

# PRACTICE EXAM 16: ASE A4 SIMULATION

## (40 QUESTIONS)

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### STEERING SYSTEMS DIAGNOSIS AND REPAIR (Questions 1–12)

1. A 2023 vehicle has had its battery replaced. Since the service, the EPS warning light has been illuminated and the steering has reduced assist. Scan tool shows DTC P0562 "System voltage low" but battery voltage reads 12.8 V at rest and 14.2 V running. What is the correct next step?

- A. Replace the EPS control module because voltage loss during battery service damaged it
- B. Perform the manufacturer-specified EPS initialization procedure after battery service
- C. Perform the manufacturer-specified EPS initialization procedure and clear the DTC after verification
- D. Replace the battery with a new OE specification unit to meet the EPS voltage requirement

2. A vehicle has lane-keep assist. After a complete alignment was performed that adjusted front toe and re-centered the steering wheel, the lane-keep system is now causing the vehicle to drift toward the left lane marker. What is MOST likely the cause?

- A. The forward camera requires calibration after the steering wheel was re-centered during alignment
- B. The lane-keep assist module has failed and requires replacement with the new specification unit
- C. The steering angle sensor requires physical replacement because alignment disturbed the sensor
- D. The alignment was performed incorrectly and must be redone to restore lane-keep function

3. A 2020 truck with column-mounted EPS arrives with a complaint of heavy steering at parking speeds. Scan tool data shows EPS motor current at 5 A when steering is at full lock. Specification under this condition is 60–90 A. What does this indicate?

- A. The EPS motor windings have failed open reducing current flow below specification value
- B. The steering angle sensor has failed and is preventing motor activation during parking steering

- C. The torque sensor is not reporting driver input to the EPS control module during the test
- D. The EPS control module has a faulty output driver preventing adequate current flow to motor

4. A clockspring installation has just been completed. The new clockspring has a centering tab that must be removed after installation. The technician removes the tab before installing the steering wheel. What is the consequence?

- A. The clockspring will function normally because the tab is only for shipping purposes
- B. The clockspring may rotate out of center during installation damaging the ribbon cable
- C. The clockspring requires an additional calibration step when the tab is removed early
- D. The ribbon cable will become excessively tight at one steering wheel rotation direction

5. A power steering system has a hydraulic rack with a return line routed through an engine-driven cooler. The customer reports fluid overheating complaints. Scan tool data shows fluid temperature at 245°F during highway driving. Specification limit is 250°F. What is the MOST likely cause?

- A. The cooler has internal restriction preventing adequate fluid flow and heat dissipation
- B. The power steering pump is worn and producing excessive heat from internal bypass
- C. The hydraulic fluid has degraded and requires replacement with fresh manufacturer fluid
- D. The coolant system temperature is affecting the power steering cooler heat exchange efficiency

6. A technician is inspecting a rack-mounted EPS system. The rack has been in service for 6 years and 110,000 miles. Scan tool data shows normal operation. What service practice is appropriate at this mileage?

- A. Preventive replacement of the rack assembly to avoid imminent failure from age
- B. Preventive calibration of the EPS module to compensate for age-related sensor drift
- C. Continue normal service — rack-mounted EPS has no scheduled replacement requirement
- D. Flush the power steering fluid — EPS systems require periodic fluid replacement service

7. A vehicle with electronic variable-assist steering shows the following symptoms: light twitchy steering at all speeds, no warning lights, no DTCs. Scan tool data shows vehicle speed signal consistently reading 0 mph at actual speeds above 30 mph. What is the cause?

- A. The EPS control module has failed internally and requires complete replacement with new unit
- B. The EPS fluid is contaminated and requires replacement before any diagnostic can continue
- C. The steering angle sensor has lost calibration and requires scan tool recalibration procedure
- D. Loss of VSS signal causes the system to default to maximum assist at actual highway speeds

8. A 2021 vehicle has had its steering angle sensor replaced. After installation, the scan tool SAS warning light stays illuminated. The technician has not performed any post-installation procedure. What is the correct next step?

- A. Disconnect the battery for 30 minutes to force a module reset and automatic SAS relearn
- B. Perform the manufacturer-specified SAS calibration procedure using an OE-compatible scan tool
- C. Drive the vehicle at highway speed for 30 minutes to allow automatic sensor calibration
- D. Replace the new SAS because it is defective and is producing the persistent warning condition

9. A power steering hose has visible surface cracks in the outer rubber cover. The hose is a high-pressure line between the pump and the gear. What is the correct action?

- A. Apply silicone sealant over the cracks to prevent ozone penetration and continue service
- B. Monitor the cracks during future service intervals and replace only if fluid leaks from cracks
- C. Replace the complete hose assembly — outer cover cracks compromise pressure containment integrity
- D. Wrap the cracked section with reinforced tape to prevent further deterioration in service

10. A recirculating ball gearbox is leaking fluid at the pitman shaft seal. The gearbox has been rebuilt with new seals, and the leak returns within 2 months. What is MOST likely the underlying cause?

- A. The pitman shaft is worn or scored at the location where the seal lip contacts it during rotation

- B. The replacement seals are from a defective production batch from the supplier to the shop
- C. The power steering fluid being used is incompatible with the seal material causing deterioration
- D. The gearbox mounting bolts are over-torqued causing distortion of the pitman shaft seal area

11. A 2022 vehicle has a DTC for "Steering column lock malfunction." The customer reports the steering wheel will not unlock when the ignition is activated. What is the MOST likely cause?

- A. The steering angle sensor has failed and is preventing the column lock from receiving commands
- B. The electronic steering column lock actuator has failed and cannot release the column
- C. The EPS control module requires initialization after a previous battery disconnect event
- D. The clockspring has failed causing loss of electrical communication to the column lock system

12. A 2023 truck with rack-mounted EPS arrives with a complaint of intermittent heavy steering. Scan tool data shows torque sensor channel A voltage at 2.50 V and channel B voltage at 2.60 V at rest. Specification states the two channels should read within 0.10 V of each other. What is the correct repair?

- A. Replace only the steering angle sensor because it affects torque sensor calibration reference
- B. Perform an EPS module reset and recalibrate the torque sensor using a scan tool procedure
- C. Clear the DTC and road test the vehicle because the readings are within specification tolerance
- D. Replace the rack and pinion assembly — the torque sensor is integrated and not serviceable

### **SUSPENSION SYSTEMS DIAGNOSIS AND REPAIR (Questions 13–24)**

13. A vehicle with four-corner air suspension has had all four air springs replaced. After installation, the vehicle will not rise to normal ride height — the compressor runs but the system does not respond. Ride height sensors test good. What is MOST likely missing from the service procedure?

- A. The air suspension system requires a calibration procedure after new air spring installation
- B. The new air springs require pre-inflation to a specified pressure before system activation
- C. The compressor requires resetting using a scan tool after air spring replacement procedure

D. The four new air springs must be bench-tested before installation to verify service function

14. A MagneRide damper has been replaced on one corner of a vehicle. After installation, the damper cannot be commanded via scan tool — it does not respond to damping commands. Wiring tests good. What is the MOST likely cause?

- A. The suspension control module requires calibration after any damper replacement service
- B. The new damper is defective and requires immediate replacement with another new unit
- C. The damper requires a programming procedure specific to the vehicle and its control module
- D. The MR fluid in the new damper has not been conditioned by initial magnetic field exposure

15. A vehicle with adaptive damping has fault codes for damper current out of range on three corners simultaneously. The fourth corner has no fault code. What is MOST likely the cause?

- A. Three of four dampers have failed simultaneously from environmental exposure or manufacturing defect
- B. The suspension control module has developed multiple output driver failures for the damper circuits
- C. A single fuse or power supply to the three damper circuits has failed isolating three corners at once
- D. The vehicle has been flooded causing water damage to three damper circuits simultaneously

16. A rear subframe has been replaced on a unibody vehicle after collision repair. During installation, the centering pins were used. After completion, the rear toe cannot be adjusted within specification. What is MOST likely the cause?

- A. The centering pins are defective and did not properly locate the subframe during installation
- B. The replacement subframe is defective and requires replacement to restore correct geometry
- C. The alignment equipment requires calibration for the vehicle after the subframe service
- D. The centering pins were not fully engaged during the mounting bolt torque procedure

17. A customer complains their vehicle bounces excessively over highway bumps. The technician performs a bounce test — pushing down hard on each corner and releasing. The vehicle bounces through 3 complete cycles before settling at each corner. What is the correct interpretation?

- A. The shock absorbers or struts have failed internally and cannot control spring oscillation properly
- B. The coil springs have sagged and are producing excessive suspension travel during service cycles
- C. The tire pressures are below specification causing excessive rolling vibration over highway bumps
- D. The alignment has shifted out of specification causing the suspension to operate incorrectly

18. A pickup truck with torsion bar front suspension has been in service for 12 years and 150,000 miles. The customer complains the front sits 1.5 inches below specification on both sides. The torsion bar adjusters are near the end of their adjustment range. What is MOST likely the cause?

- A. The torsion bar preload adjusters have seized and cannot be turned further to specification
- B. The torsion bar mounts have deteriorated allowing the bars to shift from their original position
- C. The coil springs have replaced the torsion bars and are out of specification tolerance value
- D. The torsion bars have lost spring rate over time and preload adjustment cannot compensate further

19. A leaf spring rear suspension has been in service for 8 years. The main leaf shows no visible cracks but the spring arc is 4 inches compared to the specification of 5.5 inches for new. What is the correct diagnosis?

- A. The leaf spring arc is still within acceptable tolerance for used springs in service conditions
- B. The leaf spring pack should be inspected for broken helper leaves hidden in the spring pack
- C. The leaf spring has sagged significantly and lost its designed load capacity requiring replacement
- D. The leaf spring center bolt has worn allowing the axle to shift affecting the arc measurement

20. A stabilizer bar end link is being replaced on a vehicle. The link has a ball-and-stud design at each end with rubber bushings. Technician A says the fasteners should be torqued at full suspension droop on a lift. Technician B says the fasteners should be torqued at ride height. Who is correct?

- A. Technician A only
- B. Technician B only
- C. Both Technicians A and B
- D. Neither Technician A nor B

21. A multi-link rear suspension has a fault code for "Rear ride height sensor left invalid." Scan tool data shows the sensor output at 15 V when specification is 4.5–4.8 V at ride height. The sensor wiring tests good. What is the correct repair?

- A. Reset the suspension control module to clear the invalid reading and continue service
- B. Adjust the ride height at the affected corner to bring the sensor into specification range
- C. Replace the ride height sensor and inspect the linkage arm for damage during installation
- D. Replace the ride height sensor at the affected corner — the output is out of range from failure

22. A customer complains of clunking from the front suspension on railroad tracks — specifically when both front wheels hit the bump simultaneously. Single-wheel bumps produce no noise. What is the MOST likely cause?

- A. Worn upper strut bearings on both sides of the vehicle producing noise during bump impacts
- B. Worn outer tie rod ends on both sides producing noise during suspension deflection events
- C. Worn subframe mounting bushings allowing the subframe to shift under bilateral bump impact
- D. Worn stabilizer bar end links on both sides producing noise during bilateral bump events

23. A wear-indicator ball joint has the grease fitting projecting 3/16 inch above the housing surface when inspected at curb height. Specification states the fitting should be at or above the housing surface. What does this indicate?

- A. The ball joint is within acceptable wear limits and does not require replacement now
- B. The ball joint has reached its wear limit and requires immediate replacement for service
- C. The wear indicator is defective and the joint must be inspected using alternate methods

D. The vehicle must be lifted to access the ball joint for proper inspection at curb height

24. A coil spring is being installed during strut assembly. The spring has a directional painted marking on one end indicating the top. The technician installs the spring with the mark at the bottom. What is the likely consequence?

- A. The spring will function normally because the marking is for assembly reference only
- B. The spring rate will be incorrect causing ride height error and potentially handling issues
- C. The spring will fracture within the first 1000 miles of service from reversed stress pattern
- D. The spring isolator will wear faster than normal from the reversed installation orientation

### **WHEEL ALIGNMENT DIAGNOSIS, ADJUSTMENT, AND REPAIR (Questions 25–35)**

25. A vehicle has had an alignment performed. The ADAS forward camera was not physically moved during service. The alignment changed the rear toe significantly. Does the ADAS forward camera require calibration?

- A. No, the ADAS camera is only affected by windshield replacement or direct physical disturbance
- B. No, the ADAS camera is isolated from alignment changes and does not require calibration
- C. Yes, only if the customer reports lane-keep assist problems after the alignment is completed
- D. Yes, because ADAS camera calibration is tied to vehicle geometry references including rear toe

26. A vehicle with torsion beam rear suspension has a rear alignment reading  $0.30^\circ$  out of spec on one side. Which repair approach is correct?

- A. Adjust the rear toe eccentric cam on the trailing arm pivot to correct the reading to spec
- B. Install aftermarket torsion beam mounts to provide rear toe adjustment capability for service
- C. Inspect the torsion beam and trailing arm for bent or damaged condition — replace as needed
- D. Document the reading on the printout and advise the customer no repair is available

27. A vehicle's alignment shows: Front camber both sides  $+0.2^\circ$ , Front caster both sides  $+4.0^\circ$ , Front toe total  $+0.10^\circ$ , Rear toe symmetric within spec, Thrust angle  $0.02^\circ$ . What does the thrust angle value confirm?

- A. The front alignment is complete and the steering wheel will be centered during straight driving
- B. The rear toe settings are essentially symmetric and the thrust line matches the vehicle centerline
- C. The vehicle has no setback at the front axle based on the thrust angle measurement value
- D. The alignment equipment is calibrated correctly based on the thrust angle reading match

28. A vehicle arrives with a pull to the right at highway speed. Tire pressures are correct. A tire swap reverses the pull to the left. What is the correct diagnosis?

- A. A tire has conicity causing it to lead in one direction regardless of wheel position or alignment
- B. The alignment is out of specification and requires correction to eliminate the original pull
- C. A dragging front brake caliper is causing the pull during straight driving at highway speed
- D. The steering gear has internal bypass causing a direction-dependent pull during operation

29. A technician is setting front toe on a vehicle. The steering wheel has been centered and locked with a holder tool. Left tie rod reads  $+0.05^\circ$  and right tie rod reads  $+0.08^\circ$ . Specification is  $+0.10^\circ \pm 0.05^\circ$  total. What is the current condition?

- A. The total toe is  $+0.13^\circ$  which exceeds specification and requires reduction to meet specs
- B. The total toe is  $+0.03^\circ$  which is below specification and requires increase to meet spec
- C. The individual readings are asymmetric but the total is outside the specified tolerance range
- D. The total toe is  $+0.13^\circ$  which is within specification at the upper tolerance — acceptable for service

30. A vehicle with lane-keep assist has had its alignment completed. The steering wheel was re-centered during toe adjustment. The forward camera was not physically moved. Which calibrations are typically required?

- A. Only the tire pressure monitoring system requires a reset after the alignment service completion

- B. Only the electronic stability control module requires a relearn during a road test on the highway
- C. The steering angle sensor calibration and the ADAS forward camera calibration are typically required
- D. No calibration is needed because the forward camera was not physically disturbed during service

31. A vehicle has alignment readings: Front camber Left  $+0.3^\circ$ , Right  $-0.4^\circ$ , within spec. Front caster Left  $+3.5^\circ$ , Right  $+3.6^\circ$ . The vehicle pulls to the left. What is MOST likely the cause?

- A. Cross-camber of  $0.7^\circ$  with the left side more positive than the right produces a leftward pull
- B. Cross-caster between left and right produces the pull at highway speeds during driving conditions
- C. The absolute camber values are too low and cause the pull direction toward the more-positive side
- D. Front toe is causing the pull because both camber and caster readings appear within tolerance

32. A vehicle has SAI readings of  $13.2^\circ$  on the left and  $12.4^\circ$  on the right. Camber is within specification on both sides at  $-0.3^\circ$ . Specification for SAI is  $13.0^\circ \pm 0.5^\circ$ . What does this indicate?

- A. The alignment equipment requires recalibration before continuing the alignment service work
- B. The tire pressures differ between sides causing the apparent SAI measurement difference
- C. The ride height varies between sides producing the SAI difference on the alignment rack
- D. The right front steering knuckle is bent — the SAI difference exceeds tolerance and camber was adjusted around the damage

33. A vehicle's alignment printout shows: Thrust angle  $+0.30^\circ$ , Total rear toe within spec, Front toe set relative to thrust line. The steering wheel sits centered during straight driving. What is confirmed?

- A. The rear alignment is correct at  $0^\circ$  thrust angle and the vehicle tracks along geometric centerline
- B. The alignment is out of specification — thrust angle of  $0.30^\circ$  exceeds any normal tolerance value
- C. The front toe was correctly set to the thrust line producing a centered wheel during straight driving
- D. The rear toe was adjusted symmetrically eliminating the thrust angle during the alignment completed

34. A vehicle has front camber that has drifted out of specification over the past 20,000 miles. The original alignment was performed per factory specification. Visual inspection reveals no obvious component damage. What is MOST likely the cause?

- A. The alignment equipment was miscalibrated during the original alignment service performed
- B. Worn suspension bushings are allowing camber shift under dynamic loading during operation
- C. The customer has been driving aggressively and caused the misalignment during hard cornering
- D. The alignment angles shift naturally over time and periodic re-alignment is a normal service

35. A vehicle with MacPherson strut front suspension has no factory adjustment for camber. The camber has drifted  $0.8^\circ$  more negative on one side after 80,000 miles of service. Visual inspection reveals intact strut and mount. What is the correct action?

- A. Install aftermarket camber adjustment hardware or inspect the underlying cause for bushing wear
- B. Swap the left and right struts to equalize the camber readings between the two sides
- C. Leave the camber out of specification and document the condition on the alignment printout
- D. Reduce the tire pressure on the affected side to compensate for the out-of-spec camber reading

### **WHEEL AND TIRE DIAGNOSIS AND SERVICE (Questions 36–40)**

36. A direct TPMS sensor has stopped reporting data to the vehicle. The scan tool shows the sensor as "not communicating." The tire pressure measures correct with a gauge. The vehicle is 8 years old. What is MOST likely the cause?

- A. The TPMS module has lost programming and requires reprogramming with the vehicle VIN
- B. The tire pressure is fluctuating enough to confuse the sensor into incorrect reporting
- C. The wheel speed sensor at that corner is affecting the TPMS direct sensor communication
- D. The TPMS sensor battery has reached end of life — typical life is 5–10 years on sensors

37. A vehicle with indirect TPMS has been serviced — tires were rotated front-to-rear. After rotation, the TPMS warning light stays illuminated. All tire pressures measure at specification. What is required to clear the warning?

- A. Replace all four TPMS sensors with new units programmed to the vehicle's specification
- B. Perform the vehicle-specific TPMS relearn or programming procedure for each wheel position
- C. Perform the indirect TPMS "set pressure" reset procedure using a scan tool or menu option
- D. Drive the vehicle at highway speed for 30 minutes to trigger automatic relearn procedure

38. A wheel hub assembly installation requires an axle nut specification of 240 ft-lb plus 90°. The technician torques to 240 ft-lb and skips the 90° rotation. What is the likely consequence?

- A. The wheel bearing will have excessive preload causing overheating and immediate failure
- B. The wheel bearing will have insufficient preload causing excessive play and eventual failure
- C. The axle nut will loosen during driving due to vibration at highway speed operation
- D. The brake rotor will develop excessive runout from improper hub seating during installation

39. A tire puncture in the tread area is 1/4 inch in diameter — exactly at the industry-standard maximum repairable size. The tire has 5/32 inch tread remaining. What is the correct service action?

- A. Replace the tire because 1/4 inch is too large to repair safely even at the stated size limit
- B. Install an external string plug since the puncture is exactly at the maximum repairable size
- C. Install an interior patch only without plugging since the puncture is at the size threshold
- D. Repair using a combination plug/patch from inside — 1/4 inch is the maximum repairable size

40. A tire sidewall reads "P235/55R18 104W." The "55" represents:

- A. The tire's aspect ratio — sidewall height expressed as a percentage of the section width
- B. The tire's wheel diameter in inches to match the wheel rim specification for the vehicle
- C. The tire's load index specifying maximum load at rated inflation pressure during service
- D. The tire's speed rating expressed in hundreds of kilometers per hour for sustained use

## Practice Exam 16: Answer Key and Explanations

1. C — After battery replacement, perform the manufacturer-specified EPS initialization procedure, then clear the DTC after verifying the system has relearned properly. The P0562 code is stored from the actual voltage loss during battery service — running the initialization and clearing the code in sequence restores normal operation. Module replacement is unnecessary.
2. A — When the steering wheel is re-centered during alignment, the SAS's learned zero-point shifts. On lane-keep-assist-equipped vehicles, the forward camera uses the SAS's reference to interpret lane position — if the reference has shifted, the system steers toward an incorrect lane reference. Forward camera calibration is required to restore correct lane-keep function.
3. D — When EPS motor current reads 5 A under a condition that should produce 60–90 A, the module is commanding properly but the output driver is unable to deliver current to the motor. Motor winding failure, SAS faults, and torque sensor issues would produce different symptom patterns. The control module output circuit has failed and the module requires replacement.
4. B — The centering tab locks the clockspring at its centered position during shipping and installation. Removing it before installing the steering wheel allows the clockspring to rotate out of center during handling, putting the internal ribbon cable near one of its travel limits. The tab must stay in place until after the steering wheel is installed.
5. A — A cooler restriction prevents fluid from flowing through at the required rate to dissipate heat. The fluid continues to recirculate without adequate cooling, producing the sustained high temperature. Pump wear produces different symptoms; fluid degradation rarely causes temperature issues; coolant system status doesn't directly affect PS cooler heat exchange in hydraulic systems.
6. C — Rack-mounted EPS systems have no scheduled replacement interval or fluid service requirements. Unlike hydraulic systems, there is no fluid to flush, and the electronic components typically last the life of the vehicle. Preventive replacement and calibration are unnecessary without evidence of failure. Normal service continues.
7. D — When the vehicle speed signal is lost or reads zero, variable-assist systems default to maximum assist (as if at parking-lot speed). The result is twitchy, overboosted steering at actual highway speeds. No DTCs may set because the signal is simply absent, not faulted. Always verify the VSS before condemning the actuator or module.

8. B — After any SAS replacement, the manufacturer-specified calibration procedure must be performed using an OE-compatible scan tool. The sensor doesn't self-calibrate, and highway drives or battery disconnects do not substitute for the procedure. Replacing a new SAS without performing calibration first assumes defect without proper diagnosis.

9. C — Outer rubber cover cracks on a high-pressure power steering hose expose the inner reinforcement to ozone, moisture, and physical damage. Without intact outer cover protection, the reinforcement degrades rapidly and the hose can rupture without warning. Sealants, monitoring, and tape are all unsafe practices — replacement is the only acceptable repair.

10. A — When a seal fails repeatedly despite proper replacement with correct parts and fluid, the sealing surface (pitman shaft) is damaged. A worn or scored shaft prevents any new seal from maintaining seal lip contact. The repair is pitman shaft replacement or complete gearbox replacement — not another seal. This is a classic "repeat failure" diagnostic pattern.

11. B — An electronic column lock malfunction DTC combined with a steering wheel that will not unlock is the direct signature of a failed column lock actuator. The actuator is an electromechanical device that releases the column when commanded by the ignition system. SAS, EPS initialization, and clockspring issues produce different symptoms.

12. D — Torque sensor channels differing by 0.10 V are AT the tolerance limit and fault code indicates an issue under some operating condition. On modern rack-mounted EPS systems, the torque sensor is integrated into the rack assembly as a non-serviceable unit. When the sensor produces implausible signals, rack replacement is the correct repair — the sensor cannot be serviced independently.

13. A — After new air spring installation, most air suspension systems require a calibration procedure via scan tool to reset reference values and teach the system the new springs' characteristics. Without calibration, the system cannot correctly interpret ride height sensor signals relative to the new springs. Pre-inflation and bench-testing are not standard practices.

14. C — After replacing a MagneRide damper, the new unit typically requires a programming or configuration procedure specific to the vehicle and its control module. Without this, the module doesn't recognize the new damper as a valid component and won't respond to commands. This is a standard post-service step for most vehicle-specific electronic dampers.

15. C — When three of four dampers simultaneously show the same fault code, a shared electrical supply (fuse, power wire, or connector) is the most likely common point. Three simultaneous damper failures or three output driver failures are statistically unlikely; water damage typically doesn't isolate to exactly three corners. Check the shared electrical path first.

16. D — When centering pins have been used but alignment still can't reach specification, the pins may not have been fully engaged during the mounting bolt torque procedure. The pins must be fully seated AND the bolts tightened WITH the pins in place to lock the correct position. Checking pin engagement is the next step before blaming the subframe or equipment.

17. A — A properly functioning shock produces one complete rebound cycle before settling. Three cycles of bounce indicates failed damping — the shock has lost its internal damping capability. Sagged springs affect ride height; tire pressure affects harshness; alignment affects tracking. None of these produce the multi-cycle bounce that specifically identifies shock failure.

18. D — Torsion bars lose spring rate over extended service life (particularly at 150,000 miles and 12 years). Preload adjustment compensates for initial production tolerance and minor settling, but cannot overcome significant spring rate loss. When adjusters are near end of range and ride height is still low, the bars need replacement, not more preload.

19. C — A spring arc measurement of 4 inches vs. the 5.5-inch new specification represents 1.5 inches of sag — a significant loss of designed arc. This indicates the leaf spring has sagged substantially and lost its designed load capacity. A center bolt issue would show as axle shift, not lost arc; broken leaves would be visible on inspection.

20. B — Only Technician B is correct. Stabilizer end link fasteners with rubber bushings must be torqued at ride height with the suspension loaded to the vehicle curb weight. Torqueing at full droop on a lift preloads the bushings in a twisted position, accelerating wear. The ride-height torque rule applies to any suspension fastener passing through a rubber bushing.

21. D — A ride height sensor output of 15 V is far beyond the 4.5–4.8 V specification, indicating the sensor has failed. Since the sensor wiring tests good, the sensor itself is the failed component. Replace the sensor and inspect the linkage arm for damage. Reset, adjustment, and changing ride height don't fix a sensor that's out of electrical range.

22. C — Clunking that occurs only when BOTH front wheels hit bumps simultaneously (railroad tracks) but not during single-wheel bumps is the specific signature of worn subframe mounting bushings. Bilateral bump loading shifts the subframe; single-wheel bumps don't produce the simultaneous load pattern. Unilateral wear components don't produce this specific symmetric symptom.

23. A — On wear-indicator ball joints, when the grease fitting projects 3/16 inch ABOVE the housing surface at curb height, the joint is within acceptable wear limits. Only when the indicator recedes flush with or below the housing does the joint need replacement. Inspection at curb height (loaded) is correct procedure — the projecting indicator means the joint is healthy.

24. B — Coil springs with directional markings must be installed with the marking oriented correctly. Installation upside-down typically produces incorrect spring rate characteristics because the coil design incorporates variable pitch or directional loading. The result is often incorrect ride height and compromised handling. Always install per the manufacturer's orientation marking.

25. D — ADAS forward camera calibration is required when alignment changes vehicle geometry references — including rear toe changes that affect thrust line and vehicle tracking. The camera's lane-keep function depends on accurate geometry inputs; changes invalidate the calibration. Physical camera disturbance is only one of several triggers for recalibration.

26. C — Torsion beam rear suspensions typically have no rear toe adjustment. An out-of-spec reading means the beam is bent or the trailing arm is damaged — requiring component replacement, not adjustment. Installing aftermarket adjustment or accepting the out-of-spec condition are both incorrect repair approaches. The bent component is the actual problem.

27. B — Thrust angle of  $0.02^\circ$  (essentially zero) confirms the rear toe settings are essentially symmetric and the thrust line matches the geometric centerline. This is the specific function of thrust angle measurement — it validates rear axle symmetry. Thrust angle does not directly confirm steering wheel position, setback, or equipment calibration.

28. A — When a tire swap reverses the pull direction, the pull is caused by tire conicity — an inherent lead direction from manufacturing. Alignment, brake drag, and steering gear issues produce pulls that stay in the same direction regardless of tire position. The swap test is the definitive tire-vs-alignment diagnostic.

29. D — Left  $+0.05^\circ$  plus right  $+0.08^\circ$  equals  $+0.13^\circ$  total, which is within the  $+0.10^\circ \pm 0.05^\circ$  specification ( $+0.05^\circ$  to  $+0.15^\circ$  acceptable). While the individual readings are slightly asymmetric, the total is within tolerance. Recognizing in-spec totals even when individual readings aren't equal is a core alignment skill.

30. C — Alignment with re-centered steering wheel invalidates the SAS's learned zero-point. On lane-keep-equipped vehicles, the forward camera also typically requires calibration because the system depends on accurate vehicle geometry references. Both the SAS and the forward camera typically need calibration — physical camera disturbance is not the only trigger.

31. A — Cross-camber (side-to-side camber difference) of  $0.7^\circ$  is significant enough to produce a clear pull toward the more-positive side (the left in this case). Individual values within tolerance don't tell the whole story — cross-camber drives pull behavior. Memorize: camber pulls toward the more-positive side.

32. D — Side-to-side SAI mismatch of  $0.8^\circ$  exceeds the  $0.5^\circ$  typical tolerance — the signature of a bent steering knuckle. Camber may be within spec because it was adjusted around the damage, but the underlying included angle variation indicates the knuckle casting itself is bent. The knuckle must be replaced before valid alignment is possible.

33. C — Thrust angle of  $0.30^\circ$  with the wheel centered means the front toe was correctly set RELATIVE to the thrust line, not to the geometric centerline. This produces a centered steering wheel despite the thrust angle being non-zero. The rear toe is asymmetric (creating the thrust angle), but the front toe compensates. Proper alignment technique when rear toe is non-adjustable.

34. B — When alignment drifts over 20,000 miles with no obvious component damage, worn suspension bushings are the most common cause. Bushings allow dynamic geometry shift under load, producing alignment changes over time even though the static alignment looks correct on the rack. This progression pattern is classic high-mileage bushing wear.

35. A — When a MacPherson strut vehicle has no factory camber adjustment and the reading has drifted despite intact components, install aftermarket adjustment hardware (slotted bolts, offset plates) OR inspect for underlying bushing wear allowing the shift. Swapping struts, leaving out of spec, or using tire pressure compensation are all unacceptable approaches.

36. D — Direct TPMS sensor batteries have a typical service life of 5–10 years. On an 8-year-old vehicle with a sensor reporting "not communicating" despite correct actual tire pressure, battery failure is the most likely cause. Replacement and relearn restore function. Module programming, pressure fluctuations, and wheel speed sensor issues produce different symptom patterns.

37. C — Indirect TPMS systems use ABS wheel speed sensors to infer tire pressure from rotation rate differences. After rotation or new tires, the system needs a "set pressure" reset to tell it the current correct pressures are the new reference. Without the reset, the system reports a false warning. Sensor replacement and battery disconnect don't apply to indirect systems.

38. B — Torque-plus-angle specifications must be completed in full. Torquing to 240 ft-lb without the additional 90° rotation leaves the bearing under-preloaded — the nut has not stretched to its final preload. Excessive play develops, leading to premature bearing failure. Always complete both stages of the specification for correct preload.

39. D — The industry-standard maximum repairable tread puncture diameter is 1/4 inch. A puncture exactly at 1/4 inch is at the maximum allowable size and can be repaired using a combination plug/patch from inside the tire. The repair is the industry-standard method: plug seals the channel, patch seals the inner liner. External string plugs are temporary only.

40. A — In a tire size code, the number following the slash and before "R" represents the aspect ratio — the sidewall height as a percentage of section width. In "P235/55R18," the 55 means sidewall height is 55% of 235mm width, approximately 129mm. The 18 is wheel diameter in inches; the 104 is load index; the W is speed rating.