PRACTICE EXAM 16: ASE L3 SIMULATION (45 Questions)

Time Limit: 2 hours | Passing target: 80% or higher on simulation practice

1. A customer reports that their hybrid vehicle's fuel economy has decreased significantly over the past year. The technician inspects the vehicle and finds no DTCs and the HV battery shows normal capacity and operation. Which factor is most likely contributing to the reduced fuel economy in this case?

A. The HV battery is approaching end-of-life and requires immediate replacement for fuel economy restoration

B. The vehicle's tire pressure has increased significantly from the original specification levels during summer months

C. Customer driving patterns or environmental factors that affect overall hybrid system efficiency during normal use

D. The engine has internal damage requiring a complete engine rebuild for full fuel economy recovery in operation

2. A NiMH hybrid battery pack uses a forced-air cooling system that draws cabin air through ducting and a filter. What is the most appropriate maintenance interval for the cooling air inlet filter on this NiMH battery system?

A. Filter replacement is not required because the system uses self-cleaning filters from the factory during operation

B. Filter cleaning or replacement at intervals specified by the OEM service maintenance schedule for the vehicle

C. Filter replacement only when DTCs are set indicating battery cooling system failure conditions during operation

D. Filter cleaning only when the HV battery pack shows obvious external signs of overheating during normal use

3. A hybrid drive motor has been replaced with a remanufactured unit. The technician installed the motor but did not perform the required resolver offset calibration. During the test drive, the motor produces normal torque output but the inverter shows higher than normal current draw for the commanded torque. What is the most likely cause?

A. The new motor has internally shorted windings causing higher than normal current draw during operation events

B. The inverter has internal damage from operating with incorrect motor calibration values during the test drive

C. The HV battery is providing excessive voltage to the inverter through the boost converter during operation

D. The resolver offset is misaligned causing the inverter to apply current at suboptimal angles relative to rotor

4. A hybrid vehicle uses an integrated power module that combines the inverter, DC-DC converter, and boost converter into a single physical assembly. What is one primary advantage of this integrated power module design over separate components?

A. Shared cooling system reduces overall weight and packaging requirements compared to separate component units

B. Lower cost components because integrated modules use less expensive switching devices than separate units do

C. Higher overall efficiency because integrated modules cannot be optimized for each individual function separately

D. Simpler service procedure because individual sections can be replaced separately when failed during diagnostic events

5. A hybrid vehicle's heat pump A/C system uses R-1234yf refrigerant. The system requires the addition of refrigerant after a successful leak repair. What is the correct procedure for refrigerant charging in this hybrid A/C system?

A. Add refrigerant by weight using a standard R-134a charging procedure adapted for R-1234yf service requirements

B. Add refrigerant by pressure reading at the high-side service port during system operation in the shop bay

C. Evacuate the system completely with a vacuum pump then charge by precise weight per OEM specification value

D. Add refrigerant gradually while monitoring system pressures until cooling performance returns to normal levels

6. A hybrid vehicle's 12V auxiliary battery is being load tested in the service bay. The technician applies a 100A load and notes that the battery voltage drops from 12.6V at rest to 9.8V under the applied load condition. What does this voltage drop indicate about the 12V battery?

A. Normal battery behavior for an AGM battery under heavy load testing conditions during routine service procedures

B. The battery is fully charged and reading the proper voltage during the heavy load test in normal operating range

C. The battery has minor degradation but is still serviceable for continued hybrid vehicle operation without replacement

D. The battery has significant internal degradation and likely cannot support normal hybrid system operation reliably

7. A hybrid vehicle technician needs to disconnect the 12V auxiliary battery for service work. Before disconnecting the 12V battery, what is the most important consideration regarding the hybrid control modules in the vehicle?

A. Document any learned values or adaptive parameters that may be lost during 12V power interruption to the modules

B. Disconnect the HV battery service plug first before any 12V auxiliary battery disconnection occurs during service work

C. Replace the 12V auxiliary battery with a new factory unit before performing any service procedures on the vehicle

D. Run a complete diagnostic scan of all vehicle modules before disconnecting the 12V battery cable during service work

8. A lithium-ion HV battery pack contains 96 cells connected in series. The nominal pack voltage is 355V at the main bus. If one cell becomes short-circuited internally, what is the most likely effect on the overall pack voltage?

A. The pack voltage will drop to 0V because the shorted cell creates a complete short circuit through the entire pack

B. The pack voltage will drop by approximately 3.7V due to the loss of the affected cell contribution to total voltage

C. The pack voltage will remain at 355V because the BMS automatically bypasses the shorted cell during operation

D. The pack voltage will increase as adjacent cells overcharge to compensate for the loss of the affected cell voltage

9. A hybrid drive motor uses a wye-connected stator with the three phase windings joined at a common neutral point inside the motor. If a technician measures resistance from the neutral point to one phase terminal, what should be the expected resistance reading?

A. The same resistance as measured between any two phase terminals on the motor windings during testing operations

B. Twice the resistance measured between any two phase terminals on the motor stator windings during testing operations

C. Half the resistance measured between any two phase terminals on the motor stator windings during testing operations

D. Zero resistance because the neutral point connects all three windings directly together at one point in the motor

10. A hybrid vehicle's inverter is being tested for proper PWM switching frequency at the output to the motor. The technician measures a fundamental switching frequency of 8 kHz at the inverter output terminals during operation. What does this 8 kHz frequency represent in the inverter operation?

A. The carrier frequency of the PWM modulation used to generate three-phase AC output to the drive motor windings

B. The fundamental electrical frequency of the AC current flowing through the motor stator windings during operation

C. The mechanical rotation frequency of the motor rotor during normal operating conditions in the vehicle drivetrain

D. The clock frequency of the inverter control module's main processor during normal operation in the vehicle system

11. A hybrid vehicle's electric A/C compressor uses a brushless DC motor with a built-in temperature sensor in the motor windings. If this temperature sensor circuit develops an open circuit fault during operation, what is the most likely effect on system operation?

A. The compressor will operate at maximum speed continuously regardless of cooling demand from the system control module

B. The compressor will operate normally because the temperature sensor is used only for diagnostic data display purposes

C. The compressor will operate at reduced speed until the temperature sensor is replaced and the system is fully restored

D. The compressor will shut down or operate in a protection mode to prevent thermal damage from undetected overheating

12. A hybrid vehicle's regenerative braking system uses wheel speed sensors as inputs to determine vehicle deceleration rates during braking events. If one wheel speed sensor fails during driving, what effect does this failure have on regenerative braking system operation?

A. The regenerative braking system will continue to operate normally using the remaining functional wheel speed sensors

B. The regenerative braking may be reduced or disabled to prevent unsafe operating conditions during the braking event

C. The friction braking system will compensate by applying additional force to the wheel with the failed speed sensor

D. The hybrid control module will recalibrate the remaining sensors to provide accurate vehicle speed data during operation

13. A hybrid vehicle technician is performing HV system de-energization following an OEM service procedure. After removing the service plug and waiting the specified time, the technician must verify zero voltage at multiple test points before proceeding. Which test points are typically required for verification?

A. Only the inverter input terminals require zero voltage verification before any further HV system service work begins

B. Only the HV battery main contactor terminals require zero voltage verification before HV service work proceeds normally

C. Multiple HV component terminals including inverter input, motor terminals, and HV bus locations require verification

D. Only the HV cable connections at the inverter housing require zero voltage verification before service work begins

14. A lithium iron phosphate (LiFePO4) HV battery pack is being inspected for service. Compared to a conventional lithium-ion battery using NCA or NMC chemistry, what is one characteristic of LiFePO4 chemistry that differentiates it in service?

A. LiFePO4 cells have a flatter voltage discharge curve and improved thermal stability compared to other lithium chemistries

B. LiFePO4 cells have higher specific energy than NCA or NMC cells of equal physical size in the same vehicle application

C. LiFePO4 cells require operation at higher temperatures than other lithium-ion chemistries to function properly in service

D. LiFePO4 cells use a liquid metal electrolyte rather than a polymer electrolyte design in the cell construction technique

15. A hybrid drive motor and transaxle assembly is being inspected after a customer complaint of a metallic grinding noise during driving. The technician finds that the motor rotor has shifted axially within the stator housing during operation. What is the most likely cause of this rotor shift?

A. Normal wear of the rotor laminations during extended hybrid vehicle service operation over many years of service life

B. Worn or damaged rotor bearings allowing the rotor to move out of its proper axial alignment within the stator housing

C. Excessive lubricant in the transaxle housing causing the rotor to slide during normal motor operation in the vehicle

D. Loose stator mounting bolts allowing the stator to shift relative to the rotor during normal motor operation in service

16. A hybrid vehicle's DC-DC converter is being tested for proper operation. The technician notes that the converter output voltage is correct at 14.0V but the converter is producing an unusual buzzing noise during operation. What is the most likely cause of the audible buzzing?

A. The converter is operating normally as some buzzing is typical of DC-DC converter operation in hybrid vehicle systems

B. The HV battery voltage is too low causing the converter to operate at maximum output current and produce audible noise

C. The 12V auxiliary battery is fully charged causing the converter to back off output current and produce audible noise

D. Magnetostriction in the converter's transformer or inductor possibly indicating component aging or magnetic core degradation

17. A hybrid vehicle's electric A/C compressor uses POE oil as the refrigerant lubricant in the system. After a system contamination event from a failed component, the technician needs to remove the contaminated oil from the system. What is the most effective method for removing POE oil from accessible system components?

A. Flush components with an OEM-approved refrigerant flush solvent followed by drying with dry nitrogen gas at low pressure

B. Pour clean POE oil through each component to displace the contaminated oil before reassembly into the vehicle system

C. Apply heat to the components while connected to vacuum to evaporate the contaminated oil out through the vacuum pump

D. Allow the contaminated oil to settle out of the system through gravity during component storage on the workbench during service

18. Two technicians are discussing high-voltage cable identification on hybrid vehicles in the shop. Technician A says all high-voltage cables in any hybrid vehicle are colored orange to indicate dangerous

voltage levels present during operation. Technician B says some 48V mild hybrid systems use blue cable color coding to distinguish from the main HV bus circuits. Who is correct?

A. Technician A only is correct on hybrid vehicle HV cable color coding industry standards across all manufacturers

B. Both Technician A and Technician B are correct on hybrid vehicle HV cable color coding standards used in industry

C. Technician B only is correct on hybrid vehicle HV cable color coding industry standards across all manufacturers

D. Neither Technician A nor Technician B is correct on hybrid vehicle HV cable color coding standards used in industry

19. A hybrid vehicle has been parked for an extended period of time and the HV battery has reached a low state of charge but is not completely depleted. The vehicle is brought into the shop for service. What is the safest method to recover the HV battery state of charge in this situation?

A. Connect a battery charger directly to the HV battery service ports to recharge the pack fully before any service work begins

B. Allow the vehicle to start and idle so the engine charges the HV battery through normal hybrid system charging operation

C. Replace the HV battery pack with a new factory unit since long-term parking damages all hybrid batteries beyond service

D. Push-start the vehicle to engage regenerative charging while rolling down a moderate slope on a public roadway nearby

20. A hybrid drive motor uses external cooling fins on the motor housing for passive natural convection cooling during operation. The technician inspects the motor and finds the cooling fins are covered with road dirt, debris, and accumulated dust. What is the most appropriate corrective action?

A. Apply additional cooling fluid to the motor housing to compensate for restricted airflow through the dirty cooling fins

B. Replace the motor housing with a new unit since cleaning the cooling fins typically damages the surface during cleaning

C. Leave the dirt and debris in place since natural convection cooling is not effective for hybrid motor cooling applications

D. Clean the cooling fins thoroughly to restore proper heat dissipation through natural convection cooling during operation

21. A hybrid vehicle uses a 400V architecture with a maximum operating voltage of 450V during peak load conditions. The technician needs to safely test the HV bus voltage during diagnostic work. What category and voltage rating of multimeter is most appropriate for this work?

A. CAT III 1000V multimeter provides safe transient overvoltage protection well above the maximum system voltage limits

B. CAT II 600V multimeter is sufficient for testing any hybrid vehicle HV bus voltage levels during routine service work

C. CAT IV 600V multimeter is required for testing hybrid vehicle HV systems for safety per industry service standards

D. CAT I 300V multimeter is appropriate for any automotive electrical testing including HV system measurements in shops

22. A hybrid vehicle has experienced a customer complaint of poor cabin heating performance in cold weather conditions. The technician finds the heat pump A/C system is operating but the engine is not cycling on to provide additional heat to the cabin heater core. What component most directly controls when the engine cycles on for cabin heating purposes?

A. The cabin temperature sensor signal sent to the climate control module during cold weather operation events

B. The HV battery temperature sensor signal sent to the hybrid control module during cold weather operation in winter

C. The engine coolant temperature combined with HVAC demand triggering engine start commands from the hybrid module

D. The outside ambient air temperature sensor signal sent to the climate module during cold weather operation events

23. A hybrid vehicle's electric water pump for the engine cooling system is being diagnosed. The pump is electronically controlled by the engine control module through a PWM signal during operation. If this electric water pump fails completely, what symptom is most likely to occur during driving?

A. The pump will operate continuously at maximum speed regardless of engine temperature levels during normal driving

B. The engine will overheat during operation triggering thermal protection and a reduced power operating mode in the vehicle

C. The cabin heater will not function because heated coolant cannot flow to the heater core in the dashboard area

D. The HV battery cooling system will be affected because both systems share coolant flow paths in the vehicle design

24. A hybrid vehicle's HV battery pack is being inspected for a customer complaint of reduced electric driving range. The pack is a lithium-ion design that is now five years old with 75,000 miles of service. The scan tool reports current cell capacity as approximately 75% of original rated capacity. What does this capacity measurement indicate?

A. The pack has failed completely and requires immediate replacement to restore proper vehicle operation and driving range

B. The pack has manufacturing defects that have appeared after five years of normal hybrid vehicle service operation in the field

C. The pack capacity measurement is incorrect and the pack is actually still performing at full original capacity in service

D. The pack is showing normal aging-related capacity loss expected at this age and mileage level for lithium-ion chemistry

25. A power-split hybrid uses an internal combustion engine and two motor/generators connected through a single planetary gear set assembly. During highway cruising at constant speed on a flat road, what is the most efficient operating condition for this complete hybrid system?

A. Both motor/generators operating at maximum speed to provide propulsion assistance to the engine during highway cruising

B. The engine operating at minimum RPM while one motor/generator provides primary propulsion at highway cruising speed

C. The engine operating in its most efficient RPM range with MG1 controlling engine speed via the planetary gear set

D. Both motor/generators operating in regenerative mode during all cruising to maintain HV battery state of charge

26. A hybrid vehicle's HV system has been de-energized following the OEM procedure. The technician needs to verify the system is safe to service before opening any HV component covers. What is the correct sequence of voltage verification using a multimeter at the inverter terminals?

A. Test the multimeter on a known voltage source, then test the inverter terminals, then retest the multimeter for confirmation

B. Test the inverter terminals directly and trust the multimeter reading without any additional verification testing procedures

C. Test the inverter terminals first, then test a known voltage source to verify the multimeter is still working correctly afterward

D. Use only an oscilloscope rather than a multimeter for accurate HV system zero voltage verification during the service work

27. A hybrid vehicle's HV battery pack uses modular construction allowing individual modules to be replaced during service. After replacing one degraded module with a new module, what additional service step is required to ensure proper pack operation going forward?

A. No additional service is required as the new module integrates automatically with the existing pack during normal operation

B. The new module should be matched to the existing modules through a balancing or conditioning cycle using the dealer tool

C. The entire pack must be replaced because mixing new and old modules damages the entire pack assembly during operation

D. The new module requires a software update before it can communicate with the battery management module properly in service

28. A hybrid drive motor has been replaced with an identical OEM motor of the same part number. The technician notes that even though the part number matches, the inverter calibration must be relearned after motor installation. What is the most likely reason this calibration is required after motor replacement?

A. The new motor uses a different rotor magnet material requiring inverter recalibration for proper operation in the vehicle

B. The new motor has a different number of stator poles requiring a software update to the inverter assembly during service

C. The new motor has a different gear ratio in the transaxle requiring a complete inverter reflash procedure during service

D. Individual motor manufacturing variations require resolver-to-rotor alignment learning for optimal torque output and efficiency

29. A hybrid vehicle's boost converter has an inductor that has developed a partial short circuit between turns of the winding. The vehicle continues to operate but performance has degraded. What symptom is most likely to occur during normal vehicle operation with this fault?

A. The boost converter output voltage will be lower than commanded causing reduced motor power output during acceleration

B. The boost converter will operate normally but with increased current draw from the HV battery during normal operation

C. Increased operating temperature in the boost converter assembly with possible inverter thermal protection activation events

D. The 12V auxiliary battery voltage will rise significantly above the normal regulated 14V output during vehicle operation

30. A hybrid vehicle's electric A/C compressor uses a brushless DC motor with three-phase windings driven by an inverter integrated into the hybrid control module. The technician needs to monitor compressor speed during diagnosis. What scan tool data parameter would most directly indicate the current compressor speed?

A. Commanded compressor RPM displayed in revolutions per minute on the scan tool data display screen during operation

B. Refrigerant high-side pressure displayed in pounds per square inch on the scan tool data display screen during operation

C. Compressor inlet refrigerant temperature displayed in degrees on the scan tool data display screen during operation

D. Cabin temperature setpoint displayed as a percentage on the scan tool data display screen during normal A/C operation

31. A hybrid vehicle's 12V auxiliary battery is being replaced after a confirmed failure. After installation of the new 12V battery, several control modules require relearning of their adaptive memory and learned values. Which procedure should the technician follow to complete the relearning?

A. Drive the vehicle for several days to allow modules to relearn automatically through normal vehicle operation in service

B. Use the OEM scan tool to manually initiate relearning procedures for affected modules requiring it after the battery change

C. Disconnect and reconnect the 12V battery several times to reset all modules to factory default settings during service

D. Replace each affected module with a new factory unit to avoid the relearning procedure entirely during the service event

32. A hybrid vehicle technician is required to wear arc-rated PPE during certain HV service procedures involving live HV components. What is the primary purpose of arc-rated clothing in this specific service application?

A. Arc-rated clothing prevents electrical shock from accidental contact with energized HV components during service work

B. Arc-rated clothing provides chemical protection against refrigerant exposure during A/C system service procedures performed

C. Arc-rated clothing protects the technician from burns caused by electrical arc-flash energy release during fault events

D. Arc-rated clothing prevents static electricity buildup during sensitive electronic component handling in dry shop conditions

33. A lithium-ion HV battery pack uses a busbar system to connect individual cells in series throughout the assembly. The OEM torque specification for the busbar mounting bolts is 8 Nm. During service, the technician accidentally overtightens one bolt to approximately 15 Nm. What is the most likely consequence of this overtightening?

A. The overtorqued bolt will provide superior electrical conductivity due to the increased clamping force on the busbar joint

B. The bolt threads will strip but the pack will continue to operate normally during vehicle service after the strip occurs

C. The pack BMM will detect the overtightening and set an appropriate DTC during vehicle operation after the bolt overtightening

D. The overtorqued bolt may damage the cell terminal threads compromising the electrical connection and creating safety concerns

34. A hybrid vehicle uses a coaxial motor design where the electric motor and reduction gearbox share the same rotational shaft axis. What is one primary advantage of this coaxial design compared to a parallel axis design?

A. Reduced overall package length compared to designs where the motor and gearbox are mounted on offset parallel shaft axes

B. Lower manufacturing cost than designs where the motor and gearbox are mounted side by side on parallel shaft axes

C. Improved cooling capacity because the motor and gearbox share the same cooling system loop in the coaxial arrangement

D. Higher torque output because the coaxial alignment increases mechanical efficiency significantly compared to offset designs

35. A hybrid vehicle's inverter is being diagnosed for a stored "Phase U Current Sensor Range" DTC. The technician verifies the wiring to the phase U current sensor is intact and the connectors show no corrosion or damage. What is the most likely cause of this DTC?

A. The motor windings have shorted internally causing abnormally high current in the U phase only during normal operation

B. The inverter has a cooling system failure causing high temperatures in the U phase circuit only during normal operation

C. The current sensor itself has failed and is providing out-of-range data values to the inverter module during operation

D. The HV battery contactor for the U phase has failed open preventing current flow through that phase during operation

36. A hybrid vehicle's heat pump A/C system uses an electronic expansion valve (EEV) controlled by the climate control module through a stepper motor. If this EEV fails in the fully open position during operation, what symptom is most likely to occur in the system?

A. The system will produce excessive cooling at all temperature settings during normal A/C operation in warm weather

B. The system will not produce proper cooling because refrigerant cannot expand and absorb heat at the evaporator in cabin

C. The compressor will overheat from excessive refrigerant flow through the system during normal A/C operation in vehicle

D. The condenser will freeze due to insufficient refrigerant flow through the high-side circuit during normal A/C operation

37. A hybrid vehicle is brought in with multiple HV-related DTCs stored in the hybrid control module. The technician is preparing to begin diagnostic work on the HV system. What is the most appropriate first step before any electrical testing of HV components?

A. Replace the most commonly failed component associated with these specific DTCs based on past repair experience records

B. Clear all DTCs from the system memory and observe whether they return during a test road test cycle in normal operation

C. Reprogram the hybrid control module with the latest available calibration software update from the manufacturer before testing

D. De-energize the HV system following manufacturer-specified procedures before any HV testing or service work begins on vehicle

38. A hybrid vehicle's HV battery pack uses a thermal management system with a dedicated liquid coolant loop. During inspection, the technician finds that the battery coolant is contaminated with oil residue. What is the most likely source of this oil contamination in the battery coolant loop?

A. Internal failure of a heat exchanger allowing oil from another system to mix with the battery coolant in the cooling loop

B. Normal coolant degradation that occurs over time in hybrid vehicle battery cooling systems during extended service life

C. Improper coolant added during previous service that contained oil from another vehicle system during a prior repair event

D. Atmospheric moisture absorption causing the coolant to break down into oil-like substances over time during normal service

39. A hybrid vehicle uses an axial-flux motor design instead of a conventional radial-flux motor for its primary drive system. What is one primary advantage of axial-flux motor design over conventional radial-flux design?

A. Axial-flux motors produce torque only in one direction limiting their use to single-direction drive applications in service

B. Axial-flux motors require simpler control electronics than conventional radial-flux motor designs of equal power rating in service

C. Axial-flux motors provide high power density in a compact disc-shaped form factor that improves vehicle packaging significantly

D. Axial-flux motors operate at much lower voltage than radial-flux designs reducing the overall HV system voltage requirements

40. A hybrid vehicle's DC-DC converter operates at a switching frequency of 100 kHz. Compared to a similar converter operating at a lower switching frequency, what is one primary advantage of this higher switching frequency design choice?

A. Lower component cost because high-frequency components are typically less expensive to manufacture than low-frequency parts

B. Smaller magnetic components and capacitors can be used due to the high switching frequency reducing component size requirements

C. Reduced electromagnetic interference because high-frequency switching operation produces less noise than lower frequency designs

D. Higher overall efficiency because higher switching frequencies always improve power conversion efficiency in any topology design

41. A hybrid vehicle's electric A/C compressor has been operating with a known low refrigerant charge condition. The compressor inverter shows the compressor running but the refrigerant pressures are very low in both high and low sides of the system. What is the primary concern with continued operation of the compressor in this condition?

A. The condenser will overheat due to lack of refrigerant flow through the high-pressure side of the system during operation

B. The expansion valve will freeze due to lack of pressure differential across the system valves during normal operation events

C. The receiver/drier will become saturated with the limited refrigerant in the system overall during continued normal operation

D. The compressor motor windings may overheat due to lack of refrigerant used for motor cooling and bearing lubrication in service

42. A hybrid vehicle technician is documenting an HV service procedure for the customer file and shop records. The documentation must include specific information for regulatory compliance and warranty protection purposes. What information is typically required in this HV service documentation?

A. PPE used during the service, HV voltage verification readings taken, and the technician's qualifications for HV service work

B. Customer satisfaction rating after service, vehicle warranty status at the time of service, and the technician's lunch break times

C. Vehicle exterior paint condition, interior cleanliness rating, and the technician's clothing color description during the service event

D. Engine oil change interval since last service, tire rotation service records, and the technician's training completion dates from school

43. A hybrid vehicle's HV battery pack uses internal cell voltage sensing with sense wires routed through a connector to the battery management module. During pack inspection, the technician finds the sense

wire connector has visibly corroded contact pins inside the connector. What is the most likely effect on hybrid system operation from this corrosion?

A. The pack will overcharge because the BMM cannot detect cell voltages accurately through the corroded sense wire connector pins

B. The pack will continue normal operation as cell sensing is redundant through multiple monitoring paths and sources in the module

C. The BMM will set sense fault DTCs and may enter reduced-power operation to protect the pack from undetected cell conditions

D. The 12V auxiliary battery will be affected because cell sensing uses 12V power through the corroded sense wire connector pins

44. A hybrid vehicle's electric power steering system uses position sensing to determine steering wheel angle and direction of rotation during driving. If the steering position sensor signal becomes intermittent during normal driving, what symptom is most likely to occur?

A. The steering wheel will lock in one direction until the position sensor is repaired or replaced through service action

B. The EPS assist may become inconsistent or shut down completely while setting steering-related DTCs in the EPS control module

C. The vehicle will not start because EPS sensor faults prevent the hybrid control module operation during the normal startup sequence

D. The steering will operate normally because position sensing is not critical for EPS operation during normal vehicle driving events

45. A hybrid vehicle's inverter contains internal gate driver circuits for each IGBT switch. These gate driver circuits are powered by isolated DC power supplies specifically designed for this application. Why is electrical isolation required for the gate driver power supplies in this inverter design?

A. To reduce the cost of the inverter assembly through use of simpler power supply designs without isolation requirements

B. To allow the IGBTs to operate at lower switching frequencies than non-isolated power supply designs would normally require

C. To improve cooling of the gate driver circuits by reducing the heat generated during normal operation in the inverter assembly

D. The IGBT emitters operate at different voltages from chassis ground requiring floating reference levels for the gate drive signals

FULL ANSWER KEY WITH EXPLANATIONS – PRACTICE EXAM 16

1. C — When no DTCs are present and the HV battery is operating normally, the most likely cause of reduced fuel economy is non-mechanical factors. Customer driving patterns such as aggressive acceleration, short trips that prevent engine warm-up, cold weather, increased cargo load, or accessory use all reduce hybrid efficiency without setting fault codes. Investigating these factors should precede any component replacement.

2. B — NiMH battery cooling filters require periodic cleaning or replacement per the OEM service maintenance schedule to prevent restricted airflow. Following the published schedule maintains proper pack cooling and prevents elevated cell temperatures that accelerate aging. Waiting for DTCs or visible overheating allows damage to occur before service is performed.

3. D — Resolver offset calibration aligns the rotor's electrical zero position with the inverter's switching reference angle. When this calibration is missing, the inverter applies stator current at the wrong angles relative to rotor position, requiring excess current to produce the same torque. The motor still functions but operates at reduced efficiency with elevated current draw.

4. A — Integrating the inverter, DC-DC converter, and boost converter into a single module allows them to share one cooling loop, one housing, and consolidated electrical connections. This reduces total mass, simplifies vehicle packaging, and lowers manufacturing complexity. The integrated approach is now standard on most modern hybrid and EV platforms.

5. C — R-1234yf systems must be evacuated completely with a vacuum pump to remove moisture and non-condensables before charging by precise weight per OEM specification. Pressure-based charging is unreliable because system pressure varies with temperature and ambient conditions. Accurate charging requires a calibrated electronic scale and the exact manufacturer's charge specification.

6. D — A healthy 12V battery should maintain at least 9.6V under a load equal to half its CCA rating. Dropping from 12.6V to 9.8V under 100A indicates internal resistance is significantly elevated and the battery cannot deliver current without excessive voltage sag. The battery cannot reliably support hybrid system startup or accessory loads and must be replaced.

7. A — Disconnecting the 12V battery erases volatile memory in many modules including adaptive transmission settings, throttle learning, EPS calibration, and brake system stored values. Documenting

these values before disconnect allows verification of proper relearning after service. Skipping this step can leave the vehicle with degraded driveability that takes weeks to relearn through normal driving.

8. B — Each cell in a series-connected pack contributes its nominal voltage to the total pack voltage. A shorted cell contributes 0V instead of its nominal 3.7V, reducing the pack total by approximately that amount. The remaining cells continue to function, but the pack is now imbalanced and operating at lower total voltage than design.

9. C — In a wye-connected three-phase motor, the resistance between any two phase terminals is the sum of two coil resistances in series. The resistance from the neutral point to one phase terminal is just one coil, which is half the phase-to-phase value. This relationship allows technicians to identify the winding topology and locate the neutral connection during testing.

10. A — The PWM carrier frequency is the rate at which the inverter switches its IGBTs to synthesize the output waveform delivered to the motor. The 8 kHz measurement is the carrier frequency, not the fundamental electrical frequency of the motor current. The motor's actual electrical frequency is much lower and varies continuously with motor speed.

11. D — Loss of the winding temperature signal prevents the inverter from knowing whether the compressor motor is at a safe operating temperature. The safety response is to enter protection mode or shut down to prevent the motor from overheating undetected during operation. Continuing to operate without thermal feedback risks insulation failure and permanent compressor damage.

12. B — Wheel speed sensors provide critical input to the regenerative braking algorithm for ABS coordination and traction monitoring during deceleration. With a failed sensor, the brake control module cannot ensure safe regen application, so the system reduces or disables regen and relies on friction braking. This protects against unsafe braking behavior on the affected wheel.

13. C — A thorough HV de-energization verification requires checking multiple points along the HV bus including the inverter input, motor terminals, and other accessible HV locations. Voltage can remain trapped in different sections of the system if a component failure prevented full discharge. Checking only one point can miss residual voltage elsewhere in the circuit.

14. A — LiFePO4 cells maintain nearly constant voltage across most of their state-of-charge range, producing a characteristically flat discharge curve. They also have superior thermal stability and resistance to thermal runaway compared to NCA or NMC chemistries. The trade-off is lower specific energy, which is why they are used more in stationary and commercial applications than in compact passenger EVs.

15. B — Axial movement of the rotor indicates the bearings supporting it have failed or worn beyond tolerance. Rotor displacement causes the air gap to vary and can allow the rotor to contact the stator, producing the grinding noise heard during operation. The motor requires teardown to replace bearings before catastrophic stator damage occurs.

16. D — Audible buzzing from a DC-DC converter typically indicates magnetostriction in the transformer or inductor core as magnetic domains shift with the switching current. While some noise is normal,

abnormal buzzing combined with aging components suggests core lamination degradation or loosening. The converter may continue operating but should be monitored for further failure indicators.

17. A — POE oil contamination must be removed by flushing with an OEM-approved refrigerant flush solvent followed by drying with dry nitrogen gas. The flush solvent dissolves and carries away the contaminated oil, while nitrogen displaces residual moisture and solvent. This is the only reliable method to restore system cleanliness before installing a new compressor.

18. C — Technician A is incorrect because not all elevated-voltage cables in hybrid systems are orange. Some 48V mild hybrid systems use blue color coding to distinguish their intermediate voltage from the main HV orange cables. Technician B correctly identifies this exception, which is documented in VDA color-coding recommendations followed by major manufacturers.

19. B — Allowing the engine to idle is the safest method for recovering a low HV battery in a hybrid vehicle. The engine drives the generator which charges the HV pack through the normal hybrid charging system at controlled rates managed by the BMM. Connecting external chargers directly to the HV pack is prohibited on most hybrids and can damage the pack or BMM electronics.

20. D — Cooling fins shed heat through natural convection, and accumulated dirt or debris reduces heat transfer by insulating the fins from surrounding air. Cleaning the fins restores heat dissipation without damaging the motor housing. This is a routine service step that should be performed during any motor inspection or related service event.

21. A — CAT III at 1000V provides the transient overvoltage protection required for distribution-level circuits and exceeds the 450V maximum operating voltage of the vehicle with significant safety margin. Lower CAT ratings or voltage limits cannot safely handle the transient spikes present on hybrid HV buses. This is the industry-standard meter rating for hybrid HV service work.

22. C — Engine cycling for cabin heat is triggered when coolant temperature falls below the threshold needed to support heater core operation while HVAC heat demand is active. The hybrid control module monitors both inputs and starts the engine to warm the coolant, then cycles it off when temperature recovers. This balances cabin comfort against fuel economy efficiency.

23. B — The electric water pump is the only source of coolant circulation through the engine in most hybrids during operation. With the pump failed, coolant cannot transfer heat from the engine block to the radiator, causing rapid overheating during normal driving. The engine control module typically responds with thermal protection and a reduced-power limp mode to prevent engine damage.

24. D — Lithium-ion battery capacity loss of approximately 25% after five years and significant mileage is consistent with normal calendar and cycle aging for hybrid pack chemistry. This is expected degradation, and the pack continues to function at the reduced capacity. Replacement is not warranted unless capacity loss is severe enough to affect drivability or set fault codes.

25. C — During steady highway cruising, the most efficient operating point places the engine at its best brake-specific fuel consumption RPM regardless of vehicle speed. MG1 acts as a continuously variable

speed governor through the planetary gear set, decoupling engine RPM from road speed. This allows the engine to run at peak efficiency while vehicle speed is maintained.

26. A — The live-dead-live procedure requires testing the multimeter on a known live voltage source before and after testing the suspected dead circuit. This confirms the meter was working correctly during the verification reading and rules out a failed meter that could have read zero on a live circuit. This is the safety standard for any electrical isolation verification.

27. B — A new replacement module typically has different state of charge and slightly different impedance than the existing aged modules in the pack. The pack must be balanced through a conditioning cycle or BMM-managed balancing routine to bring the new module into equilibrium with the others. Without this, the BMM will see persistent imbalance and may set DTCs.

28. D — Resolver-to-rotor alignment varies slightly between individual motors due to manufacturing tolerances in magnet placement and resolver mounting. Each motor requires individual offset learning regardless of part number to optimize torque production and current efficiency. This is a calibration step the inverter must perform on every motor installation, including identical replacements.

29. C — Shorted turns in the boost converter inductor create a low-resistance loop that absorbs additional energy and converts it to heat. The increased heat raises the inductor temperature, which transfers to the assembly housing and may trigger inverter thermal protection. The fault progresses until the inductor fails completely or the converter shuts down from thermal limits.

30. A — The scan tool's commanded compressor RPM parameter directly displays the speed the hybrid control module has commanded the compressor to operate at during current conditions. Pressure and temperature parameters relate to system conditions but do not directly indicate compressor speed. This is the primary parameter for diagnosing compressor speed control issues.

31. B — Many hybrid modules retain learned values in volatile memory that is lost when 12V power is interrupted during battery replacement. After 12V battery replacement, the OEM scan tool initiates specific relearning procedures for affected modules including brake initialization, steering position, and idle relearns. Skipping this step leaves the vehicle with degraded performance and possible warning messages.

32. C — Arc-rated clothing is designed to resist ignition and limit burn injuries from electrical arc-flash thermal energy. An arc flash releases intense radiant heat and energy that can cause severe burns through ordinary clothing. The arc rating specifies the energy level the clothing can withstand without breaking open and exposing skin to the heat.

33. D — Cell terminal threads are designed for the specified torque, and exceeding it stresses the threads beyond their design limit. The resulting damage may include stripped threads, cracked terminals, or compromised electrical contact that creates resistance and localized heating under load. Proper torque specification must be followed to ensure reliable and safe connections.

34. A — A coaxial motor and gearbox arrangement places both components on the same rotational axis, dramatically shortening the overall package length compared to parallel-axis designs. This compact form

allows easier integration into transverse and underfloor mounting locations. The trade-off is more complex internal layout for the motor and gearbox components in the combined housing.

35. C — Range codes specifically indicate the sensor signal is outside its expected electrical limits, pointing to the sensor itself when wiring and connectors check good. The current sensor is the source of the out-of-range data and must be replaced to restore proper inverter operation. Motor or contactor issues would produce different DTC patterns and additional related fault codes.

36. B — An electronic expansion valve that fails fully open allows refrigerant to flow without pressure drop, preventing the temperature reduction needed at the evaporator. Without proper expansion, the refrigerant cannot absorb heat efficiently, so the system fails to cool the cabin. The EEV must close partially to create the high-to-low pressure transition required for refrigeration cycle operation.

37. D — HV system de-energization following the OEM procedure is the mandatory safety first step before any electrical testing on energized HV circuits. Performing testing without de-energization exposes the technician to lethal voltage and arc-flash hazards. This safety step applies regardless of how many DTCs are present in the system memory.

38. A — Oil contamination in battery coolant typically results from internal failure of a heat exchanger that allows cross-mixing between systems. The most common source is a battery cooler that exchanges heat with another component such as an engine oil cooler or transmission cooler through a shared heat exchanger. The contaminated coolant must be replaced and the failed heat exchanger identified and repaired.

39. C — Axial-flux motors arrange their stator and rotor on parallel disc-shaped surfaces, producing torque through magnetic flux that flows parallel to the motor's axis. This geometry packages high power output into a compact, thin form factor compared to radial-flux designs of equal output. The compact shape is advantageous for in-wheel and integrated transmission applications.

40. B — Higher switching frequencies allow inductors, transformers, and capacitors to be smaller because each switching cycle moves less energy through the magnetic components. This dramatically reduces the size and weight of the magnetic components in the converter assembly. The trade-off is increased switching losses, which is why component selection and topology must be optimized for the chosen frequency.

41. D — Electric A/C compressors use refrigerant flow to cool the internal motor windings and lubricate the moving parts with entrained POE oil. Without adequate refrigerant flow, the motor overheats and the lubricant cannot reach the bearings or scrolls during operation. Continued operation in this condition damages the compressor permanently and may cause motor winding failure.

42. A — HV service documentation typically requires the PPE used during service, the voltage readings taken to verify de-energization, and the technician's certification level for HV service work. This documentation protects the shop and demonstrates compliance with safety regulations and OEM service requirements. The records support warranty claims and any future investigation of service work performed.

43. C — Corroded sense wire connector contacts create unreliable voltage readings or open-circuit conditions at the affected cell during operation. The BMM sets sense fault DTCs when it loses voltage data from a cell and enters reduced-power operation to prevent undetected overcharge or over-discharge. Cleaning or replacing the affected connector restores normal sensing and clears the fault.

44. B — An intermittent steering position sensor signal disrupts the EPS control algorithm's ability to determine steering input and provide proper assist. The system may give inconsistent assist that varies with sensor reliability and ultimately defaults to a fail-safe mode that may shut down assist entirely. DTCs related to position sensor signal quality are typical with this fault condition.

45. D — Each IGBT in a three-phase inverter has its emitter at a different voltage relative to chassis ground, particularly the upper devices whose emitters swing between bus voltage and ground during switching. The gate driver must reference the IGBT's own emitter, requiring an isolated floating power supply for each driver. This is fundamental to driving high-side IGBTs in any half-bridge or three-phase bridge topology.