What are the HVACR assessments?

The Automatic Transmission/Transaxle Technician, Brakes Technician, Electrical/Electronics Systems Technician, Engine Performance Technician, Heating, Ventilation, and Air Conditioning Technician, Suspension and Steering Technician, and Engine Repair Technician assessments are end-of-program assessments for students in Automotive education programs. The assessments provide an indication of student mastery of knowledge and concepts necessary for success in careers in these areas.

## How were the assessments developed?

The assessments were developed by the CareerTech Testing Center. The assessments and standards align with ASE standards and are endorsed by the Oklahoma Automobile Dealers Association. Items were developed and reviewed by a committee of subject matter experts.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

## What do the assessments cover?

Specifically, the test includes multiple-choice test items over the following areas:

### Automatic Transmission/Transaxle Technician (55 questions)

|                                                                  |     |
|------------------------------------------------------------------|-----|
| Perform General Transmission and Transaxle Diagnosis             | 55% |
| Perform In-Vehicle Transmission/Transaxle Maintenance and Repair | 25% |
| Perform Off-Vehicle Transmission and Transaxle Repair            | 20% |

### Brakes Technician (55 questions)

|                                                                                             |     |
|---------------------------------------------------------------------------------------------|-----|
| Perform General Brake Systems Diagnosis                                                     | 15% |
| Perform Hydraulic System Diagnosis and Repair                                               | 25% |
| Perform Drum Brake Diagnosis and Repair                                                     | 11% |
| Perform Disc Brake Diagnosis and Repair                                                     | 24% |
| Perform Power-Assist Units Diagnosis and Repair                                             | 7%  |
| Perform Related Systems (Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair   | 13% |
| Perform Electronic Brake Control Systems Diagnosis and Repair:                              | 5%  |
| Antilock Brake (ABS), Traction Control (TCS) and Electronic Stability Control (ESC) Systems |     |

### **Electrical/Electronic Systems Technician (55 questions)**

|                                                                                |     |
|--------------------------------------------------------------------------------|-----|
| Perform General Electrical System Diagnosis                                    | 29% |
| Perform Battery (Low Voltage) Diagnosis and Service                            | 15% |
| Perform Starting System (Low Voltage) Diagnosis and Repair                     | 16% |
| Perform Charging System (Low Voltage) Diagnosis and Repair                     | 11% |
| Perform Lighting Systems Diagnosis and Repair                                  | 7%  |
| Perform Instrument Cluster and Driver Information Systems Diagnosis and Repair | 6%  |
| Perform Body Electrical Systems Diagnosis and Repair                           | 16% |
| Perform xEV Systems Diagnosis and Repair                                       | 0%  |

### **Engine Performance Technician (55 questions)**

|                                                                       |     |
|-----------------------------------------------------------------------|-----|
| Perform General Engine Diagnosis                                      | 29% |
| Perform Computerized Engine Controls Diagnosis and Repair             | 15% |
| Perform Ignition System Diagnosis and Repair                          | 11% |
| Perform Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair | 27% |
| Perform Emissions Control Systems Diagnosis and Repair                | 18% |

### **Heating, Ventilation, and Air Conditioning Technician (55 questions)**

|                                                                               |     |
|-------------------------------------------------------------------------------|-----|
| Perform General HVAC System Diagnosis and Repair                              | 31% |
| Perform Refrigeration System Component Diagnosis and Repair                   | 29% |
| Perform Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair | 9%  |
| Perform Operating Systems and Related Controls Diagnosis and Repair           | 18% |
| Perform Refrigerant Recovery, Recycling, and Handling                         | 13% |

### **Suspension and Steering Technician (55 questions)**

|                                                           |     |
|-----------------------------------------------------------|-----|
| Perform General Suspension and Steering Systems Diagnosis | 11% |
| Perform Steering Systems Diagnosis and Repair             | 25% |
| Perform Suspension Systems Diagnosis and Repair           | 18% |
| Perform Related Suspension and Steering Service           | 6%  |
| Perform Wheel Alignment Diagnosis and Repair              | 18% |
| Perform Wheels and Tires Diagnosis and Repair             | 22% |

### **Engine Repair Technician (55 questions)**

|                                                              |     |
|--------------------------------------------------------------|-----|
| Perform General Engine Diagnosis and Repair                  | 27% |
| Perform Cylinder Head and Valve Train Diagnosis and Repair   | 20% |
| Perform Engine Block Assembly Diagnosis and Repair           | 7%  |
| Perform Lubrication and Cooling Systems Diagnosis and Repair | 46% |

## **What are the benefits of using these assessments?**

Students receive a competency certificate for each assessment they pass. This certificate should be included in the student's portfolio and used to communicate their mastery of the subject matter to potential employers. Oklahoma students can also receive a digital badge that can be added to the students' digital resume or social media accounts. For more information on digital badges, please visit the badging section of the website at <https://oklahoma.gov/careertech/educators/certifications-and-badging/badging.html>.

## When should the assessments be taken?

The CareerTech Testing Center recommends that students take the assessments as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

## Are the assessments timed?

No. However, most students finish the assessment within one hour.

## What resources can students use on these assessments?

Students are allowed to use calculators and scratch paper on CTTC assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps on cell phones and other devices may not be used on these assessments.

## What accommodations can be made for students with Individualized Education Plans (IEPs)?

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- Extended time — This assessment is not timed; therefore, students may take as much time as needed to finish. The assessment must be completed in one testing session.
- Readers — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- Enlarged text — Students needing this accommodation can activate this feature by clicking the  icon in the upper right corner of the screen.

## What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor **cannot** be an instructor or anyone who was involved with the student during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Students may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that shows the student's score on the assessment and how the student performed in each standard area.

## Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who retest must wait at least three days between attempts.

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2101 AUTOMATIC TRANSMISSION/TRANSAXLE TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General Transmission and Transaxle Diagnosis

Duty B: Perform In-Vehicle Transmission/Transaxle Maintenance and Repair

Duty C: Perform Off-Vehicle Transmission and Transaxle Repair

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### **DUTY A: Perform General Transmission and Transaxle Diagnosis (30 questions)**

| CODE | TASK                                                                                                                                                                                                                                    | P#  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and/or vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Identify automatic transmission and transaxle components and configurations, including torque converter automatic, dual-clutch automatic (DCT), CVT, and xEV drive.                                                                     | P-1 |
| A.03 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                              | P-1 |
| A.04 | Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle equipped with a dipstick.                                                                                                       | P-1 |
| A.05 | Inspect transmission fluid condition; check fluid level; inspect for leaks on transmission or transaxle not equipped with a dipstick.                                                                                                   | P-1 |
| A.06 | Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.                                                                                                  | P-1 |
| A.07 | Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).                                                                                                                                                 | P-2 |
| A.08 | Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action.                                                                          | P-1 |
| A.09 | Diagnose fluid loss and condition concerns; determine needed action.                                                                                                                                                                    | P-1 |

## **DUTY A: Perform General Transmission and Transaxle Diagnosis (30 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                            | <b>P#</b> |
|-------------|------------------------------------------------------------------------------------------------------------------------|-----------|
| A.10        | Perform stall test; determine needed action.                                                                           | P-3       |
| A.11        | Perform lock-up converter system tests; determine needed action.                                                       | P-3       |
| A.12        | Perform pressure tests on transmissions/transaxles equipped with electronic pressure control; determine needed action. | P-2       |
| A.13        | Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.   | P-1       |

## **DUTY B: Perform In-Vehicle Transmission/Transaxle Maintenance and Repair (14 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                 | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| B.01        | Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch. | P-2       |
| B.02        | Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.                                                | P-1       |
| B.03        | Perform relearn procedures.                                                                                                                 | P-2       |
| B.04        | Inspect, replace and/or align power train mounts.                                                                                           | P-1       |
| B.05        | Inspect for leakage; replace external seals, gaskets, and bushings.                                                                         | P-2       |
| B.06        | Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits.                                                | P-1       |

## **DUTY C: Perform Off-Vehicle Transmission and Transaxle Repair (11 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                          | <b>P#</b> |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| C.01        | Describe the operational characteristics of a continuously variable transmission (CVT).                                                                              | P-2       |
| C.02        | Describe the operational characteristics of a hybrid vehicle drive train.                                                                                            | P-2       |
| C.03        | Describe the operational characteristics of dual-clutch transmission (DCT)                                                                                           | P-2       |
| C.04        | Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces. | P-2       |
| C.05        | Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.                                                                    | P-1       |
| C.06        | Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.      | P-2       |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2102 BRAKES TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General Brake Systems Diagnosis  
 Duty B: Perform Hydraulic System Diagnosis and Repair  
 Duty C: Perform Drum Brake Diagnosis and Repair  
 Duty D: Perform Disc Brake Diagnosis and Repair  
 Duty E: Perform Power-Assist Units Diagnosis and Repair  
 Duty F: Perform Related Systems (Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair  
 Duty G: Perform Electronic Brake Control Systems Diagnosis and Repair: Antilock Brake (ABS),  
 Traction Control (TCS) and Electronic Stability Control (ESC) Systems

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### **DUTY A: Perform General Brake Systems Diagnosis (8 questions)**

| CODE | TASK                                                                                                                                                                                                                                                                              | P#  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, system design (hydraulic, electronic, etc.), vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Identify brake system components and configurations.                                                                                                                                                                                                                              | P-1 |
| A.03 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                                                                        | P-1 |
| A.04 | Place a vehicle in service mode as needed before servicing the brake system.                                                                                                                                                                                                      | P-1 |
| A.05 | Perform calibration/recalibration, initialization, or relearn procedures as required.                                                                                                                                                                                             | P-1 |
| A.06 | Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).                                                                                                                                                         | P-1 |
| A.07 | Install wheel and torque lug nuts/wheel fasteners.                                                                                                                                                                                                                                | P-1 |
| A.08 | Identify and interpret brake system concerns; determine needed action.                                                                                                                                                                                                            | P-1 |

## **DUTY B: Perform Hydraulic System Diagnosis and Repair (14 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                   | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| B.01        | Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).                                                                     | P-1       |
| B.02        | Measure brake pedal height, travel, and free play (as applicable); determine needed action.                                                                   | P-1       |
| B.03        | Check primary cylinder for internal/external leaks and proper operation; determine needed action.                                                             | P-1       |
| B.04        | Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports; determine needed action. | P-1       |
| B.05        | Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.                                           | P-1       |
| B.06        | Bleed and/or replace fluid in the brake system.                                                                                                               | P-1       |
| B.07        | Test brake fluid for contamination.                                                                                                                           | P-2       |
| B.08        | Identify, inspect, test, and replace components of brake warning light system.                                                                                | P-2       |
| B.09        | Remove, bench bleed, and reinstall primary cylinder.                                                                                                          | P-1       |
| B.10        | Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.                                | P-2       |
| B.11        | Replace brake lines, hoses, fittings, and supports.                                                                                                           | P-2       |
| B.12        | Fabricate brake lines using proper material and flaring procedures.                                                                                           | P-2       |

## **DUTY C: Perform Drum Brake Diagnosis and Repair (6 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                     | <b>P#</b> |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| C.01        | Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.                                                                                                   | P-2       |
| C.02        | Refinish brake drum and measure final drum diameter; compare with specification.                                                                                                                | P-2       |
| C.03        | Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. | P-2       |
| C.04        | Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.                                                                                                           | P-2       |
| C.05        | Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.                                                  | P-2       |
| C.06        | Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.                                                                    | P-2       |

**DUTY D: Perform Disc Brake Diagnosis and Repair (13 questions)**

| CODE | TASK                                                                                                                                     | P#  |
|------|------------------------------------------------------------------------------------------------------------------------------------------|-----|
| D.01 | Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action.                                         | P-1 |
| D.02 | Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action                                 | P-1 |
| D.03 | Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action.                                              | P-1 |
| D.04 | Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads against rotor; inspect for leaks.                     | P-1 |
| D.05 | Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. | P-1 |
| D.06 | Remove and reinstall/replace rotor.                                                                                                      | P-1 |
| D.07 | Refinish rotor on vehicle; measure final rotor thickness and compare with specification.                                                 | P-2 |
| D.08 | Refinish rotor off vehicle; measure final rotor thickness and compare with specification.                                                | P-2 |
| D.09 | Retract and re-adjust caliper piston on an integrated parking brake system.                                                              | P-1 |
| D.10 | Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.          | P-1 |
| D.11 | Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.                   | P-1 |

**DUTY E: Perform Power-Assist Units Diagnosis and Repair (4 questions)**

| CODE | TASK                                                                                                                                                                                                    | P#  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| E.01 | Check brake pedal travel with and without engine running to verify proper power booster operation.                                                                                                      | P-2 |
| E.02 | Identify components of the brake power assist system (vacuum/ hydraulic/electric).                                                                                                                      | P-2 |
| E.03 | Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster; determine needed action. | P-2 |
| E.04 | Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action.                                                                                     | P-2 |

**DUTY F: Perform Related Systems (Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair (7 questions)**

| CODE | TASK                                                                                                                                                  | P#  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| F.01 | Remove, clean, inspect, repack/replace, and install wheel bearings; remove and install bearing races; replace seals; install hub and adjust bearings. | P-3 |
| F.02 | Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.                            | P-2 |
| F.03 | Check parking brake operation (including electric parking brakes); check parking brake indicator light system operation; determine needed action.     | P-2 |
| F.04 | Check operation of brake stop light system.                                                                                                           | P-1 |
| F.05 | Inspect and replace wheel studs/wheel fasteners.                                                                                                      | P-2 |
| F.06 | Remove, reinstall, and/or replace sealed wheel bearing assembly.                                                                                      | P-1 |
| F.07 | Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.                                                         | P-2 |

**DUTY G: Perform Electronic Brake Control Systems Diagnosis and Repair: Antilock Brake (ABS), Traction Control (TCS) and Electronic Stability Control (ESC) Systems (3 questions)**

| CODE | TASK                                                                                                                            | P#  |
|------|---------------------------------------------------------------------------------------------------------------------------------|-----|
| G.01 | Identify and inspect electronic brake control system components and describe function (ABS, TCS, ESC); determine needed action. | P-1 |
| G.02 | Describe the operation of a regenerative braking system.                                                                        | P-2 |
| G.03 | Bleed the electronic brake control system hydraulic circuits.                                                                   | P-2 |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2103 ELECTRICAL/ELECTRONIC SYSTEMS TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General Electrical System Diagnosis  
 Duty B: Perform Battery (Low Voltage) Diagnosis and Service  
 Duty C: Perform Starting System (Low Voltage) Diagnosis and Repair  
 Duty D: Perform Charging System (Low Voltage) Diagnosis and Repair  
 Duty E: Perform Lighting Systems Diagnosis and Repair  
 Duty F: Perform Instrument Cluster and Driver Information Systems Diagnosis and Repair  
 Duty G: Perform Body Electrical Systems Diagnosis and Repair  
 Duty H: Perform xEV Systems Diagnosis and Repair

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

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P-1: 95% must be taught in the curriculum.  
 P-2: 80% must be taught in the curriculum.  
 P-3: 50% must be taught in the curriculum.

### **DUTY A: Perform General Electrical System Diagnosis (16 questions)**

| CODE | TASK                                                                                                                                                                                                                                 | P#  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Identify electrical/electronic system components and configurations.                                                                                                                                                                 | P-1 |
| A.03 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                           | P-1 |
| A.04 | Perform calibration/recalibration, initialization, or relearn procedures as required.                                                                                                                                                | P-1 |
| A.05 | Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).                                                                                           | P-1 |
| A.06 | Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow and resistance.                                                                                   | P-1 |
| A.07 | Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.                                                                                              | P-1 |
| A.08 | Describe precautions related to the use of test lights.                                                                                                                                                                              | P-3 |

## **DUTY A: Perform General Electrical System Diagnosis (16 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                          | <b>P#</b> |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| A.09        | Use fused jumper wires to check operation of electrical circuits per service information.                                                                                            | P-1       |
| A.10        | Use wiring diagrams during the diagnosis of electrical/electronic circuit problems.                                                                                                  | P-1       |
| A.11        | Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine needed action.                                                                                  | P-1       |
| A.12        | Inspect and test fusible links, circuit breakers, and fuses; determine needed action                                                                                                 | P-1       |
| A.13        | Inspect, test, repair, and/or replace components, connectors, terminals, harnesses, and wiring in electrical/electronic systems (including solder repairs); determine needed action. | P-1       |
| A.14        | Test and measure circuit using an oscilloscope and/or graphing multimeter (GMM); interpret results; determine needed action.                                                         | P-2       |

## **DUTY B: Perform Battery (Low Voltage) Diagnosis and Service (8 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                               | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| B.01        | Perform battery state-of-charge test; determine needed action.                                                                                                            | P-1       |
| B.02        | Confirm proper battery capacity, size, type, and application for vehicle; perform battery capacity and load test as recommended by manufacturer; determine needed action. | P-1       |
| B.03        | Maintain or restore electronic memory functions as recommended by manufacturer.                                                                                           | P-2       |
| B.04        | Inspect and clean battery; check battery cables, connectors, clamps, and hold-downs.                                                                                      | P-1       |
| B.05        | Perform battery charging according to manufacturer's recommendations.                                                                                                     | P-1       |
| B.06        | Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply according to manufacturer's recommendations.                                    | P-1       |
| B.07        | Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.   | P-2       |

### **DUTY C: Perform Starting System (Low Voltage) Diagnosis and Repair (9 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                           | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------|-----------|
| C.01        | Perform starter current draw test; determine needed action.                                                           | P-1       |
| C.02        | Perform starter circuit voltage drop tests; determine needed action.                                                  | P-1       |
| C.03        | Inspect and test starter relays and solenoids; determine needed action.                                               | P-2       |
| C.04        | Remove and install starter in a vehicle.                                                                              | P-2       |
| C.05        | Inspect and test switches, connectors, and wires of starter control circuits; determine needed action.                | P-1       |
| C.06        | Demonstrate knowledge of automatic idle-stop/start-stop system that uses a low-voltage starter to restart the engine. | P-1       |
| C.07        | Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.      | P-2       |
| C.08        | Diagnose a no-crank condition using a wiring diagram and test equipment; determine needed action.                     | P-2       |

### **DUTY D: Perform Charging System (Low Voltage) Diagnosis and Repair (6 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                       | <b>P#</b> |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| D.01        | Perform charging system output test; determine needed action.                                                                                                     | P-1       |
| D.02        | Inspect, adjust, and replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment; determine needed action. | P-1       |
| D.03        | Remove, inspect, and replace generator (alternator); determine needed action.                                                                                     | P-2       |
| D.04        | Perform charging circuit voltage drop tests; determine needed action.                                                                                             | P-1       |
| D.05        | Diagnose charging system for causes of undercharge, no-charge, or overcharge conditions; determine needed action.                                                 | P-1       |

### **DUTY E: Perform Lighting Systems Diagnosis and Repair (4 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                     | <b>P#</b> |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| E.01        | Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); determine needed action. | P-1       |
| E.02        | Aim headlights.                                                                                                                                 | P-2       |
| E.03        | Diagnose the causes of brighter-than-normal, intermittent, dim, or no light operation; determine needed action.                                 | P-1       |

### **DUTY F: Perform Instrument Cluster and Driver Information Systems Diagnosis and Repair (3 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                  | <b>P#</b> |
|-------------|------------------------------------------------------------------------------------------------------------------------------|-----------|
| F.01        | Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators as required.          | P-1       |
| F.02        | Inspect and test gauges and gauge sensors/sending units for causes of abnormal readings; determine needed action.            | P-2       |
| F.03        | Diagnose the causes of incorrect operation of warning devices and other driver information systems; determine needed action. | P-2       |

### **DUTY G: Perform Body Electrical Systems Diagnosis and Repair (9 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                                | <b>P#</b> |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| G.01        | Diagnose vehicle comfort, convenience, access, safety, and related systems operation; determine needed action.                                                                                             | P-2       |
| G.02        | Remove and reinstall door panel.                                                                                                                                                                           | P-1       |
| G.03        | Diagnose operation of security/anti-theft systems and related circuits (such as: theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed action.      | P-2       |
| G.04        | Describe disabling and enabling procedures for supplemental restraint system (SRS); verify indicator lamp operation.                                                                                       | P-1       |
| G.05        | Verify windshield wiper and washer operation; replace wiper blades.                                                                                                                                        | P-1       |
| G.06        | Diagnose operation of entertainment/infotainment systems and related circuits (such as: radio, DVD, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed action. | P-2       |
| G.07        | Diagnose operation of safety systems and related circuits (such as: horn, airbags, seat belt pretensioners, occupancy classification, wipers, and washers); determine needed action.                       | P-2       |
| G.08        | Diagnose body electronic system circuits using a scan tool; check for module communication errors (data communication bus systems); determine needed action.                                               | P-2       |
| G.09        | Describe the process for software transfer, software updates, or reprogramming of electronic modules.                                                                                                      | P-2       |

### **DUTY H: Perform xEV Systems Diagnosis and Repair (0 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                              | <b>P#</b> |
|-------------|------------------------------------------------------------------------------------------|-----------|
| H.01        | Locate procedures to safe de-energize/destable and energize/enable high-voltage systems. | P-3       |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2104 ENGINE PERFORMANCE TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General Engine Diagnosis

Duty B: Perform Computerized Engine Controls Diagnosis and Repair

Duty C: Perform Ignition System Diagnosis and Repair

Duty D: Perform Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

Duty E: Perform Emissions Control Systems Diagnosis and Repair

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### DUTY A: Perform General Engine Diagnosis (16 questions)

| CODE | TASK                                                                                                                                                                                                                                 | P#  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                           | P-1 |
| A.03 | Verify proper engine cooling system operation; determine needed action.                                                                                                                                                              | P-1 |
| A.04 | Verify correct camshaft timing including engines equipped with variable valve timing (VVT) systems; determine needed action.                                                                                                         | P-1 |
| A.05 | Verify engine performance concerns; determine needed action.                                                                                                                                                                         | P-1 |
| A.06 | Diagnose abnormal engine noises or vibration concerns; determine needed action.                                                                                                                                                      | P-3 |
| A.07 | Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine needed action.                                                                                               | P-2 |
| A.08 | Perform engine manifold pressure tests (vacuum/boost); determine needed action.                                                                                                                                                      | P-1 |
| A.09 | Perform cylinder power balance test; determine needed action.                                                                                                                                                                        | P-2 |

### **DUTY A: Perform General Engine Diagnosis (16 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                       | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------|-----------|
| A.10        | Perform cylinder cranking and running compression tests; determine needed action. | P-1       |
| A.11        | Perform cylinder leakage test; determine needed action.                           | P-1       |

### **DUTY B: Perform Computerized Engine Controls Diagnosis and Repair (8 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                                                                        | <b>P#</b> |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| B.01        | Identify computerized control system components and configurations.                                                                                                                                                                                | P-1       |
| B.02        | Access and use service information to perform step-by-step (troubleshooting) diagnosis.                                                                                                                                                            | P-1       |
| B.03        | Perform active tests of actuators using a scan tool; determine needed action.                                                                                                                                                                      | P-1       |
| B.04        | Demonstrate knowledge of OBD readiness flags, monitors, and drive cycle for repair verification.                                                                                                                                                   | P-1       |
| B.05        | 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. | P-2       |
| B.06        | Describe the process for reprogramming or recalibrating the powertrain/engine control module (PCM/ECM).                                                                                                                                            | P-1       |

### **DUTY C: Perform Ignition System Diagnosis and Repair (6 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                         | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| C.01        | Identify ignition system components and configurations.                                                                                                                                             | P-1       |
| C.02        | Remove and replace spark plugs; inspect secondary ignition components for wear and damage; determine needed action.                                                                                 | P-1       |
| C.03        | Diagnose no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns related to ignition system problems; determine needed action. | P-2       |
| C.04        | Inspect and test crankshaft and camshaft position sensor(s); determine needed action.                                                                                                               | P-2       |
| C.05        | Inspect, test, and/or replace ignition control module and/or powertrain/engine control module; reprogram/initialize as needed.                                                                      | P-2       |

## DUTY D: Perform Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair (15 questions)

| CODE | TASK                                                                                                                                                                                             | P#  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| D.01 | Identify fuel, air induction, and exhaust system components and configurations.                                                                                                                  | P-1 |
| D.02 | Replace fuel filter(s) where applicable.                                                                                                                                                         | P-3 |
| D.03 | Inspect, service, or replace air filters, filter housings, and intake duct work.                                                                                                                 | P-1 |
| D.04 | Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields for leaks and unmetered air; determine needed action. | P-1 |
| D.05 | Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine needed action.                                                                                        | P-1 |
| D.06 | Check and refill diesel exhaust fluid (DEF).                                                                                                                                                     | P-3 |
| D.07 | Check fuel for quality, composition, and contamination; determine needed action.                                                                                                                 | P-2 |
| D.08 | Inspect and test fuel pump(s) and pump control system for pressure, regulation, and volume; determine needed action.                                                                             | P-1 |
| D.09 | Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.                                                                                  | P-1 |
| D.10 | Inspect, test, and/or replace fuel injectors on low- and high-pressure systems.                                                                                                                  | P-2 |
| D.11 | Verify proper idle speed; determine needed action.                                                                                                                                               | P-1 |
| D.12 | Perform exhaust system back-pressure test; determine needed action.                                                                                                                              | P-2 |
| D.13 | Demonstrate knowledge of the operation of turbocharger/supercharger systems.                                                                                                                     | P-2 |

## DUTY E: Perform Emissions Control Systems Diagnosis and Repair (10 questions)

| CODE | TASK                                                                                                                                                                                                                                                                                                                                          | P#  |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| E.01 | Identify emission control system components and configurations.                                                                                                                                                                                                                                                                               | P-1 |
| E.02 | Inspect, test, service, and/or replace positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; determine needed action.                                                                                                                                                                                      | P-2 |
| E.03 | Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.                                                                                                                                                                                                  | P-2 |
| E.04 | Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service and/or replace electrical/electronic sensors, controls, wiring, tubing, exhaust passages, coolers, vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) system; determine needed action. | P-2 |
| E.05 | Inspect and test electrical/electronically operated components and circuits of secondary air injection systems; determine needed action.                                                                                                                                                                                                      | P-3 |
| E.06 | Diagnose emissions and driveability concerns caused by catalytic converter system; determine needed action.                                                                                                                                                                                                                                   | P-1 |
| E.07 | Diagnose emissions and driveability concerns caused by the evaporative emissions control (EVAP) system; determine needed action.                                                                                                                                                                                                              | P-1 |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2105 HEATING, VENTILATION, AND AIR CONDITIONING TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General HVAC System Diagnosis and Repair

Duty B: Perform Refrigeration System Components Diagnosis and Repair

Duty C: Perform Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

Duty D: Perform Operating Systems and Related Controls Diagnosis and Repair

Duty E: Perform Refrigerant Recovery, Recycling, and Handling

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### DUTY A: Perform General HVAC System Diagnosis and Repair (17 questions)

| CODE | TASK                                                                                                                                                                                                                                                    | P#  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information, including refrigerant/oil/fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Identify heating, ventilation, and air conditioning (HVAC) components and configurations.                                                                                                                                                               | P-1 |
| A.03 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                                              | P-1 |
| A.04 | Perform A/C system performance test as recommended by manufacturer; interpret results; determine needed action.                                                                                                                                         | P-1 |
| A.05 | Identify abnormal operating noises in the A/C system; determine needed action.                                                                                                                                                                          | P-2 |
| A.06 | Leak test A/C system; determine needed action.                                                                                                                                                                                                          | P-1 |
| A.07 | Verify and interpret heating and air conditioning concerns; determine needed action.                                                                                                                                                                    | P-1 |

## DUTY A: Perform General HVAC System Diagnosis and Repair (17 questions)

| CODE | TASK                                                                                                                                                   | P#  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.08 | Place a vehicle in service mode as needed before servicing and diagnosing the HVAC system.                                                             | P-1 |
| A.09 | Identify refrigerant type; test for sealant/contaminant; select and connect proper gauge set/test equipment; record temperature and pressure readings. | P-1 |
| A.10 | Inspect condition/quantity of refrigerant oil removed from A/C system; determine needed action.                                                        | P-1 |
| A.11 | Determine recommended oil and oil capacity for system application and component(s) replacement.                                                        | P-1 |

## DUTY B: Perform Refrigeration System Components Diagnosis and Repair (16 questions)

| CODE | TASK                                                                                                                                                                | P#  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| B.01 | Inspect, remove, and/or replace A/C compressor drive belts, pulleys, and tensioners; determine needed action.                                                       | P-1 |
| B.02 | Inspect for proper A/C condenser airflow; determine needed action.                                                                                                  | P-1 |
| B.03 | Inspect evaporator housing condensation drain; determine needed action.                                                                                             | P-1 |
| B.04 | Inspect, test, and/or service A/C compressor clutch components and/or assembly; determine needed action.                                                            | P-2 |
| B.05 | Remove, inspect, and reinstall, and/or replace A/C compressor and mountings; determine recommended oil type and quantity.                                           | P-2 |
| B.06 | Remove and inspect A/C system hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.                                                  | P-2 |
| B.07 | Remove, inspect, and replace receiver/drier, accumulator/drier, or desiccant; determine recommended oil type and quantity.                                          | P-2 |
| B.08 | Remove, inspect, and install expansion valve or orifice (expansion) tube.                                                                                           | P-2 |
| B.09 | Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and/or control module) to interrupt system operation; determine needed action. | P-2 |
| B.10 | Determine procedure to remove and reinstall evaporator; determine required oil type and quantity.                                                                   | P-2 |
| B.11 | Remove, inspect, reinstall, and/or replace condenser; determine required oil type and quantity.                                                                     | P-3 |

### **DUTY C: Perform Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair (5 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                         | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| C.01        | Inspect engine cooling and heater systems hoses and pipes; determine needed action                                                                  | P-1       |
| C.02        | Inspect and test heater control valve(s); determine needed action.                                                                                  | P-2       |
| C.03        | Diagnose temperature control problems in the HVAC system related to the engine cooling system, including electric heating; determine needed action. | P-3       |
| C.04        | Determine procedure to remove, inspect, reinstall, and/or replace heater core; properly refill system.                                              | P-2       |

### **DUTY D: Perform Operating Systems and Related Controls Diagnosis and Repair (10 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                             | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| D.01        | Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.                                           | P-1       |
| D.02        | Identify the source of HVAC system odors.                                                                                               | P-2       |
| D.03        | Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.       | P-1       |
| D.04        | Diagnose A/C compressor control systems; determine needed action.                                                                       | P-2       |
| D.05        | Diagnose malfunctions in the vacuum, mechanical, and/or electrical components and controls of the HVAC system; determine needed action. | P-2       |
| D.06        | Inspect, test, remove and/or replace HVAC system control panel; determine needed action.                                                | P-2       |
| D.07        | Check operation of automatic HVAC control systems; determine needed action.                                                             | P-2       |

### **DUTY E: Perform Refrigerant Recovery, Recycling, and Handling (7 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                 | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| E.01        | Demonstrate knowledge of the requirement to recover, recycle, and handle refrigerants using proper equipment and procedures.                | P-1       |
| E.02        | Use and maintain refrigerant handling equipment according to equipment manufacturer's standards.                                            | P-1       |
| E.03        | Identify A/C system refrigerant; test for sealants/contaminants; recover, evacuate, and charge A/C system; add refrigerant oil as required. | P-1       |
| E.04        | Recycle, label, and store refrigerant.                                                                                                      | P-1       |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2106 SUSPENSION AND STEERING TECHNICIAN SKILLS STANDARDS AST Skills

Duty A: Perform General Suspension and Steering Systems Diagnosis

Duty B: Perform Steering Systems Diagnosis and Repair

Duty C: Perform Suspension System Diagnosis and Repair

Duty D: Perform Related Suspension and Steering Service

Duty E: Perform Wheel Alignment Diagnosis, Adjustment, and Repair

Duty F: Perform Wheels and Tires Diagnosis and Repair

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### DUTY A: Perform General Suspension and Steering Systems Diagnosis (6 questions)

| CODE | TASK                                                                                                                                                                                                                                 | P#  |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Identify suspension and steering system components and configurations.                                                                                                                                                               | P-1 |
| A.03 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                           | P-1 |
| A.04 | Disable, enable, and properly handle SRS/airbag system components during vehicle service following manufacturer's procedures.                                                                                                        | P-1 |
| A.05 | Identify and interpret suspension and steering system concerns; determine needed action.                                                                                                                                             | P-1 |

## DUTY B: Perform Steering Systems Diagnosis and Repair (14 questions)

| CODE | TASK                                                                                                                                                       | P#  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| B.01 | Inspect rack and pinion steering gear, tie rod ends (sockets), and bellows boots; repair or replace as needed.                                             | P-1 |
| B.02 | Inspect power steering fluid level and condition.                                                                                                          | P-2 |
| B.03 | Drain and replace power steering system fluid; use proper fluid type per manufacturer specification.                                                       | P-2 |
| B.04 | Inspect for power steering fluid leakage; determine needed action.                                                                                         | P-2 |
| B.05 | Remove, inspect, replace, and/or adjust power steering pump drive belt.                                                                                    | P-2 |
| B.06 | Inspect, remove, and/or replace power steering hoses and fittings.                                                                                         | P-2 |
| B.07 | Inspect, remove, and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.                        | P-3 |
| B.08 | Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps (nonrack and pinion).                                                  | P-3 |
| B.09 | Inspect and test electric power steering system; determine needed action.                                                                                  | P-2 |
| B.10 | Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).                                                    | P-1 |
| B.11 | Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.                         | P-2 |
| B.12 | Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.  | P-3 |
| B.13 | Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.      | P-2 |
| B.14 | Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action. | P-2 |
| B.15 | Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets                                                                   | P-2 |
| B.16 | Remove and reinstall power steering pump.                                                                                                                  | P-2 |
| B.17 | Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.                                                                | P-2 |

## DUTY C: Perform Suspension Systems Diagnosis and Repair (10 questions)

| CODE | TASK                                                                                                | P#  |
|------|-----------------------------------------------------------------------------------------------------|-----|
| C.01 | Inspect, remove, and/or replace upper and/or lower control arms, bushings, and shafts.              | P-2 |
| C.02 | Inspect and replace rebound/jounce bumpers.                                                         | P-2 |
| C.03 | Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings. | P-2 |
| C.04 | Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators).   | P-3 |

## **DUTY C: Perform Suspension Systems Diagnosis and Repair (10 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                   | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------|-----------|
| C.05        | Inspect, remove, and/or replace suspension system coil springs and spring insulators.                         | P-2       |
| C.06        | Inspect, remove, and/or replace torsion bars and mounts.                                                      | P-3       |
| C.07        | Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.           | P-2       |
| C.08        | Inspect, remove, and/or replace strut assembly, strut coil spring, insulators, and upper strut bearing mount. | P-2       |
| C.09        | Inspect, remove, and/or replace components of rear suspension systems (Coil, Leaf, and Torsion Beam).         | P-1       |
| C.10        | Inspect, remove, and/or replace components of electronically controlled suspension systems.                   | P-2       |
| C.11        | Inspect, remove, and/or replace steering knuckle assemblies.                                                  | P-2       |
| C.12        | Diagnose suspension system noises, body sway, and uneven ride height concerns; determine needed action.       | P-1       |

## **DUTY D: Perform Related Suspension and Steering Service (3 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                         | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| D.01        | Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.                                                                       | P-1       |
| D.02        | Inspect, service, and/or replace front and rear wheel bearings.                                                                                     | P-1       |
| D.03        | Describe the function of electronically controlled suspension and steering systems and components, (i.e., active suspension and stability control). | P-2       |

## **DUTY E: Perform Wheel Alignment Diagnosis, Adjustment, and Repair (10 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                       | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| E.01        | Determine the need to recalibrate a vehicle's advanced driver assistance system (ADAS) that may require calibration after repairs or adjustments.                                                 | P-1       |
| E.02        | Perform pre-alignment inspection, place vehicle in service mode as required; measure vehicle ride height; determine needed action.                                                                | P-1       |
| E.03        | Describe four-wheel alignment angles (camber, caster, toe, setback, and thrust angle) and effects on vehicle handling/tire wear.                                                                  | P-1       |
| E.04        | Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front caster, front and rear camber, and toe as required; center steering wheel. | P-1       |
| E.05        | Check toe-out-on-turns (turning radius); determine needed action.                                                                                                                                 | P-1       |
| E.06        | Check steering axis inclination (SAI) and included angle; determine needed action.                                                                                                                | P-1       |
| E.07        | Check rear wheel thrust angle; determine needed action.                                                                                                                                           | P-1       |

## **DUTY E: Perform Wheel Alignment Diagnosis, Adjustment, and Repair (10 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                         | <b>P#</b> |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| E.08        | Check for front wheel setback; determine needed action.                                                                                             | P-1       |
| E.09        | Identify front and/or rear cradle (subframe) misalignment; determine needed action.                                                                 | P-1       |
| E.10        | Reset steering angle sensor.                                                                                                                        | P-1       |
| E.11        | Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action. | P-1       |

## **DUTY F: Perform Wheels and Tires Diagnosis and Repair (12 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                                   | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| F.01        | Inspect tire condition/age; identify tire wear patterns; check for correct tire size, application (service-class, load, and speed ratings), and air pressure as listed on the tire information placard/label. | P-1       |
| F.02        | Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring system (TPMS).                                                                              | P-1       |
| F.03        | Dismount, inspect, and remount tire on wheel (with/without TPMS); balance wheel and tire assembly.                                                                                                            | P-1       |
| F.04        | Inspect tire and wheel assembly for air loss; determine needed action.                                                                                                                                        | P-1       |
| F.05        | Repair tire following tire manufacturer approved procedure.                                                                                                                                                   | P-1       |
| F.06        | Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate/relearn system; verify operation of instrument panel lamps.                                                                   | P-1       |
| F.07        | Demonstrate knowledge of steps required to remove and replace sensors (per OEM/sensor manufacturer) in a tire pressure monitoring system (TPMS).                                                              | P-1       |
| F.08        | Perform Road Force balance/match mounting.                                                                                                                                                                    | P-2       |
| F.09        | Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.                                                                                                                                    | P-1       |
| F.10        | Measure wheel, tire, axle flange, and hub runout; determine needed action.                                                                                                                                    | P-2       |
| F.11        | Diagnose tire pull problems; determine needed action.                                                                                                                                                         | P-1       |

# Automotive Skills Standards Instructional Ratings

## AUTOMOTIVE SERVICES 2107 ENGINE REPAIR TECHNICIAN SKILLS STANDARDS

Duty A: Perform General Engine Repair  
Duty B: Perform Cylinder Head and Valve Train Repair  
Duty C: Perform Engine Block Assembly  
Duty D: Perform Lubrication and Cooling Systems Repair

For every skill listed within the auto mechanics skills standards list, the following safety requirements must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The ASE committee assigned a priority number, which determines the significance of each task for test development: P-1, P-2, or P-3 to all skills. These priority numbers pertain to requirements for instruction on tasks as follows:

P-1: 95% must be taught in the curriculum.

P-2: 80% must be taught in the curriculum.

P-3: 50% must be taught in the curriculum.

### DUTY A: Perform General Engine Repair (15 questions)

| CODE | TASK                                                                                                                                                                                                                                                                       | P#  |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| A.01 | Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including xEVs and vehicles equipped with advanced driver assistance systems (ADAS). | P-1 |
| A.02 | Retrieve and record on-board diagnostics, DTCs, monitor status, and freeze frame data; clear codes and data when directed.                                                                                                                                                 | P-1 |
| A.03 | Verify operation of the instrument panel engine warning indicators.                                                                                                                                                                                                        | P-1 |
| A.04 | Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.                                                                                                                                                                                  | P-1 |
| A.05 | Install engine covers using gaskets, seals, and sealers as required.                                                                                                                                                                                                       | P-1 |
| A.06 | Verify engine mechanical timing.                                                                                                                                                                                                                                           | P-1 |
| A.07 | Inspect, remove, and/or replace engine mounts.                                                                                                                                                                                                                             | P-2 |
| A.08 | Identify service precautions related to service of the internal combustion engine of an xEV.                                                                                                                                                                               | P-1 |

## **DUTY B: Perform Cylinder Head and Valve Train Repair (11 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                                                                                                                                                  | <b>P#</b> |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| B.01        | Identify cylinder head and valve train components and configurations.                                                                                                                                                                                                                                                        | P-1       |
| B.02        | Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specification and procedure.                                                                                                                                                                           | P-1       |
| B.03        | Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.                                                                                                                                                                                   | P-2       |
| B.04        | Inspect valve actuating mechanisms for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine needed action.                                                                                                                                                                                       | P-2       |
| B.05        | Adjust valves (mechanical or hydraulic lifters).                                                                                                                                                                                                                                                                             | P-2       |
| B.06        | Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing/variable lift components; verify correct camshaft timing. | P-1       |

## **DUTY C: Perform Engine Block Assembly (4 questions)**

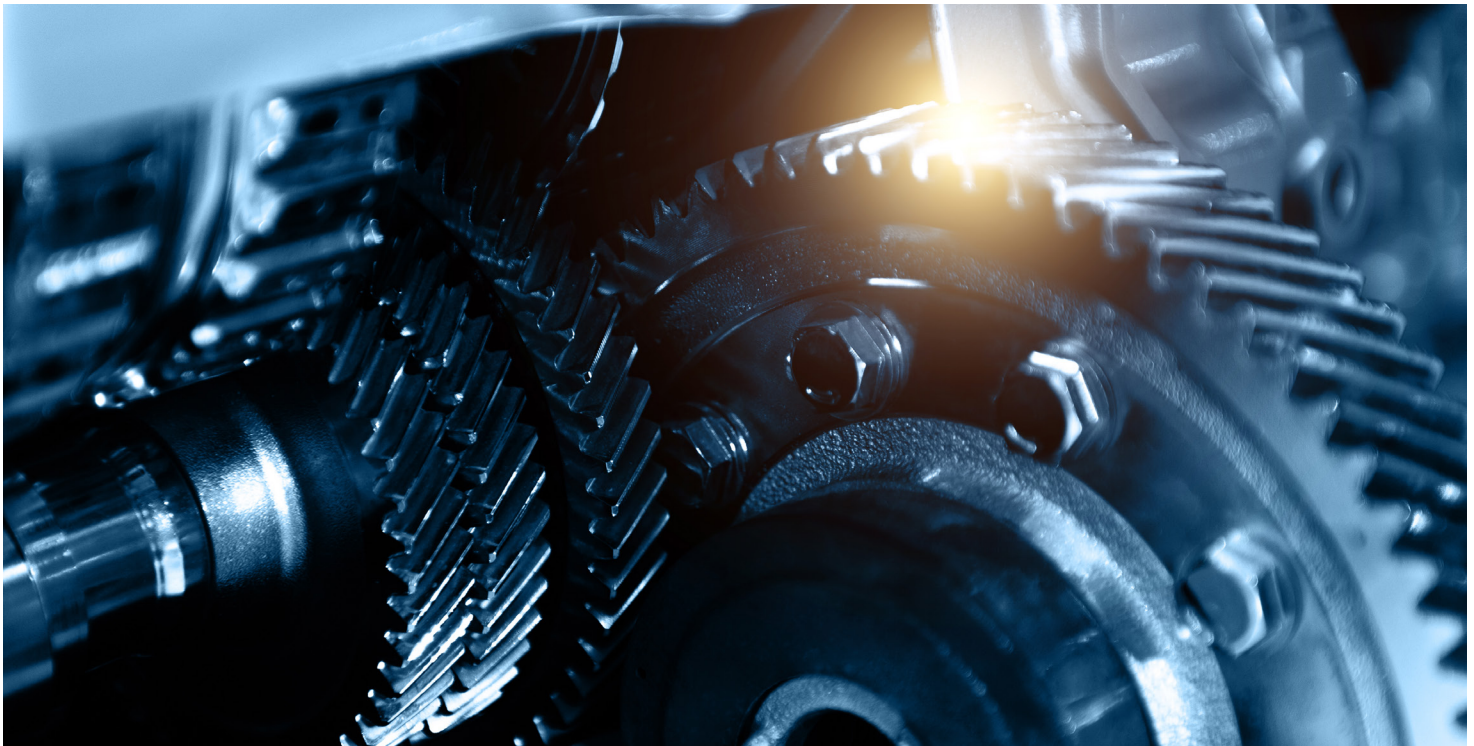
| <b>CODE</b> | <b>TASK</b>                                                                      | <b>P#</b> |
|-------------|----------------------------------------------------------------------------------|-----------|
| C.01        | Identify engine block assembly components and configurations.                    | P-1       |
| C.02        | Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer). | P-2       |

## **DUTY D: Perform Lubrication and Cooling Systems Repair (25 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                                                                                                                           | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| D.01        | Identify lubrication and cooling system components and configurations.                                                                                                                                                                | P-1       |
| D.02        | Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.                                                                                                   | P-1       |
| D.03        | Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant reservoir/recovery tank, heater core, and galley plugs; determine needed action. | P-1       |
| D.04        | Identify causes of engine overheating.                                                                                                                                                                                                | P-1       |
| D.05        | Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.                                                                                                                                | P-1       |
| D.06        | Inspect and test coolant; drain and recover coolant; flush and/or refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.                                                                 | P-1       |
| D.07        | Identify different types of water/coolant pumps (belt driven, chain driven, and electric).                                                                                                                                            | P-1       |
| D.08        | Remove, inspect, and replace thermostat and gasket/seal.                                                                                                                                                                              | P-1       |
| D.09        | Inspect, remove, and replace water/coolant pumps.                                                                                                                                                                                     | P-2       |
| D.10        | Remove and replace radiator.                                                                                                                                                                                                          | P-2       |

## **DUTY D: Perform Lubrication and Cooling Systems Repair (25 questions)**

| <b>CODE</b> | <b>TASK</b>                                                                                                                     | <b>P#</b> |
|-------------|---------------------------------------------------------------------------------------------------------------------------------|-----------|
| D.11        | Inspect and test fan(s), fan clutch (electrical and/or mechanical), fan shroud, and air dams/shutters; determine needed action. | P-1       |
| D.12        | Perform oil pressure tests; determine needed action.                                                                            | P-1       |
| D.13        | Inspect auxiliary coolers; determine needed action.                                                                             | P-2       |
| D.14        | Inspect, test, and replace oil temperature and pressure switches and sensors.                                                   | P-2       |



## Sample Questions

- \_\_\_\_\_ 1. Prior to performing a road test for an automatic transmission, Technician A says you should gather detailed information from the driver of the vehicle. Technician B says you need to check and record the shift points and shift quality. Who is correct?
- a. Technician A
  - b. Technician B
  - c. Both Technician A and Technician B
  - d. Neither Technician A nor Technician B
- \_\_\_\_\_ 2. Technician A says transmission upshifts depend on car speed and throttle position. Technician B says transmission upshifts depend on car speed and engine speed. Who is correct?
- a. Technician A
  - b. Technician B
  - c. Both Technician A and Technician B
  - d. Neither Technician A nor Technician B
- \_\_\_\_\_ 3. Transmission fluid leaking from the rear of the transmission is caused by \_\_\_\_\_.
- a. a bad extension housing bushing
  - b. a bad oil pump
  - c. a broken speedometer cable
  - d. too much modular vacuum
- \_\_\_\_\_ 4. If the fill port on the master cylinder becomes plugged \_\_\_\_\_.
- a. air can bypass the rear piston cup and get into the brake system
  - b. heat expansion cannot take place in the cylinder
  - c. pressure can build in the cylinder forcing too much fluid to the brakes
  - d. pressure in the cylinder could blow the cover off
- \_\_\_\_\_ 5. A partially restricted brake line or hose causes \_\_\_\_\_.
- a. brake drag/pull
  - b. pedal drop
  - c. pulsation
  - d. spongy pedal

- \_\_\_\_\_ 6. Before removing the alternator from the system, a technician should first disconnect the \_\_\_\_\_.
- a. alternator wiring
  - b. ammeter from the ground
  - c. battery ground cable
  - d. field circuit
- . \_\_\_\_\_ 7. A dim courtesy light operation is present, but all other lights function normally. What is the most likely cause?
- a. defective dimmer switch
  - b. defective light switch
  - c. loose ground
  - d. weak battery
- \_\_\_\_\_ 8. When a vehicle accelerates, the manifold absolute pressure (MAP) \_\_\_\_\_.
- a. decreases rapidly
  - b. fluctuates up and down
  - c. increases rapidly
  - d. stays the same
- \_\_\_\_\_ 9. A technician has performed a resistance test on the compressor clutch magnet and has found the coil to have low resistance. This is an indication of \_\_\_\_\_.
- a. normal operation
  - b. open
  - c. a short to ground
  - d. a short to power
- \_\_\_\_\_ 10. A vehicle's idler arm has too much vertical (up and down) movement. Technician A says this causes excessive change in toe. Technician B says this causes excessive change in caster angles when cornering. Who is correct?
- a. Technician A
  - b. Technician B
  - c. Both Technician A and Technician B
  - d. Neither Technician A nor Technician B
- \_\_\_\_\_ 11. Technician A says a bad upper bearing on a strut assembly causes a riding height problem. Technician B says a bad upper bearing causes a grinding noise when turning. Who is correct?
- a. Technician A
  - b. Technician B
  - c. Both Technician A and Technician B
  - d. Neither Technician A nor Technician B

- \_\_\_\_\_ 12. During inspection of the engine block, a crack is found on the outside of the block between the core plugs. What most likely caused this condition?
- a. excessive engine blow-by
  - b. improper coolant/water mixture
  - c. incorrect oil viscosity
  - d. leaking oil pressure relief valve
- \_\_\_\_\_ 13. During the inspection of an engine block and crankshaft assembly, crankshaft endplay is found to be out of the manufacturer's specifications. What most likely caused this condition?
- a. damaged main bearing cap
  - b. excessive thrust bearing wear
  - c. excessive wear of the timing chain/belt components
  - d. worn connecting rod bearings
- \_\_\_\_\_ 14. When inspecting a transmission extension housing, a technician finds pieces of plastic. These pieces are part of the \_\_\_\_\_.
- a. 3-4 drive gear
  - b. blocker ring
  - c. shift fork
  - d. speedometer drive gear
- \_\_\_\_\_ 15. If the transmission shaft bearing preload torque measurement is excessive, a technician should replace the \_\_\_\_\_.
- a. counter shaft
  - b. main shaft
  - c. shim with a thicker shim
  - d. shim with a thinner shim

## Sample Questions — Key

- \_\_\_\_\_ 1. Prior to performing a road test for an automatic transmission, Technician A says you should gather detailed information from the driver of the vehicle. Technician B says you need to check and record the shift points and shift quality. Who is correct?
- a. Technician A Wrong, but plausible
  - b. Technician B Wrong, but plausible
  - c. Both Technician A and Technician B Correct
  - d. Neither Technician A nor Technician B Wrong, but plausible
- \_\_\_\_\_ 2. Technician A says transmission upshifts depend on car speed and throttle position. Technician B says transmission upshifts depend on car speed and engine speed. Who is correct?
- a. Technician A Correct
  - b. Technician B Wrong, but plausible
  - c. Both Technician A and Technician B Wrong, but plausible
  - d. Neither Technician A nor Technician B Wrong, but plausible
- \_\_\_\_\_ 3. Transmission fluid leaking from the rear of the transmission is caused by \_\_\_\_\_.
- a. a bad extension housing bushing Correct
  - b. a bad oil pump Wrong, but plausible
  - c. a broken speedometer cable Wrong, but plausible
  - d. too much modular vacuum Wrong, but plausible
- \_\_\_\_\_ 4. If the fill port on the master cylinder becomes plugged \_\_\_\_\_.
- a. air can bypass the rear piston cup and Get into the brake system Correct
  - b. heat expansion cannot take place in the cylinder Wrong, but plausible
  - c. pressure can build in the cylinder forcing too much fluid to the brakes Wrong, but plausible
  - d. pressure in the cylinder could blow the cover off Wrong, but plausible
- \_\_\_\_\_ 5. A partially restricted brake line or hose causes \_\_\_\_\_.
- a. brake drag/pull Correct
  - b. pedal drop Wrong, but plausible
  - c. pulsation Wrong, but plausible
  - d. spongy pedal Wrong, but plausible

- \_\_\_\_\_ 6. Before removing the alternator from the system, a technician should first disconnect the \_\_\_\_\_.
- a. alternator wiring Wrong, but plausible
  - b. ammeter from the ground Wrong, but plausible
  - c. battery ground cable Correct
  - d. field circuit Wrong, but plausible
- \_\_\_\_\_ 7. A dim courtesy light operation is present, but all other lights function normally. What is the most likely cause?
- a. defective dimmer switch Wrong, but plausible
  - b. defective light switch Wrong, but plausible
  - c. loose ground Correct
  - d. weak battery Wrong, but plausible
- \_\_\_\_\_ 8. When a vehicle accelerates, the manifold absolute pressure (MAP) \_\_\_\_\_.
- a. decreases rapidly Wrong, but plausible
  - b. fluctuates up and down Wrong, but plausible
  - c. increases rapidly Correct
  - d. stays the same Wrong, but plausible
- \_\_\_\_\_ 9. A technician has performed a resistance test on the compressor clutch magnet and has found the coil to have low resistance. This is an indication of \_\_\_\_\_.
- a. normal operation Correct
  - b. open Wrong, but plausible
  - c. a short to ground Wrong, but plausible
  - d. a short to power Wrong, but plausible
- \_\_\_\_\_ 10. A vehicle's idler arm has too much vertical (up and down) movement. Technician A says this causes excessive change in toe. Technician B says this causes excessive change in caster angles when cornering. Who is correct?
- a. Technician A Correct
  - b. Technician B Wrong, but plausible
  - c. Both Technician A and Technician B Wrong, but plausible
  - d. Neither Technician A nor Technician B Wrong, but plausible
- \_\_\_\_\_ 11. Technician A says a bad upper bearing on a strut assembly causes a riding height problem. Technician B says a bad upper bearing causes a grinding noise when turning. Who is correct?
- a. Technician A Wrong, but plausible
  - b. Technician B Correct
  - c. Both Technician A and Technician B Wrong, but plausible
  - d. Neither Technician A nor Technician B Wrong, but plausible

\_\_\_\_\_ 12. During inspection of the engine block, a crack is found on the outside of the block between the core plugs. What most likely caused this condition?

- |                                      |                      |
|--------------------------------------|----------------------|
| a. excessive engine blow-by          | Wrong, but plausible |
| b. improper coolant/water mixture    | Correct              |
| c. incorrect oil viscosity           | Wrong, but plausible |
| d. leaking oil pressure relief valve | Wrong, but plausible |

\_\_\_\_\_ 13. During the inspection of an engine block and crankshaft assembly, crankshaft endplay is found to be out of the manufacturer's specifications. What most likely caused this condition?

- |                                                       |                      |
|-------------------------------------------------------|----------------------|
| a. damaged main bearing cap                           | Wrong, but plausible |
| b. excessive thrust bearing wear                      | Correct              |
| c. excessive wear of the timing chain/belt components | Wrong, but plausible |
| d. worn connecting rod bearings                       | Wrong, but plausible |

\_\_\_\_\_ 14. When inspecting a transmission extension housing, a technician finds pieces of plastic. These pieces are part of the \_\_\_\_\_.

- |                           |                      |
|---------------------------|----------------------|
| a. 3-4 drive gear         | Wrong, but plausible |
| b. blocker ring           | Wrong, but plausible |
| c. shift fork             | Wrong, but plausible |
| d. speedometer drive gear | Correct              |

\_\_\_\_\_ 15. If the transmission shaft bearing preload torque measurement is excessive, a technician should replace the \_\_\_\_\_.

- |                              |                      |
|------------------------------|----------------------|
| a. counter shaft             | Wrong, but plausible |
| b. main shaft                | Wrong, but plausible |
| c. shim with a thicker shim  | Wrong, but plausible |
| d. shim with a thinner shim` | Correct              |

## Abbreviations, Symbols and Acronyms

When abbreviations, symbols or acronyms are more commonly used in written and verbal communications within the automotive industry than the words they represent, they will also be used on the written examination required for competency. The following is a list of abbreviations, symbols and acronyms used on the automotive examinations.

|                |                                                |
|----------------|------------------------------------------------|
| '              | Feet                                           |
| "              | Inches                                         |
| °              | Degrees                                        |
| \$             | Dollars                                        |
| O <sub>2</sub> | Oxygen                                         |
| %              | Percent                                        |
| 2K             | a coating that needs a hardener                |
| ABS            | anti-lock brake system                         |
| AC             | alternating current                            |
| A/C            | air conditioning                               |
| ADAS           | advanced driver assistance system              |
| ASE            | Automotive Service Excellence                  |
| ATF            | automatic transmission fluid                   |
| BCM            | body control module                            |
| CAN/BUS        | Controller Area Network                        |
| CCA            | cold cranking amp                              |
| CV             | constant-velocity                              |
| CVT            | continuously variable transmission             |
| DC             | direct current                                 |
| DCT            | dual clutch transmission                       |
| DEF            | diesel exhaust fluid                           |
| DMM            | digital multimeter                             |
| DTC            | diagnostic trouble code                        |
| DVOM           | digital volt/ohm meter                         |
| ECM            | electronic control module                      |
| EGR            | exhaust gas recirculation                      |
| EVAP           | evaporative emission                           |
| Ft             | feet                                           |
| FWD            | front wheel drive                              |
| GTX            | a name of a GE developed plastic (Noryl GTX)   |
| HEPA           | high-efficiency particulate arrestance         |
| Hg             | Mercury                                        |
| HVAC           | heating, ventilation, and air conditioning     |
| IAC            | idle air control                               |
| ID             | inside diameter                                |
| In             | inch                                           |
| IP             | instrument panel                               |
| ISO            | International Organization for Standardization |
| kV             | kilovolts                                      |
| MIG            | metal inert gas                                |

|       |                                                       |
|-------|-------------------------------------------------------|
| MIL   | malfunction indicator lamp                            |
| mm    | millimeter                                            |
| MPH   | miles per hour                                        |
| MSDS  | material safety data sheet                            |
| NATEF | National Automotive Technicians Education Foundation  |
| NIOSH | National Institute for Occupational Safety and Health |
| OBD   | On-Board Diagnostics                                  |
| OEM   | original equipment manufacturer                       |
| OSHA  | Occupational Safety and Health Administration         |
| PAG   | polyalkylene glycol                                   |
| PCV   | positive crankcase ventilation                        |
| PM    | permanent generator                                   |
| POA   | pilot operated absolute                               |
| PSI   | pounds per square inch                                |
| RPM   | revolutions per minute                                |
| SAI   | steering axis inclination                             |
| SMC   | sheet moulded compound                                |
| SRS   | supplemental restraint system                         |
| STRSW | squeeze type resistance spot welding                  |
| TDC   | top dead center                                       |
| TEO   | thermoplastic elastomeric olefin                      |
| TIG   | tungsten inert gas                                    |
| TPS   | throttle position sensor                              |
| TSB   | Transportation Safety Bulletin                        |
| TV    | throttle valve                                        |
| USB   | universal serial bus                                  |
| V     | volt                                                  |
| VOC   | volatile organic compounds                            |
| xEV   | electrified vehicle                                   |

## Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

### General Testing Advice

1. Get a good night's rest the night before the test — eight hours of sleep is recommended.
2. Avoid junk food and “eat right” several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

### Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.



## NOTES

[illegible]

## NOTES

[illegible]