PRACTICE EXAM 6: T6 SIMULATION (50 QUESTIONS)

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1. An oscilloscope trace of a J1939 data bus shows the differential signal alternating between recessive (~0V differential) and dominant (~2V differential) states. Which observation indicates correct bus operation?

A. Only recessive state visible on the trace

B. Clean transitions between recessive and dominant states

C. Only dominant state visible on the trace

D. Continuous noise with no clear state separation

2. A heavy-duty truck circuit uses pulse-width modulation (PWM) to control a fan motor. The duty cycle reads 75% at high fan speed. The conclusion is:

A. The fan is receiving voltage 25% of the time

B. The fan is operating at minimum speed

C. The fan signal frequency is 75 Hz

D. The fan is receiving voltage 75% of the time

3. Tech A says a Hall-effect sensor produces a digital output signal that switches between low and high voltage states. Tech B says a magnetic pickup (variable reluctance) sensor produces an analog AC voltage output. Who is correct?

A. Both Tech A and Tech B

B. Tech A only

C. Tech B only

D. Neither Tech A nor Tech B

4. An oscilloscope trace of a Hall-effect wheel speed sensor shows a clean square wave at all speeds. Voltage levels are 0 volts at the low state and 5 volts at the high state. The signal is:

A. Operating incorrectly with damaged sensor

B. Operating with insufficient amplitude

C. Operating correctly with proper digital output

D. Operating with excessive noise contamination

5. A digital multimeter set to AC volts measures the output of a magnetic pickup wheel speed sensor. At 30 mph, the meter reads 2.4 volts AC. At 60 mph, the same sensor reads:

A. Approximately 4.8 volts AC

B. Approximately 1.2 volts AC

C. Approximately 2.4 volts AC

D. Approximately 0.6 volts AC

6. A circuit contains a NPN transistor used as a switch. The transistor is fully ON when:

A. The base is at the same voltage as the collector

B. The base is at the same voltage as the emitter

C. The base voltage is below the emitter voltage

D. The base voltage is approximately 0.7 volts above the emitter

7. Tech A says a diode allows current to flow in one direction only. Tech B says a forward-biased silicon diode produces a voltage drop of approximately 0.7 volts. Who is correct?

A. Tech A only

B. Both Tech A and Tech B

C. Tech B only

D. Neither Tech A nor Tech B

8. An oscilloscope shows a square wave with rounded transitions and "ringing" on the high-to-low transition. The most likely cause is:

A. Normal switching characteristics of the circuit

B. Excessive frequency for the circuit design

C. Capacitive or inductive loading on the circuit

D. Open circuit between the source and the load

9. A heavy-duty truck circuit uses a flyback diode across a relay coil. The diode's purpose is to:

A. Suppress voltage spikes when the relay coil is de-energized

B. Allow current to flow only when the relay is energized

C. Reduce the relay coil current during operation

D. Increase the relay coil voltage during energization

10. The internal impedance of a typical digital multimeter set to DC volts is approximately:

A. 1 kilo-ohm or less

B. 100 ohms or less

C. 10 kilo-ohms

D. 10 megohms or higher

11. Tech A says a high-impedance multimeter loads the circuit minimally during measurement. Tech B says low-impedance test lights can affect circuit operation during testing on electronic circuits. Who is correct?

A. Tech A only

B. Tech B only

C. Both Tech A and Tech B

D. Neither Tech A nor Tech B

12. An oscilloscope is used to measure the rise time of a digital signal. Rise time is defined as:

A. Time for the signal to rise from 10% to 90% of its final value

B. Time for the signal to rise from 0% to 100% of its final value

C. Time for the signal to rise from 50% to its final value

D. Time for the signal to rise from low to high state

13. A heavy-duty truck CAN bus signal shows excessive ringing on the dominant-to-recessive transitions. The most likely cause is:

A. Failed engine ECU producing distorted signals

B. Failed body controller producing distorted signals

C. Open or damaged CAN-L wire

D. Missing or failed terminating resistor

14. The voltage drop across a forward-biased silicon diode in a circuit is typically:

A. 0.3 volts

B. 0.7 volts

C. 1.5 volts

D. 12.0 volts

15. An oscilloscope trace of a heavy-duty starter cranking event shows voltage dropping from 12.6 volts to 9.0 volts during cranking, with no AC ripple component visible. The most likely conclusion is:

A. AC ripple from the alternator is contaminating the trace

B. The trace shows the starter cable is open during cranking

C. The trace shows excessive resistance in the starter circuit

D. The trace shows normal starter cranking voltage drop

16. A heavy-duty truck battery shows a sulfated condition. The internal chemistry change is:

A. Lead sulfate crystallizes on the plates and resists conversion

B. Sulfuric acid concentration increases beyond specification

C. Lead oxide forms on the negative plates

D. Hydrogen gas pressure increases inside the cells

17. Tech A says battery state of charge can be determined by specific gravity measurement. Tech B says specific gravity readings must be temperature-corrected for accuracy. Who is correct?

A. Tech A only

B. Tech B only

C. Both Tech A and Tech B

D. Neither Tech A nor Tech B

18. A heavy-duty truck starter solenoid has a hold-in winding and a pull-in winding. The pull-in winding:

A. Maintains the solenoid in the engaged position during cranking

B. Pulls the solenoid plunger to engage and disengages when contacts close

C. Provides backup actuation if the hold-in winding fails

D. Reduces current draw during continuous solenoid operation

19. An oscilloscope trace of a starter cranking event shows voltage dropping in steps rather than smoothly. The stepped pattern most likely indicates:

A. Multiple battery cells with different states of charge

B. Normal starter cranking with engine compression cycles

C. Failed starter motor with internal damage

D. Failed starter solenoid with intermittent contact

20. A heavy-duty truck battery's reserve capacity (RC) rating describes:

A. The CCA rating divided by 2 for cold weather operation

B. The maximum cranking current at 0°F for 30 seconds

C. The amp-hour capacity at the 20-hour discharge rate

D. The minutes the battery can deliver 25 amps at 80°F before voltage drops below 10.5 volts

21. Tech A says lithium-ion auxiliary batteries on heavy-duty trucks have higher energy density than lead-acid batteries. Tech B says lithium-ion batteries require specific charging profiles different from lead-acid. Who is correct?

A. Tech A only

B. Tech B only

C. Neither Tech A nor Tech B

D. Both Tech A and Tech B

22. An oscilloscope trace of a starter cranking event shows excessive AC voltage component on the DC voltage. The most likely cause is:

A. Normal starter operation with brush noise

B. Alternator AC ripple contaminating the cranking circuit

C. Failed starter motor with internal damage

D. Failed battery with internal short

23. An oscilloscope trace of a heavy-duty alternator output shows a clean DC voltage with small AC ripple of approximately 0.2 volts peak-to-peak. The conclusion is:

A. The alternator rectifier diodes are functioning correctly

B. The alternator has one failed rectifier diode

C. The alternator has multiple failed rectifier diodes

D. The alternator regulator has failed

24. A heavy-duty alternator with one failed positive rectifier diode produces:

A. No DC output voltage

B. Normal DC output with no ripple

C. Reduced DC output with increased AC ripple

D. Increased DC output with no ripple

25. Tech A says a brushless alternator uses a stationary field winding excited by an external regulator. Tech B says brushless alternators eliminate slip rings and brushes as service items. Who is correct?

A. Tech A only

B. Tech B only

C. Neither Tech A nor Tech B

D. Both Tech A and Tech B

26. The voltage regulator on a heavy-duty alternator controls output voltage by:

A. Modulating the field current to control output voltage

B. Modulating the stator current to control output voltage

C. Modulating the rectifier output to control voltage

D. Modulating the rotor speed to control output voltage

27. An oscilloscope trace of an alternator output shows alternating high and low ripple peaks. The most likely cause is:

A. Normal three-phase alternator operation

B. Failed voltage regulator producing oscillation

C. One failed rectifier diode in the bridge

D. Failed stator winding producing distortion

28. An LED headlight uses a constant-current driver circuit because:

A. LEDs require constant voltage for stable operation

B. LEDs require constant current to control brightness and prevent damage

C. Constant-current operation reduces LED power consumption

D. Constant-current operation eliminates the need for heat sinks

29. Tech A says LED brightness is controlled by current, not voltage. Tech B says LED color temperature is determined by the LED chemistry and structure. Who is correct?

A. Tech A only

B. Tech B only

C. Neither Tech A nor Tech B

D. Both Tech A and Tech B

30. A heavy-duty truck multiplexed lighting system uses a body controller that sends commands to chassis nodes. The communication between the body controller and the nodes typically uses:

A. CAN bus or LIN bus communication

B. Direct hard-wired connections

C. Wireless RF communication

D. Power-line carrier communication

31. An oscilloscope trace of a PWM signal driving an LED tail lamp shows a 200 Hz square wave with 50% duty cycle. The LED appears at:

A. 50% of maximum brightness

B. 100% of maximum brightness

C. 25% of maximum brightness

D. 0% of maximum brightness

32. The forward voltage drop of a typical white LED used in heavy-duty truck applications is approximately:

A. 0.7 volts per LED

B. 1.5 volts per LED

C. 3.0 volts per LED

D. 12.0 volts per LED

33. Tech A says incandescent bulbs draw constant current regardless of voltage. Tech B says incandescent bulb resistance increases significantly when the bulb is hot compared to cold. Who is correct?

A. Tech A only

B. Tech B only

C. Both Tech A and Tech B

D. Neither Tech A nor Tech B

34. A heavy-duty truck headlight using a halogen bulb provides higher light output than a standard incandescent bulb because:

A. Halogen bulbs use a different color temperature filter

B. Halogen bulbs operate at lower filament temperature

C. Halogen bulbs produce more current at the same voltage

D. Halogen gas allows higher filament operating temperature

35. An oscilloscope trace of a J1939 data bus shows the differential signal at 2 volts during dominant state and 0 volts during recessive state. The bus is:

A. Operating correctly per J1939 specification

B. Operating with excessive amplitude

C. Operating with insufficient amplitude

D. Operating with reverse polarity

36. The communication speed of J1939 at 250 kbps means:

A. Each bit transmission takes 4 milliseconds

B. The bus transmits 250 messages per second

C. Each bit transmission takes 4 microseconds

D. The bus transmits 250 bytes per second

37. Tech A says J1939 messages use 29-bit identifiers (extended frame format). Tech B says J1939 message identifiers contain priority, source address, and destination address information. Who is correct?

A. Tech A only

B. Both Tech A and Tech B

C. Tech B only

D. Neither Tech A nor Tech B

38. An oscilloscope trace of a CAN-H signal shows the wire idling at 3.5 volts and dropping to 2.5 volts during dominant state. The conclusion is:

A. CAN-H signal levels are inverted from specification

B. CAN-H signal levels are normal per specification

C. CAN-H signal has excessive amplitude

D. CAN-H signal has reduced amplitude

39. A heavy-duty truck instrument cluster receives engine RPM data over the J1939 bus. The data is transmitted in:

A. Analog voltage proportional to RPM

B. PWM duty cycle proportional to RPM

C. Resistance signal proportional to RPM

D. Digital messages with RPM as a numeric value

40. Tech A says J1939 bus messages have a maximum length of 8 bytes per single frame. Tech B says larger messages are transmitted using multi-frame transport protocols. Who is correct?

A. Tech A only

B. Both Tech A and Tech B

C. Tech B only

D. Neither Tech A nor Tech B

41. An oscilloscope trace of a J1939 bus shows a stuck dominant state (CAN-H high, CAN-L low) with no transitions. The most likely cause is:

A. Normal bus operation between messages

B. Failed terminating resistor on the bus

C. Module driving the bus continuously due to fault

D. Bus voltage above specification

42. The maximum number of nodes (modules) typically supported on a J1939 bus is:

A. 30 nodes per bus segment

B. 8 nodes per bus segment

C. 64 nodes per bus segment

D. 254 nodes per bus segment

43. Tech A says J1939 bus length should not exceed 40 meters typical. Tech B says drop lines from the backbone should not exceed 1 meter typical. Who is correct?

A. Tech A only

B. Tech B only

C. Neither Tech A nor Tech B

D. Both Tech A and Tech B

44. A heavy-duty truck temperature gauge displays correct temperature data on the J1939 bus but shows incorrect reading on the gauge itself. The most likely cause is:

A. Temperature sensor producing incorrect data

B. Cluster gauge calibration or scaling error

C. Data bus corruption between sensor and cluster

D. Engine ECU producing incorrect data

45. An oscilloscope trace of a J1939 bus shows clean signaling when one specific module is unplugged but distorted signaling when that module is connected. The most likely cause is:

A. Failed module loading the bus excessively

B. Failed terminating resistor on the bus

C. Bus wiring damage at the module connection

D. Other modules producing the distortion

46. The J1939 bus arbitration mechanism uses:

A. Time-division multiplexing with fixed time slots

B. Token-passing between nodes for transmission

C. Master-slave architecture with a central controller

D. CSMA/CD with priority based on message identifier

47. Tech A says J1939 messages have a CRC field for error detection. Tech B says J1939 messages use acknowledgment to confirm receipt by other nodes. Who is correct?

A. Tech A only

B. Tech B only

C. Both Tech A and Tech B

D. Neither Tech A nor Tech B

48. A heavy-duty truck warning lamp is driven by a body controller through a multiplexed network. The lamp circuit fault detection (lamp-out detection) typically uses:

A. Direct voltage measurement at the lamp

B. Current sensing to verify lamp current draw

C. Resistance measurement of the lamp circuit

D. PWM duty cycle monitoring of the lamp circuit

49. An oscilloscope trace of a heavy-duty truck telematics module data transmission shows packets sent over the J1939 bus to a gateway. The packets are then transmitted via:

A. Cellular wireless to the fleet management server

B. Direct wired connection to the fleet management server

C. Optical fiber connection to the fleet management server

D. Radio frequency direct to the fleet management server

50. The J1939 bus uses bit stuffing in the data frame to:

A. Add error correction bits to the message

B. Increase the data rate of the bus

C. Ensure adequate signal transitions for clock recovery

D. Reduce the message length for transmission efficiency

PRACTICE EXAM 6: ANSWER KEY AND EXPLANATIONS

1. B — Clean transitions between recessive and dominant states. A properly functioning J1939 bus shows clean, sharp transitions between recessive and dominant states, indicating proper signal integrity and no bus loading issues. Distorted transitions or stuck states indicate bus faults requiring diagnosis.

2. D — The fan is receiving voltage 75% of the time. PWM duty cycle represents the percentage of time the signal is high (on) within each cycle, so 75% duty cycle means voltage is applied 75% of the time. This produces 75% of full power to the fan motor.

3. A — Both Tech A and Tech B. Hall-effect sensors produce digital output signals that switch between low (typically 0V) and high (typically 5V) voltage states based on magnetic field presence. Magnetic pickup (variable reluctance) sensors produce analog AC voltage outputs whose amplitude and frequency increase with rotation speed.

4. C — Operating correctly with proper digital output. A clean square wave with 0V low state and 5V high state is the proper output of a Hall-effect digital sensor, providing reliable speed information regardless of operating speed. This signal characteristic distinguishes Hall-effect from variable reluctance sensors.

5. A — Approximately 4.8 volts AC. Magnetic pickup (variable reluctance) sensor output amplitude is proportional to rotation speed, so doubling the speed approximately doubles the output voltage. From 2.4 volts at 30 mph, the output at 60 mph is approximately 4.8 volts AC.

6. D — The base voltage is approximately 0.7 volts above the emitter. An NPN transistor turns fully ON when the base-emitter junction is forward-biased with approximately 0.7 volts of voltage drop, allowing current to flow from collector to emitter. This is the standard silicon transistor saturation condition.

7. B — Both Tech A and Tech B. A diode allows current to flow in one direction (forward) and blocks current in the reverse direction. A forward-biased silicon diode produces a voltage drop of approximately 0.7 volts, which is the silicon junction characteristic.

8. C — Capacitive or inductive loading on the circuit. Rounded transitions and ringing on a square wave are the classic signature of capacitive or inductive loading on the circuit, which slows transitions and produces oscillation. This is typically caused by long wires, connectors, or downstream loads affecting signal integrity.

9. A — Suppress voltage spikes when the relay coil is de-energized. A flyback diode across a relay coil suppresses the voltage spike (back-EMF) that occurs when the coil is de-energized, protecting downstream electronics from damage. The diode is reverse-biased during normal operation and forward-biased during de-energization.

10. D — 10 megohms or higher. Modern digital multimeters set to DC volts have internal impedance of 10 megohms or higher, which loads the circuit minimally during measurement. This high impedance allows accurate measurement of electronic circuits without affecting their operation.

11. C — Both Tech A and Tech B. High-impedance multimeters load the circuit minimally during measurement, providing accurate readings on electronic circuits. Low-impedance test lights draw enough current to affect circuit operation on electronic circuits, where they can damage components or produce false readings.

12. A — Time for the signal to rise from 10% to 90% of its final value. Rise time is defined as the time for a signal to rise from 10% to 90% of its final value, providing a standardized measurement that excludes the slow tails at start and end of the transition. This definition is industry-standard for digital signal analysis.

13. D — Missing or failed terminating resistor. Excessive ringing on CAN bus dominant-to-recessive transitions is the classic signature of missing or failed terminating resistor, which fails to absorb signal reflections and produces oscillation. Module failures and wire damage produce different patterns.

14. B — 0.7 volts. The forward voltage drop across a silicon diode is approximately 0.7 volts, which is the standard junction characteristic for silicon-based diodes. This value applies to most rectifier diodes used in heavy-duty truck applications.

DOMAIN B — BATTERY AND STARTING SYSTEMS

15. D — The trace shows normal starter cranking voltage drop. Battery voltage dropping from 12.6 to 9.0 volts during cranking is within normal range for heavy-duty starter operation, with voltage drop expected during high-current cranking. The absence of AC ripple confirms the alternator is not contaminating the measurement.

16. A — Lead sulfate crystallizes on the plates and resists conversion. Battery sulfation occurs when lead sulfate crystallizes on the plates and resists conversion back to lead and lead dioxide during charging. This condition reduces battery capacity and is the typical end-of-life mode for lead-acid batteries.

17. C — Both Tech A and Tech B. Battery state of charge can be determined by specific gravity measurement, with full charge corresponding to approximately 1.265 specific gravity in flooded

lead-acid batteries. Specific gravity readings must be temperature-corrected because electrolyte density changes with temperature.

18. B — Pulls the solenoid plunger to engage and disengages when contacts close. The pull-in winding pulls the solenoid plunger to engage the starter pinion and the main contacts, then disengages from the circuit when the main contacts close. The hold-in winding then maintains the solenoid in the engaged position during cranking with reduced current draw.

19. A — Multiple battery cells with different states of charge. Stepped voltage drops during cranking indicate individual battery cells with different capacities or states of charge, with each cell reaching its discharge limit at different times. This pattern indicates uneven cell condition requiring battery service or replacement.

20. D — The minutes the battery can deliver 25 amps at 80°F before voltage drops below 10.5 volts. Reserve capacity (RC) rating specifies the minutes the battery can deliver 25 amps at 80°F before voltage drops below 10.5 volts, indicating the battery's ability to support electrical loads when the alternator is not providing charging current.

21. D — Both Tech A and Tech B. Lithium-ion auxiliary batteries on heavy-duty trucks have higher energy density (more capacity per pound) than lead-acid batteries, which is advantageous for sleeper cab applications where weight matters. Lithium-ion batteries require specific charging profiles different from lead-acid, with different voltage limits and termination methods.

22. B — Alternator AC ripple contaminating the cranking circuit. Excessive AC voltage on the DC measurement during cranking indicates alternator AC ripple is present in the circuit, which would not normally appear during cranking when the engine is not yet running. This typically indicates a measurement issue or a unique system condition requiring investigation.

DOMAIN C — CHARGING SYSTEM

23. A — The alternator rectifier diodes are functioning correctly. Clean DC voltage with small AC ripple (under 0.5V peak-to-peak) is the signature of properly functioning rectifier diodes, with all diodes converting alternator AC output to DC. Higher ripple indicates diode failure within the rectifier bridge.

24. C — Reduced DC output with increased AC ripple. A failed positive rectifier diode in a heavy-duty alternator produces reduced DC output (because one phase is no longer rectified) and increased AC ripple (because the unrectified portion appears as ripple). This is the classic single-diode failure signature.

25. D — Both Tech A and Tech B. Brushless alternators use a stationary field winding excited by an external regulator, eliminating the need for slip rings and brushes. This design eliminates brush wear as a service issue, which is a significant advantage in heavy-duty service.

26. A — Modulating the field current to control output voltage. The voltage regulator controls alternator output voltage by modulating the field current, which controls the magnetic field strength and therefore the induced voltage in the stator windings. Higher field current produces higher output voltage.

27. C — One failed rectifier diode in the bridge. Alternating high and low ripple peaks indicate one rectifier diode is not conducting, producing asymmetric output where every other phase peak is missing. This pattern is the classic signature of a single failed diode in the rectifier bridge.

DOMAIN D — LIGHTING SYSTEMS

28. B — LEDs require constant current to control brightness and prevent damage. LEDs are current-driven devices where brightness is proportional to current and excessive current causes damage. Constant-current driver circuits regulate the current independent of supply voltage variations, providing stable brightness and protection.

29. D — Both Tech A and Tech B. LED brightness is controlled by current (not voltage), with brightness increasing as forward current increases up to the device limit. LED color temperature is determined by the LED semiconductor chemistry and physical structure, with different materials producing different spectral output.

30. A — CAN bus or LIN bus communication. Heavy-duty truck multiplexed lighting systems use CAN bus or LIN bus communication between the body controller and chassis nodes, providing efficient digital communication that eliminates point-to-point wiring. LIN bus is often used for lower-bandwidth applications like lighting control.

31. A — 50% of maximum brightness. PWM signal at 50% duty cycle produces 50% of maximum brightness because the LED is on 50% of the time. The fast switching rate (200 Hz) is above the visual flicker fusion threshold, so the eye perceives constant illumination at the average brightness level.

32. C — 3.0 volts per LED. Typical white LEDs used in heavy-duty truck applications have forward voltage drops of approximately 3.0 volts per LED, requiring multiple LEDs in series to operate from 12-volt or 24-volt supplies. The forward drop varies slightly with current and temperature.

33. B — Tech B only. Incandescent bulb resistance increases significantly when hot compared to cold (typically 10x or more increase), which means cold bulbs draw much higher initial current than steady-state operation. Tech A is incorrect because incandescent bulbs do not draw constant current — current changes with applied voltage and bulb temperature.

34. D — Halogen gas allows higher filament operating temperature. Halogen gas (typically iodine or bromine) inside the bulb allows higher filament operating temperature without rapid filament

evaporation, producing more light output and whiter color than standard incandescent bulbs at the same wattage. The halogen cycle redeposits evaporated tungsten back onto the filament.

DOMAIN E — GAUGES, WARNING DEVICES, DRIVER INFORMATION SYSTEMS

35. A — Operating correctly per J1939 specification. J1939 specifies the differential signal at 2 volts during dominant state and 0 volts during recessive state, with these specific levels being the standard. Excessive or insufficient amplitude indicates bus voltage faults requiring diagnosis.

36. C — Each bit transmission takes 4 microseconds. At 250 kbps (250,000 bits per second), each bit transmission takes 1 ÷ 250,000 = 4 microseconds. This bit time is fundamental to bus timing and signal integrity considerations.

37. B — Both Tech A and Tech B. J1939 messages use 29-bit identifiers (extended CAN frame format), providing a large address space for the many parameters and modules in heavy-duty truck systems. The 29-bit identifier contains priority bits, parameter group number (PGN), source address, and destination address information.

38. A — CAN-H signal levels are inverted from specification. J1939 specifies CAN-H idling at 2.5 volts and rising to 3.5 volts during dominant state — the described pattern (idle 3.5V, dominant 2.5V) is inverted from specification. This indicates a bus wiring fault, possibly CAN-H and CAN-L wires reversed.

39. D — Digital messages with RPM as a numeric value. Heavy-duty truck instrument clusters receive engine RPM data as digital messages over the J1939 bus, with RPM transmitted as a numeric value within the message data. Analog and PWM signals are not used on multiplexed clusters.

40. B — Both Tech A and Tech B. J1939 single-frame messages have a maximum length of 8 bytes per frame, which is the CAN protocol specification. Larger messages are transmitted using multi-frame transport protocols (BAM, RTS/CTS) that segment data across multiple frames and reassemble at the receiving end.

41. C — Module driving the bus continuously due to fault. A stuck dominant state on a J1939 bus indicates a module is driving the bus continuously, preventing other modules from communicating. This is typically caused by a faulty module or a short circuit on the bus, requiring isolation diagnosis.

42. A — 30 nodes per bus segment. J1939 specification typically supports up to 30 nodes per bus segment, which is adequate for most heavy-duty truck applications. The actual limit depends on transceiver specifications and bus loading characteristics.

43. D — Both Tech A and Tech B. J1939 bus length is typically limited to 40 meters to maintain signal integrity at the 250 kbps data rate. Drop lines (stub connections from the backbone to individual nodes) should not exceed 1 meter to minimize signal reflections that would corrupt data.

44. B — Cluster gauge calibration or scaling error. Correct data on the bus with incorrect display on the cluster indicates the cluster is receiving correct data but converting it incorrectly to gauge position. Calibration or scaling errors in the cluster software produce this pattern.

45. A — Failed module loading the bus excessively. Bus distortion appearing only when a specific module is connected indicates that module is loading the bus excessively, possibly due to a failed transceiver. Removing the module isolates the bus loading issue.

46. D — CSMA/CD with priority based on message identifier. J1939 uses CSMA/CD (Carrier Sense Multiple Access with Collision Detection) with priority based on the message identifier, where lower-numbered identifiers have higher priority. This non-destructive arbitration ensures critical messages get bus access first.

47. C — Both Tech A and Tech B. J1939 messages include a CRC (Cyclic Redundancy Check) field for error detection, allowing receiving nodes to verify message integrity. J1939 also uses acknowledgment to confirm receipt by at least one other node, ensuring reliable communication.

48. B — Current sensing to verify lamp current draw. Multiplexed lighting systems with lamp-out detection typically use current sensing in the body controller to verify the lamp is drawing rated current. Loss of current draw indicates a burned-out bulb or open circuit, allowing the system to alert the driver.

49. A — Cellular wireless to the fleet management server. Heavy-duty truck telematics modules transmit data via cellular wireless to the fleet management server, providing remote monitoring of fleet operations. Direct wired and optical connections are not practical for mobile vehicle applications.

50. C — Ensure adequate signal transitions for clock recovery. J1939 (and CAN protocol generally) uses bit stuffing in the data frame to ensure adequate signal transitions for clock recovery at the receiving node. After five consecutive identical bits, a complementary bit is inserted, providing transitions that allow synchronization.