PRACTICE EXAM 15: ASE T3 DRIVE TRAIN SIMULATION

1. A heavy-duty truck has a complaint of clutch slippage that occurs only when starting on steep grades with a heavy load. Inspection finds friction facings within wear limits, free travel correct, and no oil contamination. The MOST likely cause is:

A. Air contamination in the hydraulic clutch system requiring complete bleeding

B. Driver technique issues during launch from a complete stop

C. Excessive clutch pedal height adjustment outside of OEM specification

D. Pressure plate springs that have lost tension over service life

2. Technician A says that a heavy-duty Class 8 transmission with a twin-countershaft design simplifies lubrication through gravity oil distribution. Technician B says the twin-countershaft design distributes torque load across two shafts to handle higher torque capacity. Who is correct?

A. Technician A only

B. Technician B only

C. Both Technician A and Technician B

D. Neither Technician A nor Technician B

3. A driver complains that his AMT-equipped Class 8 tractor has refused to complete a shift to a higher gear. The dashboard shows a transmission warning light. The technician's FIRST step should be to:

A. Disassemble the transmission to inspect internal shift components for damage

B. Replace the transmission control module assuming an electronic failure

C. Connect the OEM-approved scan tool to read active and stored fault codes

D. Verify system air pressure meets the minimum specification for shifting

4. The PRIMARY function of an inter-axle differential (power divider) on a tandem-axle truck is to:

A. Allow torque transmission to both axles while accommodating speed differences

B. Provide engine braking force through hydraulic retarder mechanism action

C. Multiply torque between the forward-rear and rear-rear drive axles

D. Act as a final reduction stage in heavy-duty vocational truck applications

5. A heavy-duty drive axle has been rebuilt. During the final tooth contact pattern check, the contact appears centered on the drive side but biased high on the coast side. The MOST likely cause is:

A. The pinion is too deep and requires reduced shim thickness behind the head

B. The ring gear has been installed backwards on the differential case mounting

C. Marking compound was applied incorrectly to the wrong surface during testing

D. The pinion depth is correct but backlash is excessive on this gear set

6. A heavy-duty Class 8 tractor has been operating with the inter-axle differential lockout engaged on dry highway pavement at 60 mph. After 10 minutes, the driver reports unusual driveline noise. The MOST likely consequence of continuing operation is:

A. Improved traction at the rear axle during normal highway driving conditions

B. Slight increase in axle lubricant temperature without significant other effects

C. Driveline binding leading to tire scrub and component damage

D. Better steering response on long straightaways during operation

7. The MOST important reason for using DOT 3 or DOT 4 brake fluid in heavy-duty hydraulic clutch systems is:

A. The fluid specification matches the elastomeric seal compatibility requirements

B. The fluid is widely available at low cost from any auto parts store

C. The fluid resists boiling at the high temperatures of clutch operation

D. The fluid provides better lubrication than other hydraulic oils available

8. A heavy-duty drive axle is being inspected during overhaul. The technician finds the pinion bearings show smooth, polished roller surfaces with no visible damage. The technician should:

A. Replace the bearings because the polished appearance indicates excessive wear

B. Reinstall the bearings if the rolling action remains smooth under hand pressure

C. Reuse the bearing rollers but replace the races as standard rebuild practice

D. Install new bearings only if the technician has them available in the shop

9. Technician A says that pinion depth is established before the differential case is installed in the carrier. Technician B says pinion depth must be set first because every subsequent adjustment depends on correct pinion position. Who is correct?

A. Technician A only

B. Technician B only

C. Neither Technician A nor Technician B

D. Both Technician A and Technician B

10. A driver complains of a clunking noise from the rear of the truck that occurs only during torque direction changes. The truck has 380,000 miles on the original universal joints. The MOST likely cause is:

A. Loose driveshaft strap bolts at the transmission output yoke connection

B. Worn ring gear teeth allowing excessive backlash in the drive axle

C. Worn universal joint cross bearings allowing clearance during torque reversal

D. A bent driveshaft tube from previous impact damage during operation

11. The MOST common cause of repeat universal joint failure on heavy-duty trucks is:

A. Incorrect driveline working angles producing speed fluctuation that destroys joints

B. Use of incorrect grease formulations during chassis lubrication service

C. Manufacturing defects in the replacement universal joints from suppliers

D. Operating the vehicle at speeds above the manufacturer's recommended maximum

12. A heavy-duty truck has been operating for an extended period with insufficient transmission oil. The MOST likely consequence is:

A. Improved fuel economy from reduced internal friction losses during operation

B. External seal leakage from increased internal case pressure during operation

C. Clutch contamination from oil migrating through the input shaft seal

D. Rapid wear on upper bearings and gears not reached by oil splash

13. The PRIMARY function of the cushion springs in a heavy-duty clutch disc is to:

A. Absorb engine combustion pulses before they reach the transmission

B. Soften initial clutch engagement by allowing controlled facing compression

C. Maintain disc thickness as friction material wears throughout service

D. Hold the friction facings against the splined hub during disengagement

14. Technician A says that universal joint phasing means the yokes on the same driveshaft tube are aligned on the same rotational plane. Technician B says that universal joint phasing means both u-joints operate at the same working angle. Who is correct?

A. Technician A only

B. Both Technician A and Technician B

C. Technician B only

D. Neither Technician A nor Technician B

15. A heavy-duty truck has clutch slippage that occurs only when the engine is hot. Inspection finds friction facings within wear limits and free travel correct. The MOST likely cause is:

A. Worn cushion springs that have lost flexibility through normal service life

B. Air contamination in the hydraulic system worsening with operating heat

C. Pressure plate diaphragm spring losing tension as operating temperature rises

D. Incorrect clutch torque capacity rating for the engine application installed

16. A heavy-duty drive axle is being inspected. The lubricant drained from the axle has a milky white appearance with normal lubricant separated underneath. This indicates:

A. The lubricant has reached the end of its useful life from oxidation only

B. Normal lubricant condition for an axle approaching its service interval

C. The wrong type of lubricant was installed during the previous service

D. Water contamination in the axle, likely through a failed vent or seal

17. The MOST important diagnostic tool for AMT (automated manual transmission) service is:

A. A pneumatic tester for verifying air system pressure throughout the truck

B. The OEM-approved scan tool for reading fault codes and live data

C. A standard digital multimeter for checking electrical circuit voltages only

D. A mechanical pressure gauge for measuring hydraulic clutch system pressure

18. The transmission case vent on a heavy-duty manual transmission allows the case to:

A. Equalize internal pressure as air expands and contracts with temperature

B. Allow lubricant to circulate from the case to an external cooler unit

C. Provide an inspection point for checking transmission fluid level

D. Return vaporized lubricant to the case after operation cooling

19. A heavy-duty truck has driveline vibration that worsens significantly when the truck is loaded with freight. When empty, the vibration is minimal. This load-sensitive pattern indicates:

A. Universal joint balance weights that have shifted from original positions

B. Driveshaft imbalance from accumulated debris inside the tubing assembly

C. Driveline working angles that change with suspension position under load

D. Center support bearing rubber that has hardened from age and heat exposure

20. The function of the slip joint in a driveshaft assembly is to:

A. Multiply torque between the transmission output and drive axle pinion

B. Reduce the rotational speed of the driveshaft to prevent resonance

C. Provide a coupling point for the center support bearing assembly

D. Accommodate axial distance changes between transmission and drive axle

21. A heavy-duty drive axle has been rebuilt and the technician is performing the final tooth contact pattern check. After applying marking compound and rotating under load, the contact pattern appears centered on the tooth face approximately one-third from the toe end. The correct interpretation is:

A. The pattern is too high on the tooth and requires increased pinion shim thickness

B. The pattern is correct and the gear set is properly adjusted for service

C. The pattern is too low on the tooth and requires reduced pinion shim thickness

D. The pattern requires increased backlash to move contact toward the heel end

22. The MOST common cause of failure when installing a new universal joint on a driveshaft is:

A. Using the wrong grade of chassis lubricant in the u-joint grease fitting

B. Overtightening the u-joint strap bolts beyond manufacturer specification

C. Misalignment of a needle bearing during cup installation causing binding

D. Installing the joint without marking driveshaft orientation before removal

23. A driver complains of a high-pitched whine that increases with vehicle speed and is present in every forward gear. The whine disappears when the truck shifts to neutral with the engine running. The MOST likely source is:

A. The drive axle ring and pinion gear set in the carrier housing assembly

B. The pilot bearing experiencing relative motion at the flywheel area

C. The clutch release bearing in continuous contact with pressure plate fingers

D. The transmission input shaft bearing under engine torque transmission

24. The MOST important reason for marking the orientation of a driveshaft to its yokes before removal is to:

A. Identify which u-joint should be replaced first during the rebuild procedure

B. Allow the technician to detect any twisting damage during the operation

C. Ensure the slip joint is reassembled with correct internal spline alignment

D. Preserve the factory balance relationship when the driveshaft is reinstalled

25. A driver complains that his Class 8 tractor with a 13-speed transmission has range shifts that fail to complete during cold mornings. Once the truck warms up, range shifts work normally. The MOST likely cause is:

A. Worn synchronizers in the auxiliary section requiring complete replacement

B. Moisture in the air system freezing in the range shift valves during cold

C. Damaged shift detent springs in the range section of the transmission

D. Low transmission oil viscosity preventing proper shift fork movement

26. Technician A says that a no-slip differential requires driver activation through a dash switch. Technician B says a no-slip differential uses spring-loaded driven clutches that automatically engage and disengage based on wheel-speed differences. Who is correct?

A. Technician A only

B. Both Technician A and Technician B

C. Technician B only

D. Neither Technician A nor Technician B

27. The MOST important reason for using a clutch alignment tool during heavy-duty clutch installation is to:

A. Center the clutch disc so the input shaft can pass through the hub splines

B. Compress the cushion springs to allow easier pressure plate cover installation

C. Hold the pressure plate cover in alignment while the bolts are tightened

D. Prevent damage to the pilot bearing during the clutch installation procedure

28. A heavy-duty truck has a complaint of repeated wheel seal failures at the same wheel position. Three previous seals have failed within 30,000 miles each. The technician should investigate:

A. The driver's habits regarding cornering speed and braking pattern intensity

B. The lubricant brand and viscosity used during the previous wheel hub service

C. The wheel mounting torque procedure used during recent service operations

D. The hub bore for damage or scoring that prevents proper seal seating

29. A heavy-duty drive axle is being rebuilt. The technician finds the pinion head stamped with "+4" indicating a pinion depth variation. This number means:

A. The pinion has been used for 4,000 hours and requires immediate replacement

B. The pinion is 0.004 inches longer than nominal, requiring 0.004 inches less shim

C. The pinion bearing preload should be set 4 inch-pounds above standard specification

D. The pinion gear has 4 fewer teeth than the standard production specification

30. The MOST important reason for replacing flywheel mounting bolts during flywheel service on modern heavy-duty engines is:

A. The original bolts cost less to replace than the labor to inspect them

B. The OEM warranty requires new bolts as part of the standard service procedure

C. The bolts are torque-to-yield design and cannot be safely reused after installation

D. The original bolts may have collected debris that affects torque accuracy

31. A heavy-duty Class 8 tractor with a long wheelbase has a vibration that appears at exactly 55 mph and disappears at 50 or 60 mph. The MOST likely cause is:

A. Imbalance in the rear section of the two-piece driveshaft assembly

B. Worn universal joint at the drive axle pinion yoke connection point

C. Loose pinion nut on the drive axle allowing pinion shaft movement

D. Center support bearing rubber mount producing speed-specific resonance

32. The standard wheel hub bolt pattern for North American Class 8 drive wheels is:

A. 10 studs on an 11.25-inch bolt circle for heavy-duty applications

B. 8 studs on a 9.50-inch bolt circle for medium-duty applications

C. 6 studs on a 7.25-inch bolt circle for light commercial applications

D. 12 studs on a 13.00-inch bolt circle for severe-duty applications

33. A heavy-duty drive axle is being inspected during overhaul. The technician finds the side gear thrust washers measure 0.040 inches when the OEM specification is 0.048 inches minimum. The correct action is to:

A. Sand the thrust washer surfaces flat and reinstall them in original positions

B. Replace the thrust washers because they are below the minimum specification

C. Reuse the thrust washers if they show no visible scoring or damage

D. Install thicker washers from a different axle model to compensate for wear

34. A driver complains of clutch chatter that occurs only when the truck is launching from a complete stop with a heavy trailer attached. The chatter does not occur on bobtail driving. The MOST likely cause is:

A. Air contamination in the hydraulic clutch system requiring complete bleeding

B. Pilot bearing failure from inadequate lubrication during recent service

C. Worn engine and transmission mounts allowing powertrain oscillation under load

D. Heat-checked flywheel friction surface producing chatter during normal engagement

35. A heavy-duty truck has a complaint of overheating localized to the differential carrier housing. The lubricant level is correct, the lubricant specification matches OEM requirements, and the brakes show no signs of dragging. The MOST likely cause is:

A. Internal bearing preload error or ring and pinion mesh problem causing friction

B. Excessive vehicle weight beyond gross axle weight rating during operation

C. External heat conducted from a damaged exhaust system passing near the axle

D. Driver operating style with frequent hard braking and aggressive acceleration

36. A heavy-duty drive axle has a complaint of growling noise that is present in both drive and coast operating conditions, with the pitch varying with vehicle speed. The MOST likely source is:

A. Ring and pinion drive-side tooth contact pattern problems requiring adjustment

B. Worn synchronizer assemblies inside the transmission affecting operation

C. A failed pinion seal allowing oil to escape from the carrier housing assembly

D. Wheel bearings or side bearings that have failed and require replacement

37. The PRIMARY reason that heavy-duty truck driveshafts use hollow tubing rather than solid construction is:

A. Hollow tubing is significantly less expensive to manufacture in long lengths

B. Hollow tubing is required by federal regulations for commercial driveline components

C. Hollow tubing provides similar torsional stiffness with significantly reduced weight

D. Hollow tubing allows oil to circulate through the driveshaft for cooling purposes

38. A driver complains of a rattling noise at engine idle that disappears when the clutch pedal is depressed. The transmission is in neutral. The MOST likely cause is:

A. The clutch release bearing has failed and is rattling against pressure plate fingers

B. The clutch disc torsional damper springs are broken and rattling against the hub

C. The pilot bearing has lost lubrication and is rattling at engine idle in neutral

D. The transmission countershaft bearings are excessively worn and producing noise

39. The MOST important reason for using extreme-pressure (EP) gear oil in hypoid drive axles is:

A. To prevent metal-to-metal contact under high sliding pressures of the mesh

B. To reduce churning losses and improve fuel economy at highway speeds

C. To provide cold-weather flow during low-temperature startup conditions

D. To accommodate the higher operating temperatures of hypoid gear meshing

40. A heavy-duty truck has a complaint of jumping out of fifth gear under load on grades. All other gears hold properly. The MOST efficient diagnostic action is to:

A. Replace the entire transmission with a remanufactured unit to ensure reliability

B. Check the transmission fluid level and verify it meets the OEM viscosity grade

C. Adjust all shift detent springs to higher tension to prevent collar movement

D. Inspect the fifth-gear clutching collar, mating gear, and shift fork specifically

41. A driver complains that his AMT-equipped Class 8 tractor exhibits harsh shifts following a recent clutch replacement. The MOST likely cause is:

A. The new clutch friction material requires bedding in over the first 5,000 miles

B. The wrong clutch model was installed and does not match the transmission rating

C. Clutch actuator calibration was not performed through the OEM scan tool

D. Air contamination in the hydraulic clutch system requires complete bleeding

42. The torque capacity rating of a heavy-duty clutch should be:

A. Less than the engine's peak torque to allow controlled slippage under shock loads

B. Greater than the engine's peak torque output by an application-appropriate margin

C. Exactly equal to the engine's peak torque output with no additional safety margin

D. Twice the engine's peak torque output to handle all possible operating conditions

43. Technician A says that the inter-axle driveshaft on a tandem-axle truck connects the rear of the forward-rear axle to the front of the rear-rear axle pinion yoke. Technician B says that the inter-axle driveshaft connects the transmission to the forward-rear axle pinion yoke. Who is correct?

A. Technician A only

B. Technician B only

C. Both Technician A and Technician B

D. Neither Technician A nor Technician B

44. A heavy-duty truck has a complaint of driveline vibration that has appeared gradually over the past few months and continues to worsen. The vibration is consistent regardless of vehicle load. The MOST likely cause is:

A. Universal joint working angles changing due to suspension component wear

B. Center support bearing rubber producing speed-specific resonance issues

C. Driveshaft balance weights gradually loosening and shifting from original positions

D. Pinion seal failure allowing oil to migrate onto the driveshaft surface

45. A heavy-duty truck has been operating with the engine running rough and producing torsional pulses for an extended period. The MOST likely effect on the clutch disc over time is:

A. Premature wear on the pressure plate springs from constant pulse loading

B. Cushion spring failure from absorbing continuous engine combustion irregularities

C. Accelerated wear on the clutch release bearing from constant engagement

D. Damper spring failure from continuously absorbing the engine torsional pulses

46. The standard procedure for measuring driveshaft runout uses a:

A. Caliper to measure the diameter of the driveshaft tube at multiple points

B. Dial indicator positioned against the rotating driveshaft tube surface

C. Straightedge laid across the driveshaft to detect surface irregularities

D. Micrometer to verify the driveshaft tubing wall thickness specification

47. Technician A says that a non-synchronized constant-mesh transmission requires the driver to double-clutch when shifting between gears. Technician B says that float shifting (shifting without clutch use) is possible on these transmissions if engine speed is correctly matched. Who is correct?

A. Both Technician A and Technician B

B. Technician A only

C. Technician B only

D. Neither Technician A nor Technician B

48. Which of the following describes the proper installation orientation of a clutch disc with damper springs on one side?

A. Damper springs facing the flywheel with the flat side against the pressure plate

B. Either orientation works because the disc is symmetrical about its centerline

C. Flat side facing the flywheel with the damper springs facing the pressure plate

D. Damper springs facing the bell housing with the flat side toward the engine

49. A heavy-duty drive axle has been rebuilt. During the final tooth contact pattern check, the contact appears low on the tooth face near the flank (bottom). This indicates:

A. The pinion is too shallow and requires increased shim thickness behind the head

B. The pinion is too deep and requires reduced shim thickness behind the head

C. Backlash is excessive and requires reduction by side bearing adjustment

D. The ring gear is installed backwards on the differential case mounting flange

50. Technician A says that the differential lockout on a drive axle is engaged through an electric solenoid energized by a dash switch. Technician B says the differential lockout uses air pressure to engage a sliding clutch in the differential case. Who is correct?

A. Technician A only

B. Both Technician A and Technician B

C. Neither Technician A nor Technician B

D. Technician B only

PRACTICE EXAM 15: ANSWER KEY AND EXPLANATIONS

1. D — Pressure plate springs that have lost tension over service life. With facings within wear limits, free travel correct, and no oil contamination, the most likely remaining cause of load-dependent slippage is fatigued pressure plate springs that no longer maintain full clamping force. Springs lose tension over service life and produce slippage specifically when high torque is demanded, such as starting on grades with heavy loads.

2. B — Technician B only. The twin countershaft design splits transmitted torque between two parallel countershafts, allowing each individual gear tooth to carry approximately half the total torque. The lubrication system in twin-countershaft transmissions is more complex (not simpler) than single-countershaft designs because oil must reach both shafts and their associated bearings.

3. C — Connect the OEM-approved scan tool to read active and stored fault codes. AMT diagnostic procedures always begin with electronic fault code retrieval before any mechanical work. The DTCs identify whether the complaint is electronic, sensor-related, mechanical, or air-supply related, directing the technician to the correct repair path.

4. A — Allow torque transmission to both axles while accommodating speed differences. The inter-axle differential splits driveshaft torque between the forward-rear and rear-rear axles while permitting speed differences from cornering and tire diameter variations. Without this accommodation, driveline binding would destroy components during normal operation.

5. D — The pinion depth is correct but backlash is excessive on this gear set. When the drive side pattern is correctly centered but the coast side rides high on the tooth, pinion depth is properly set and the issue lies in backlash being too loose. Reducing backlash through side bearing shim relocation will bring the coast side pattern down to the correct position.

6. C — Driveline binding leading to tire scrub and component damage. With the lockout engaged on dry pavement at highway speed, the forward-rear and rear-rear axles cannot accommodate normal speed differences. The forced equal rotation produces severe binding that damages driveline components and causes audible tire scrub during operation.

7. A — The fluid specification matches the elastomeric seal compatibility requirements. The elastomeric seals in clutch master and slave cylinders are chemically formulated to resist DOT 3 or DOT 4 brake fluid specifically. Using incompatible fluids causes seal swelling, hardening, or dissolution that destroys the hydraulic system within days.

8. B — Reinstall the bearings if the rolling action remains smooth under hand pressure. Smooth, polished roller surfaces are normal for bearings that have run properly throughout their service life. As long as the bearings rotate smoothly under hand pressure with no roughness or visible damage, they remain serviceable for continued use.

9. D — Both Technician A and Technician B. Pinion depth is established before the differential case is installed in the carrier because the gauge tooling requires unobstructed access. Pinion depth must be set first because every subsequent adjustment depends on correct pinion position — both statements describe the same correct sequence from different perspectives.

10. C — Worn universal joint cross bearings allowing clearance during torque reversal. Clunking that appears specifically during torque direction changes is the classic symptom of worn u-joint bearings. The clearance between the cross journals and worn cup bearings takes up audibly when the driver transitions between accelerating and coasting.

11. A — Incorrect driveline working angles producing speed fluctuation that destroys joints. When u-joints repeatedly fail in a vehicle, the underlying cause is almost always a geometric problem — incorrect driveline working angles produce excessive speed fluctuation that wears out u-joints regardless of how new they are. Replacement without addressing the angles guarantees the next failure.

12. D — Rapid wear on upper bearings and gears not reached by oil splash. Splash lubrication systems depend on rotating gears dipping into the oil and distributing it throughout the case. An underfilled transmission cannot deliver oil to upper bearings and gears, causing rapid wear in those components from inadequate lubrication.

13. B — Soften initial clutch engagement by allowing controlled facing compression. Cushion springs are wavy washers between the friction facings that flex during initial clutch engagement, smoothing the application of torque. They differ from torsional damper springs (which absorb engine vibrations) and serve only the engagement-cushioning function.

14. A — Technician A only. Universal joint phasing means the yokes on the same driveshaft tube are aligned on the same rotational plane (both horizontal or both vertical). Working angles being equal is a separate concept that affects vibration cancellation but is not the definition of phasing itself.

15. C — Pressure plate diaphragm spring losing tension as operating temperature rises. Heat-related slippage that appears only when the engine is hot points to a temperature-sensitive component — most commonly a pressure plate spring that loses tension as it heats up. The reduced clamping force allows slippage under load that resolves when the system cools.

16. D — Water contamination in the axle, likely through a failed vent or seal. Milky white appearance in drained gear oil is the classic visual indicator of water contamination — water emulsifies with the lubricant to produce the milky color, and the heavier oil separates underneath in the drain pan. The water source must be identified and corrected before refilling.

17. B — The OEM-approved scan tool for reading fault codes and live data. AMT diagnosis requires the OEM scan tool to read DTCs, monitor live actuator and sensor data during operation, and perform required calibrations after service. No mechanical tool can substitute for the electronic diagnostic capability the scan tool provides.

18. A — Equalize internal pressure as air expands and contracts with temperature. The transmission case vent allows internal pressure to equalize with atmospheric pressure as the lubricant heats up and cools down during operation. A blocked vent causes pressure buildup that forces oil out through seals and gaskets.

19. C — Driveline working angles that change with suspension position under load. Working-angle vibration is the only driveline vibration that responds to load, because changing load alters suspension position and therefore u-joint operating angles. Balance and runout problems produce vibration consistent with vehicle speed regardless of load condition.

20. D — Accommodate axial distance changes between transmission and drive axle. As the suspension cycles, the distance between the transmission output and drive axle input changes slightly. The slip joint allows the driveshaft to lengthen and shorten through its splined connection while continuing to transmit torque through the engaged splines.

21. B — The pattern is correct and the gear set is properly adjusted for service. A contact pattern centered on the tooth face approximately one-third of the distance from the toe end is the textbook correct pattern indicating proper pinion depth and backlash. No adjustment is required when the pattern matches this specification.

22. C — Misalignment of a needle bearing during cup installation causing binding. A displaced needle bearing trapped under the cross journal causes the new u-joint to bind during operation and fail almost immediately. This is why every u-joint installation requires verification of free cross rotation by hand before returning the driveshaft to service.

23. A — The drive axle ring and pinion gear set in the carrier housing assembly. A whine that varies with vehicle speed and is present in every forward gear but disappears in neutral indicates the source rotates only when the driveline is transmitting torque rearward. The ring and pinion are downstream of the transmission and produce this exact pattern.

24. D — Preserve the factory balance relationship when the driveshaft is reinstalled. A balanced driveshaft has its mass distribution matched to specific yoke orientations established at the factory. Reinstalling the driveshaft in a rotated position destroys this balance relationship and can introduce vibration that was not present before service.

25. B — Moisture in the air system freezing in the range shift valves during cold. Cold-weather-only air shift problems are the classic symptom of moisture contamination — water in the air system freezes during cold conditions, blocking the small passages in shift valves and slowing or

preventing range shift completion. The symptom resolves once temperatures rise enough to thaw the ice.

26. C — Technician B only. No-slip differentials operate automatically based on wheel-speed differences using spring-loaded driven clutches that lock during straight-line driving and disengage during turns. They require no driver activation and have no dash switch.

27. A — Center the clutch disc so the input shaft can pass through the hub splines. The alignment tool keeps the disc centered relative to the pilot bearing while the cover bolts are torqued, ensuring the input shaft can pass cleanly through the disc hub when the transmission is reinstalled. Without proper alignment, the input shaft cannot mate to the disc and the splines suffer immediate damage.

28. D — The hub bore for damage or scoring that prevents proper seal seating. When a correctly-installed seal of the correct part number repeatedly fails, the cause is typically a damaged hub bore that prevents proper sealing pressure. Continuing to install new seals without correcting the bore guarantees continued failures.

29. B — The pinion is 0.004 inches longer than nominal, requiring 0.004 inches less shim. The pinion depth variation number stamped on the pinion head represents thousandths of an inch deviation from nominal length. A "+4" pinion is longer than nominal, requiring a thinner shim to position it correctly relative to the ring gear centerline.

30. C — The bolts are torque-to-yield design and cannot be safely reused after installation. Modern heavy-duty diesel engine flywheel mounting bolts are torque-to-yield design, engineered to be installed once, stretched to a specific yield point, and replaced at any future service. Reusing these bolts can cause flywheel separation at highway speeds — a catastrophic failure mode.

31. D — Center support bearing rubber mount producing speed-specific resonance. Vibration that appears at one specific speed and disappears as speed moves above or below it is the classic signature of resonance, which occurs when a deteriorated component reaches its natural frequency at a specific operating speed. The center support bearing rubber mount is the most common source of this pattern.

32. A — 10 studs on an 11.25-inch bolt circle for heavy-duty applications. The 10-on-11.25 pattern is the dominant standard for North American Class 8 drive wheels and applies to virtually all heavy-duty applications. Knowing the standard helps a technician verify wheel-to-hub compatibility during service.

33. B — Replace the thrust washers because they are below the minimum specification. The OEM minimum is an absolute limit — washers measuring 0.040 inches against a 0.048-inch minimum are below specification and must be replaced. Reinstalling sub-minimum washers allows side gears to shift axially during operation, producing noise and accelerated gear wear.

34. C — Worn engine and transmission mounts allowing powertrain oscillation under load. Chatter that occurs only when launching with a heavy load (and not bobtail) is the classic signature of

failed powertrain mounts. The heavy load amplifies the engine and transmission oscillation that worn mounts cannot control, producing visible chatter only when the load is present.

35. A — Internal bearing preload error or ring and pinion mesh problem causing friction. When external causes have been ruled out (correct lubricant, proper level, no brake drag), localized axle overheating points to internal friction sources. Excessive bearing preload or incorrect gear mesh produces continuous friction that generates measurable heat in the carrier housing.

36. D — Wheel bearings or side bearings that have failed and require replacement. Growling that varies with vehicle speed and is consistent under both drive and coast conditions indicates a bearing failure (which has no drive or coast bias) rather than a gear tooth issue. Side bearings and wheel bearings both produce this pattern and must be inspected.

37. C — Hollow tubing provides similar torsional stiffness with significantly reduced weight. A hollow steel tube of appropriate diameter has approximately the same torsional stiffness as a solid shaft but weighs significantly less and offers better critical-speed characteristics. This combination of properties is the engineering reason for the universal use of hollow tubing in truck driveshafts.

38. B — The clutch disc torsional damper springs are broken and rattling against the hub. Broken damper springs produce a rattling noise at idle that disappears when the clutch is depressed, because depressing the clutch removes torque transfer through the disc and silences the rattle source. This is the classic diagnostic signature of damper spring failure.

39. A — To prevent metal-to-metal contact under high sliding pressures of the mesh. Hypoid gears generate extreme contact pressures with significant face-sliding action that ordinary lubricants cannot handle. The EP additive package chemically reacts with the steel surfaces to form a protective film that prevents direct metal contact and the rapid wear that would otherwise result.

40. D — Inspect the fifth-gear clutching collar, mating gear, and shift fork specifically. When jumping out occurs in only one specific gear, the cause is concentrated on the components used in that gear ratio. Replacing the entire transmission for a localized issue is wasteful and unnecessary, and adjusting all detent springs ignores the actual root cause.

41. C — Clutch actuator calibration was not performed through the OEM scan tool. AMT shift quality complaints that appear immediately after clutch replacement are nearly always calibration-related rather than mechanical. The TCM operates with engagement parameters from the worn clutch until calibration teaches it the new clutch's behavior.

42. B — Greater than the engine's peak torque output by an application-appropriate margin. Clutch torque capacity must always exceed the engine's peak torque, with the safety margin selected based on application — modest for highway service, larger for severe-duty vocational applications. Matching exactly leaves no margin for shock loading or component aging.

43. A — Technician A only. The inter-axle driveshaft connects the rear of the forward-rear axle's power divider to the front of the rear-rear axle's pinion yoke, carrying torque between the two drive axles.

The main driveshaft (not the inter-axle driveshaft) connects the transmission to the forward-rear axle.

44. C — Driveshaft balance weights gradually loosening and shifting from original positions. Vibration that develops gradually over months without load sensitivity is typical of progressive imbalance — balance weights working loose, accumulated debris on the shaft, or other slow changes to the mass distribution. Working-angle issues respond to load, ruling out that cause.

45. D — Damper spring failure from continuously absorbing the engine torsional pulses. The torsional damper springs in the clutch disc hub absorb engine combustion pulses to prevent driveline rattle. Continuous exposure to abnormally severe torsional pulses (from a rough-running engine) accelerates damper spring fatigue and eventual failure.

46. B — Dial indicator positioned against the rotating driveshaft tube surface. Driveshaft runout is measured by mounting a dial indicator on the chassis with its tip against the driveshaft tube while the shaft is rotated slowly. The indicator displacement reads the runout value, which is compared to OEM specification to determine if the shaft requires replacement.

47. A — Both Technician A and Technician B. Non-synchronized constant-mesh transmissions traditionally require double-clutching during shifts, but skilled drivers can also perform float shifting without using the clutch by matching engine speed through throttle modulation alone. Both techniques are valid for these transmissions.

48. C — Flat side facing the flywheel with the damper springs facing the pressure plate. Heavy-duty clutch discs are directional and must be installed with the flat side against the flywheel and the damper spring side facing the pressure plate. Reversing the orientation places the damper springs against the flywheel, which causes immediate interference and clutch failure.

49. B — The pinion is too deep and requires reduced shim thickness behind the head. Contact biased low on the pinion teeth (near the flank) indicates the pinion is positioned too deep into the ring gear. Reducing pinion shim thickness pulls the pinion away from the ring gear, shifting the contact pattern up toward the center of the tooth face.

50. D — Technician B only. Differential lockouts on heavy-duty axles use system air pressure routed through a cab dash switch to engage a sliding clutch in the differential case. Electric solenoid actuation is not the standard method for these heavy-duty applications.