PRACTICE EXAM 12: 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 and free travel correctly adjusted. The MOST likely cause is:

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

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

C. Driver technique issues during launch from a complete stop

D. Excessive clutch pedal height adjustment outside of OEM specification

2. Technician A says that a clutch brake should be engaged during every gear shift to prevent gear clash. Technician B says the clutch brake is engaged only when the driver fully presses the pedal at a complete stop. 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

3. A driver complains of a high-pitched whine from the rear of the truck that varies with vehicle speed. The whine disappears when the transmission is shifted to neutral with the engine running. The MOST likely source is:

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

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

C. The transmission input shaft bearing under engine torque transmission

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

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

A. Provide engine braking force through hydraulic retarder mechanism action

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

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 depth is correct but backlash is excessive on this gear set

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

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

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

6. The collapsible spacer in a heavy-duty drive axle pinion bearing assembly is designed to:

A. Provide axial spacing between the pinion gear and rear of the carrier housing

B. Maintain constant lubricant flow between the inner and outer pinion bearings

C. Crush to a precise length under nut torque to set bearing preload

D. Act as a reusable shim for adjusting pinion depth during repeated rebuilds

7. A driver complains of a clunking noise from the rear of the vehicle 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 clutching teeth on the transmission's mainshaft sliding collars

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

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

8. Technician A says that wheel bearings in a heavy-duty drive axle hub can be lubricated by either oil bath or grease packing systems. Technician B says that mixing oil bath and grease lubrication in a single hub destroys both lubricants and damages the bearings. 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

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

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

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

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

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

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

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

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

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

11. A driver complains that his clutch pedal feels noticeably lighter than normal and the truck experiences slippage under load. The pedal effort has decreased by approximately 40 percent compared to specification. The MOST likely cause is:

A. Air entering the hydraulic clutch system during a recent fluid level top-off

B. Wear of the clutch disc friction facings reducing the required clamping force

C. A failed pressure plate diaphragm spring or release lever assembly

D. Lubrication of the external clutch linkage pivots reducing system friction

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

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

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

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

13. Technician A says that universal joint phasing in a multi-piece driveshaft must be preserved during all driveshaft service procedures. Technician B says that universal joint phasing can be altered during service to reduce vibration. 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

14. 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 bearing preload should be set 4 inch-pounds above standard specification

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

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

15. The PRIMARY purpose of the cushion springs located between the friction facings of a heavy-duty clutch disc is to:

A. Provide rotational damping to absorb engine combustion pulses during operation

B. Maintain consistent disc thickness as friction material wears throughout service

C. Allow the disc to slide axially along the input shaft splines during engagement

D. Soften initial clutch engagement by allowing controlled facing compression

16. A heavy-duty truck has a complaint of jumping out of seventh gear under load while pulling a grade. 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. Inspect the seventh-gear clutching collar, mating gear, and shift fork specifically

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

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

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

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

B. Provide an inspection point for checking transmission fluid level

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

D. Return vaporized lubricant to the case after operation cooling

18. 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

19. A heavy-duty truck has been operating with the inter-axle differential lockout engaged on dry highway pavement at 65 mph for an extended period. The MOST likely consequence is:

A. Improved fuel economy from increased traction at highway speed

B. Better steering response on long straightaways during operation

C. Slight cooling effect on the drive axle lubricant temperature

D. Driveline binding leading to tire scrub and component damage

20. 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

21. Technician A says that an Eaton Fuller 18-speed transmission uses a 6 × 3 architecture with six main gears and three range ratios. Technician B says the 18-speed uses a 4 × 2 × 2 architecture with four main gears, two ranges, and two splitter ratios. 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

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

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

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

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

23. The MOST important reason for replacing flywheel mounting bolts during flywheel service on modern heavy-duty diesel 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 original bolts may have collected debris that affects torque accuracy

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

24. A heavy-duty drive axle has been rebuilt. During the final tooth contact pattern check, the contact pattern 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

25. The MOST common cause of repeat universal joint failure on a heavy-duty truck is:

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

B. Use of incorrect grease formulations during chassis lubrication service intervals

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

D. Manufacturing defects in the replacement universal joints from low-quality suppliers

26. A heavy-duty truck has clutch chatter that occurs only on cold mornings during the first launch of the day. After the truck has been driven for a few minutes, the chatter does not return. The MOST likely cause is:

A. Worn cushion springs in the clutch disc that have lost compression characteristics

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

C. Moisture condensation on the clutch friction surfaces that burns off during use

D. Improperly torqued clutch cover bolts allowing pressure plate to flex unevenly

27. 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 provides similar torsional stiffness with significantly reduced weight

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

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

28. 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

29. Technician A says that a non-synchronized constant-mesh transmission requires the driver to double-clutch when shifting between gears. Technician B says that synchronized transmissions are common in heavy-duty Class 8 service in North America. 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

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

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

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

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

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

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

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

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

32. A driver complains that his clutch pedal sinks slowly to the floor when held depressed at a stop light. The pedal returns to normal height when released. The MOST likely cause is:

A. Internal master cylinder seal failure allowing fluid bypass past the piston

B. External leakage from the slave cylinder onto the bell housing area

C. Air trapped in the hydraulic system that has not been properly bled out

D. Wear in the clutch master cylinder pushrod where it contacts the pedal

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

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

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

34. A heavy-duty drive axle is being rebuilt. The technician is establishing pinion depth and finds the pinion head stamped "-2" indicating a depth variation. This means the pinion is:

A. Acceptable for installation without any shim adjustment required

B. 0.002 inches longer than nominal length, requiring 0.002 inches less shim

C. 0.002 inches shorter than nominal length, requiring 0.002 inches more shim

D. Defective and requires replacement before assembly continues

35. Technician A says that a power divider lockout should be engaged at all times on a tandem-axle tractor to maximize traction during normal operation. Technician B says that engaging the power divider lockout at highway speeds on dry pavement causes driveline binding. 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

36. A heavy-duty truck has a complaint of clutch grabbing during initial engagement. Inspection finds oil on both faces of the clutch disc friction material. The MOST likely root cause to investigate first is:

A. The rear engine main seal or transmission input shaft seal allowing leakage

B. The transmission shift cover gasket allowing oil to migrate through case

C. The clutch hydraulic master cylinder leaking fluid into the pedal area

D. The driveshaft slip joint splines allowing transmission fluid to escape

37. 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 that occurred during operation

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

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

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

D. Clutch damage from oil contamination passing through the input shaft seal

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

A. Accommodate axial distance changes between transmission and drive axle

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

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

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

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

C. Worn synchronizer assemblies inside the transmission affecting operation

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

41. A heavy-duty truck has driveline vibration that worsens significantly when the truck is loaded. 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. Center support bearing rubber that has hardened from age and heat exposure

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

42. 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

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

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

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

44. 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. Misalignment of a needle bearing during cup installation causing joint binding

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

D. Installing the joint without marking driveshaft orientation before removal

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

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

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

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

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

46. A heavy-duty truck has clutch slippage that occurs only when the engine is hot. The friction facings are within wear limits and free travel is 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

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

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

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

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

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

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

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

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

C. Provide an inspection point for checking transmission fluid level

D. Return vaporized lubricant to the case after operation cooling

49. 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

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

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

PRACTICE EXAM 12: ANSWER KEY AND EXPLANATIONS

1. A — Pressure plate springs that have lost tension over service life. With facings within wear limits and free travel correctly adjusted, 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. C — Technician B only. The clutch brake is engaged only when the driver fully presses the pedal at a complete stop, allowing the input shaft to be stopped before engaging a starting gear. Engaging it during normal shifts at speed forces the brake against rotating internal components and destroys the clutch brake disc, often within a single incident.

3. D — The drive axle ring and pinion gear set in the carrier housing. A whine that varies with vehicle speed and disappears when the transmission shifts to 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.

4. B — 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. A — 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 — Crush to a precise length under nut torque to set bearing preload. The collapsible spacer is engineered to deform a specific amount when the pinion nut is torqued to specification, producing exactly the right compression on the pinion bearings. Once crushed, it cannot be uncrushed — which is why it must be replaced any time the pinion nut is removed.

7. D — 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.

8. B — Both Technician A and Technician B. Heavy-duty drive axle hubs use either oil bath or grease lubrication depending on the design, and mixing the two systems is destructive — incompatible additive packages cause foaming, breakdown, and accelerated bearing wear. Both statements are accurate.

9. A — 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.

10. D — 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.

11. C — A failed pressure plate diaphragm spring or release lever assembly. A noticeably lighter pedal combined with slippage indicates the pressure plate has lost clamping force — typically through a broken or collapsed diaphragm spring or release lever assembly. The clutch can no longer generate design clamping force and the pedal feels light because there is less spring resistance to overcome.

12. B — 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.

13. A — Technician A only. Universal joint phasing is established at the factory and must be preserved during all service procedures. Any field alteration of phasing produces severe vibration that destroys driveline components quickly, regardless of how the change was intended.

14. C — 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.

15. D — 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.

16. B — Inspect the seventh-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.

17. C — 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.

18. 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.

19. D — 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.

20. 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.

21. C — Technician B only. The Eaton Fuller 18-speed uses a 4 × 2 × 2 architecture — four main gears multiplied by two range positions and two splitter positions, producing 16 forward ratios plus two creeper gears. A 6 × 3 architecture would produce a different gear count and is not the 18-speed configuration.

22. A — 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.

23. D — 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.

24. 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.

25. 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.

26. C — Moisture condensation on the clutch friction surfaces that burns off during use. Cold-morning chatter that disappears after a few minutes of operation is the classic cold-condensation symptom — overnight temperature changes condense moisture on the clutch surfaces, producing chatter until the heat of operation evaporates the moisture. The symptom does not return because the surfaces stay warm during the day.

27. B — 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.

28. 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.

29. A — Technician A only. Non-synchronized constant-mesh transmissions traditionally require double-clutching during shifts to match input shaft speed. Synchronized transmissions are common in medium-duty applications and some European-designed heavy-duty units, but North American Class 8 service is dominated by non-synchronized constant-mesh designs.

30. C — 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.

31. 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.

32. A — Internal master cylinder seal failure allowing fluid bypass past the piston. A pedal that sinks slowly to the floor under sustained pressure is the classic indicator of internal master cylinder bypass. The worn seals allow fluid to leak back past the piston into the reservoir rather than maintaining pressure to the slave cylinder.

33. D — 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.

34. C — 0.002 inches shorter than nominal length, requiring 0.002 inches more shim. The pinion depth variation number stamped on the pinion head represents thousandths of an inch deviation from nominal length. A "-2" pinion is shorter than nominal, requiring a thicker shim (0.002 inches more) to position it correctly relative to the ring gear centerline.

35. B — Technician B only. The power divider lockout must only be engaged at low speeds on low-traction surfaces — never at highway speeds on dry pavement. With the lockout engaged at speed on dry pavement, normal axle speed differences cannot be accommodated, producing severe driveline binding, tire scrub, and potential component failure.

36. A — The rear engine main seal or transmission input shaft seal allowing leakage. Oil contamination on both faces of the clutch disc indicates oil reaching the bell housing area in significant quantity. The two most common sources are the rear engine main seal and the transmission input shaft seal — both must be inspected to identify the leak source.

37. 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.

38. C — 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.

39. A — 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.

40. B — 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.

41. D — 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.

42. 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.

43. C — 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.

44. B — Misalignment of a needle bearing during cup installation causing joint 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.

45. D — 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.

46. 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.

47. A — 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.

48. B — 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.

49. 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.

50. D — 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.