PRACTICE EXAM 22: ASE L3 SIMULATION (45 Questions)

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

1. A hybrid technician notices fluid leaking from the HV battery pack during routine inspection. The technician identifies the leaking fluid as battery coolant rather than electrolyte from the cells. What is the most appropriate initial action to take in response to this finding?

A. Continue with the planned service work and report the leak after the current repair is completed in the service bay

B. Ignore the leak since coolant leaks are not as hazardous as electrolyte leaks in HV battery packs during service

C. Clean up the coolant with shop rags and check the coolant level for any further service requirements during normal work

D. Stop work immediately, contain the coolant leak, and identify the source before any further service work is performed

2. A hybrid vehicle's lithium-ion HV battery cell has been tested for capacity and internal resistance. The cell rated capacity is 75 Ah and the measured capacity is 60 Ah. The cell is also showing elevated internal resistance compared to factory specification values. Which battery metric best describes this combined assessment of cell condition?

A. State of Charge (SOC) which measures how much energy the cell can currently deliver to the vehicle drive system during use

B. Depth of Discharge (DOD) which measures how much capacity has been used since the last full charge cycle of the cell

C. State of Health (SOH) combined with State of Function (SoF) provides an overall assessment of cell condition for service

D. Coulombic Efficiency (CE) which measures the charge accepted divided by the charge delivered by the cell during operation

3. A hybrid vehicle uses a switched reluctance motor (SRM) in its drive system rather than a permanent magnet synchronous motor (PMSM). Compared to a PMSM, what is one operational characteristic of switched reluctance motor technology?

A. SRMs produce inherent torque ripple during operation requiring specific control algorithms to reduce noise and vibration

B. SRMs are more efficient than PMSMs across the entire operating range during normal vehicle operation in service

C. SRMs require rare-earth permanent magnets for proper rotor magnetization during normal motor operation in the drivetrain

D. SRMs operate at lower temperatures than PMSMs without requiring any active cooling system during normal vehicle use

4. A hybrid vehicle's inverter uses an isolation amplifier between the HV current sensor and the low-voltage control circuit board. What is the primary purpose of this isolation amplifier in the current sensing circuit design?

A. The isolation amplifier increases the current signal magnitude for better detection accuracy by the inverter controller during use

B. The isolation amplifier provides galvanic isolation between the HV measurement side and the low-voltage controller circuit

C. The isolation amplifier filters out high-frequency noise from the current sensor signal during normal inverter operation events

D. The isolation amplifier converts AC current signals into DC voltage signals for the controller to read accurately during operation

5. A hybrid vehicle uses a thermal expansion valve (TXV) in its A/C system rather than an electronic expansion valve (EEV). The technician finds the TXV is stuck in a partially open position causing poor cooling performance. What is the most likely cause of this stuck TXV condition?

A. The TXV control wiring has shorted to ground causing the valve to lose position calibration during normal operation

B. The TXV sensing bulb has lost its refrigerant charge causing erratic valve operation during normal A/C system use

C. The TXV stepper motor has failed causing the valve to remain in a partially open position permanently during operation

D. Refrigerant contamination or moisture has caused the TXV internal mechanism to bind in the partially open position

6. A hybrid vehicle's electric power steering system requires alignment between the steering wheel position and the steering rack center after certain repairs. After replacing the steering column, what procedure is typically required to restore proper EPS system operation?

A. Use the OEM scan tool to perform a steering angle sensor calibration after mechanical installation is complete in the vehicle

B. Drive the vehicle for 50 miles to allow the EPS system to self-calibrate during normal driving operation in customer use

C. Disconnect and reconnect the 12V battery to reset the EPS system to factory default settings during the service procedure

D. Replace the steering angle sensor with a new unit since steering column replacement typically damages the sensor permanently

7. A hybrid technician is reviewing safety standards for hybrid vehicle service work. Which industry standard specifically addresses functional safety for electric vehicle electrical systems and control software development?

A. SAE J1772 standards covering AC charging connector dimensions and pin assignments for hybrid vehicles in industry use

B. ASTM D120 standards covering rubber insulating glove construction materials and voltage ratings for testing in service

C. ISO 26262 standards covering functional safety of electrical and electronic systems in road vehicles for safe operation

D. NFPA 70E standards covering electrical safety in the workplace and arc-flash protection limits for industrial workers

8. A hybrid vehicle's HV battery pack uses prismatic cells rather than cylindrical cells in its construction. What is one primary advantage of prismatic cell design over cylindrical cell design in modern EV pack applications?

A. Prismatic cells produce higher specific power than cylindrical cells of equivalent capacity rating during operation events

B. Prismatic cells provide better packaging efficiency and higher volumetric energy density when assembled into a battery pack

C. Prismatic cells operate at higher temperatures than cylindrical cells without requiring any thermal management system at all

D. Prismatic cells eliminate the need for any battery management system during normal vehicle operation and charging events

9. A hybrid drive motor uses copper rotor bars rather than aluminum rotor bars in a squirrel-cage induction motor design. What is the primary advantage of copper rotor bars compared to aluminum rotor bars in this motor application?

A. Copper rotor bars cost less than aluminum rotor bars reducing motor manufacturing cost overall during production runs

B. Copper rotor bars are lighter than aluminum rotor bars improving the motor power-to-weight ratio during normal operation

C. Copper rotor bars require fewer manufacturing steps than aluminum bars during the motor production process at the factory

D. Copper rotor bars have lower electrical resistance providing higher operating efficiency than aluminum rotor bars during use

10. A hybrid vehicle's HV system uses a "Y-capacitor" network between the HV bus and chassis ground for EMI filtering. The technician is testing for excessive HV bus leakage to chassis ground. What measurement is most appropriate for diagnosing Y-capacitor-related leakage issues?

A. Voltage drop across the Y-capacitor during normal HV system operation in driving conditions during the test event

B. Continuity test from the HV bus to chassis ground using an ohmmeter at low voltage settings during normal testing

C. Isolation resistance test using a megohmmeter from HV bus to chassis ground at the proper specified test voltage for the system

D. Current measurement through the Y-capacitor during HV system de-energization sequence procedures in the shop bay

11. A hybrid vehicle's heat pump A/C system has been retrofitted with a new compressor that uses different oil than the original system. The technician notes the new compressor specifies POE oil but the original system used PAG oil for compatibility. What action is required for proper retrofit completion?

A. Recover the refrigerant, flush all system components to remove the PAG oil completely, then refill with the proper POE oil

B. Add additional POE oil to the system to dilute the existing PAG oil contamination during the retrofit procedure in service

C. Continue with the retrofit using mixed PAG and POE oil since both oils have similar chemical composition during operation

D. Reinstall the original PAG-compatible compressor since POE oil cannot work with the existing system components installed

12. A hybrid vehicle technician is examining a service manual for safety procedures. The manual indicates that the HV system must be de-energized using a specific sequence including PPE donning, ignition off, 12V disconnect, service plug removal, and zero voltage verification. What is the primary reason for following this exact specific sequence?

A. The sequence reduces the time required for the service procedure improving overall shop efficiency during HV service work

B. The sequence systematically reduces electrical hazards at each step protecting the technician throughout the entire procedure

C. The sequence allows the hybrid control modules to enter a safe shutdown mode before any electrical work begins in the bay

D. The sequence prevents damage to the HV battery cells by avoiding sudden current changes during the de-energization work

13. A hybrid vehicle's HV battery pack uses pouch cells rather than prismatic or cylindrical cells in its construction. The technician is inspecting the pack for damage or degradation indicators. What inspection technique is most important specifically for pouch cells?

A. Voltage measurement of each individual cell to detect any cell voltage abnormalities present in the pack assembly

B. Internal resistance measurement of each cell to detect any cell impedance issues present in the pack assembly

C. Visual inspection for swelling, bulging, or pouch deformation indicating internal cell degradation has occurred

D. Temperature measurement of each cell during operation to detect any thermal management issues present in the pack

14. A hybrid drive motor uses ferrite magnets rather than rare-earth (neodymium) magnets in the rotor assembly. What is one operational characteristic of ferrite magnets compared to rare-earth magnets in this motor application?

A. Ferrite magnets have higher temperature tolerance than rare-earth magnets requiring no cooling system at all during operation

B. Ferrite magnets produce more torque per unit volume than rare-earth magnets in motor applications during normal operation

C. Ferrite magnets are more expensive than rare-earth magnets per unit of magnetic flux produced in motor applications generally

D. Ferrite magnets have lower magnetic flux density requiring larger motors for the same power output compared to rare-earth designs

15. A hybrid vehicle's inverter is being analyzed during normal operation. The technician uses a scan tool to view inverter parameters during a road test. The scan tool shows "Inverter Internal Temperature" reading 95°C while the inverter coolant temperature reads 60°C. What does this temperature difference indicate?

A. Normal operation as IGBT junction temperatures are typically higher than the coolant temperature flowing through the inverter

B. Failed inverter coolant pump causing inadequate cooling of the inverter internal components during normal operation events

C. Failed inverter temperature sensor providing incorrect readings to the hybrid control module during normal vehicle operation

D. The inverter is operating outside specification and will shut down in protection mode imminently from excessive heat buildup

16. A hybrid vehicle's electric A/C compressor is being inspected after the customer reports unusual noise during normal operation. The technician finds metallic debris in the refrigerant oil drained from the system. What does this finding most likely indicate about the compressor condition?

A. Normal wear of the compressor scroll plates during extended hybrid vehicle service over many years of operation in the field

B. Internal compressor mechanical failure that has contaminated the entire A/C system with metal debris throughout the circuit

C. Contamination from the receiver/drier desiccant material that requires only filter replacement during the service procedure

D. Refrigerant contamination from a different vehicle service performed previously on the system in another shop visit

17. A hybrid vehicle's brake-by-wire system uses a backup hydraulic system that activates if the primary electronic braking system fails during operation. During brake system testing in the shop, the technician notes the backup hydraulic system did not activate when commanded. What is the most likely cause of this failure?

A. The brake pedal stroke sensor has failed preventing the system from detecting backup activation requests during testing

B. The hybrid control module has not received the brake activation signal from the brake control module during the test

C. The mechanical linkage between the brake pedal and the master cylinder has failed preventing backup activation in the test

D. The electronic stability control system has overridden the backup hydraulic activation command during testing in the shop

18. A hybrid technician is using a megohmmeter to test HV insulation resistance after a major repair. The technician needs to safely discharge any test voltage that remains on the system after the testing is complete. What feature of modern megohmmeters typically handles this discharge function?

A. The megohmmeter automatically discharges the test voltage when the test button is released by the user during testing

B. The megohmmeter includes a separate manual discharge button that must be pressed after each individual test sequence is run

C. The megohmmeter cannot discharge test voltage and requires an external resistor for the discharge function after the test

D. The megohmmeter includes an automatic safety discharge circuit that activates after the test is complete during normal use

19. A hybrid vehicle's HV battery pack has been opened for service work. The technician finds a service plug that has visible signs of arcing or burning damage on the contact surfaces inside the plug. What is the most appropriate action to take regarding the damaged service plug?

A. Clean the contact surfaces with electrical contact cleaner and reinstall the service plug for continued use in the vehicle

B. Replace the damaged service plug with a new OEM replacement part because damaged contacts create high-resistance connections

C. Reuse the service plug since visible arcing is normal during HV service plug installation and removal procedures over time

D. Tighten the service plug mounting bolts more securely to compensate for the damaged contact surfaces during reinstallation

20. A hybrid vehicle's drive motor uses a coolant-cooled stator with internal coolant passages running through the motor housing. During inspection, the technician finds coolant has entered the motor housing through a failed internal coolant seal. What is the most appropriate action regarding this contaminated motor?

A. Replace the motor assembly because coolant contamination damages the stator winding insulation system and is not repairable

B. Drain the coolant from inside the motor housing and reassemble the unit for continued operation in the vehicle service

C. Flush the motor internal components with isopropyl alcohol then reassemble the unit for continued operation in the vehicle

D. Continue normal service since small amounts of coolant in the motor housing cause no significant damage during normal operation

21. A hybrid vehicle's DC-DC converter operates with an input voltage of 360V DC and an output voltage of 14V DC for the 12V system. The converter is rated for 2 kW continuous output power during normal vehicle operation. What is the approximate continuous input current under full output load conditions?

A. 2.0 amperes input current at 360V DC during continuous full-load operation of the DC-DC converter in service

B. 4.5 amperes input current at 360V DC during continuous full-load operation of the DC-DC converter in service

C. 6.0 amperes input current at 360V DC during continuous full-load operation of the DC-DC converter in service

D. 14.0 amperes input current at 360V DC during continuous full-load operation of the DC-DC converter in service

22. A hybrid vehicle's heat pump A/C system uses temperature sensors at multiple points in the refrigerant circuit. The technician finds that the discharge temperature at the compressor outlet is significantly higher than the normal specification value. What does this finding most likely indicate about the system?

A. Low refrigerant charge causing reduced compressor cooling and elevated discharge temperatures during normal operation events

B. Failed condenser cooling fan motor causing high head pressure and elevated discharge temperatures during normal A/C use

C. Restricted expansion valve causing reduced refrigerant flow and elevated discharge temperatures during normal A/C operation

D. Any of the above conditions can cause elevated compressor discharge temperatures requiring further diagnosis to identify root cause

23. A hybrid technician is preparing PPE for HV service work in the shop. What is the correct recommended sequence for donning HV PPE before beginning any HV service work in the bay?

A. Insulating rubber undergloves first, then the leather protector overgloves, then the face shield and other required PPE items

B. Face shield first, then the insulating rubber gloves, then the leather protector overgloves and other required PPE items

C. Leather overgloves first to protect the insulating gloves, then the insulating rubber gloves are pulled on inside them

D. All PPE items can be donned in any order as long as everything is in place before HV service work begins in the bay

24. A hybrid vehicle has been involved in a vehicle fire during a customer incident. After the fire is fully extinguished by emergency responders, the HV battery may still pose hazards from re-ignition or thermal events. What is the most appropriate procedure for handling the post-fire HV battery?

A. Transport the vehicle to the salvage yard immediately for disposal in standard automotive scrap streams after the fire event

B. Follow OEM emergency response procedures and consider extended monitoring for potential thermal runaway events after the fire

C. Allow the vehicle to sit for 24 hours then resume normal service procedures on the HV battery system after the fire event

D. Remove the HV battery immediately from the vehicle to prevent any further damage to other vehicle systems after the fire

25. A hybrid vehicle uses an axial-flux drive motor with a "yokeless and segmented armature" (YASA) design topology. What is one primary advantage of this YASA motor design compared to conventional radial-flux motor designs?

A. YASA motors require no inverter or power electronics for proper operation in hybrid vehicles during normal driving conditions

B. YASA motors operate at lower voltage than conventional motors reducing HV system complexity and component requirements

C. YASA motors provide high torque density in a compact form factor with reduced overall mass for the same power output

D. YASA motors eliminate the need for any position sensor or feedback for proper motor control during normal operation events

26. A hybrid vehicle's HV charging system uses a Combined Charging System (CCS) connector for DC fast charging at high-power charging stations. The CCS connector contains both AC and DC charging pins in a single physical connector body. Which pins handle the actual DC fast-charging current flow during a DC charging session?

A. The L1, L2, and L3 AC power pins carry the DC fast-charging current to the vehicle during DC charging session events

B. The CP (Control Pilot) and PP (Proximity Pilot) signal pins carry the DC fast-charging current to the vehicle during DC charging

C. The PE (Protective Earth) and N (Neutral) pins carry the DC fast-charging current to the vehicle during DC charging events

D. The two large DC power pins located below the AC pins carry the DC fast-charging current to the vehicle during DC charging

27. A hybrid vehicle's electric A/C compressor has been replaced and the system has been recharged with the correct refrigerant amount. The technician notes that the system is not cooling properly even after recharge. The high-side pressure is slightly low and the low-side pressure is also slightly low. The compressor is operating at commanded speed. What component should be checked next?

A. The expansion valve or orifice tube for proper refrigerant metering and flow restriction at the evaporator inlet location

B. The condenser cooling fan motor for proper operation during system pressure testing in the shop service bay area now

C. The refrigerant charge by recovering and weighing to verify the correct system charge amount despite the recent recharge

D. The receiver/drier for moisture absorption that affects cooling capacity during system operation in normal driving conditions

28. A hybrid technician is required to test HV insulation resistance after a major repair to the HV system. The OEM specifies a test voltage and a minimum acceptable insulation resistance value for the test. If the test shows insulation resistance below the OEM minimum value, what is the most appropriate next action?

A. Document the low insulation resistance reading and continue with normal service to return the vehicle to customer operation

B. Locate and repair the source of HV system leakage before returning the vehicle to customer service for safety considerations

C. Clear all DTCs from the hybrid control module memory and retest the insulation resistance after the DTC clear procedure

D. Reprogram the hybrid control module with the latest available calibration software before retesting the insulation value

29. A hybrid vehicle's HV battery pack uses a "first-fault tolerant" safety design philosophy. What does this design philosophy mean for the battery pack safety architecture during normal vehicle operation and any fault events?

A. The pack will be automatically replaced upon the first detected fault to ensure continued vehicle operation for the customer

B. The pack will continue operation indefinitely despite multiple failures occurring in different cells during the service life

C. The pack is designed to detect any fault during the first day of vehicle operation only at the dealership before customer delivery

D. The pack remains in a safe condition (not necessarily fully functional) after a single fault occurs in any component of the system

30. A hybrid vehicle's drive motor uses a Y-Δ (wye-delta) switchable winding configuration. The motor operates in wye configuration at low speeds and switches to delta configuration at high speeds during vehicle operation. What is the primary advantage of this switchable winding design?

A. Reduced motor manufacturing cost by eliminating the need for a sophisticated inverter and control system in the drivetrain

B. Increased motor reliability by allowing continued operation if one of the two configurations fails completely during use

C. Optimized motor performance across the speed range with high torque at low speed and high power output at high speed

D. Reduced overall motor weight by allowing smaller windings to be used in both the wye and delta configurations in design

31. A hybrid vehicle uses an integrated onboard charger that supports bidirectional operation, meaning the vehicle can both charge from the grid and discharge power back to the grid (V2G) or to external loads (V2L). What is the primary purpose of this bidirectional charging capability?

A. Allow the vehicle to provide power back to the grid or to external loads during emergencies or peak demand events in the grid

B. Reduce the time required for charging by using both AC and DC charging simultaneously during a single charging session event

C. Eliminate the need for a separate DC-DC converter in the hybrid drivetrain by sharing the charger function with other components

D. Improve charging efficiency by reducing power conversion losses during normal charging operation at the home charging station

32. A hybrid vehicle's electric A/C compressor uses three-phase AC input from a dedicated inverter section integrated into the hybrid control module. The technician needs to test the compressor without removing it from the system or disconnecting electrical connections. What scan tool function is most useful for this diagnostic purpose?

A. Read existing DTCs and clear them to observe whether the system functions properly after the clear procedure during operation

B. Bidirectional control function to activate the compressor at a commanded speed and verify proper operation response from the unit

C. Reprogram the compressor inverter control module with the latest software calibration to address any operating issues present

D. Monitor only the high-side and low-side refrigerant pressure parameters during normal vehicle operation conditions in the shop

33. A hybrid technician is examining an HV cable insulation during a routine service inspection. The cable shows minor surface abrasions on the orange outer jacket but no exposed conductor or visible internal damage. What is the most appropriate action regarding this damaged HV cable?

A. Apply electrical tape over the damaged area to prevent further abrasion during normal vehicle operation in customer service

B. Continue normal service since minor surface abrasions on the outer HV cable jacket are not a safety concern during operation

C. Use heat shrink tubing to reinforce the abrasion area while maintaining the cable's electrical insulation properties for service

D. Replace the HV cable assembly because any damage to the cable jacket compromises the cable's insulation integrity and ratings

34. A hybrid vehicle's HV battery pack uses a contactor system that includes a pre-charge resistor in series with a separate pre-charge contactor, both in parallel with the main contactor. During startup, the pre-charge contactor closes first to limit inrush current, then the main contactor closes after pre-charge is complete. What happens if this sequence is reversed and the main contactor closes first?

A. Inrush current can weld the main contactor contacts closed and damage the bus filter capacitors in the inverter assembly

B. The vehicle will not start because the hybrid control module detects the incorrect sequence and prevents startup operations

C. The 12V auxiliary battery will be overcharged because the contactor coil receives extra voltage from the main contactor coil

D. The HV battery cooling system will activate at maximum capacity to compensate for the incorrect contactor sequence event

35. A hybrid drive motor is being inspected for excessive vibration during normal operation in the vehicle. The technician suspects rotor imbalance is causing the vibration. What test method is most appropriate for confirming rotor imbalance as the cause of the vibration?

A. Measure the resistance between each motor phase and the chassis ground using a megohmmeter at the proper test voltage value

B. Use a scan tool to view the resolver position data during normal motor operation in the vehicle during a road test event

C. Use a vibration analyzer to measure motor vibration frequency and amplitude during motor rotation across the operating range

D. Replace the motor mounts with new factory units and observe whether vibration improves during operation after replacement

36. A hybrid vehicle's inverter uses a programmed "deadtime" between switching the upper and lower IGBTs of each phase leg during normal operation. What is the primary purpose of this deadtime delay in the inverter switching control sequence?

A. The deadtime improves overall motor efficiency by reducing switching losses in the IGBT modules during normal operation events

B. The deadtime prevents shoot-through (simultaneous conduction of upper and lower IGBTs causing a direct short circuit across the bus)

C. The deadtime allows the motor windings to charge fully between switching events in the inverter during normal operation cycles

D. The deadtime reduces electromagnetic interference generated by the inverter during normal operation in the vehicle drivetrain

37. A hybrid vehicle's PTC electric cabin heater is connected directly to the HV bus through a dedicated relay. The technician notes the heater is drawing less power than commanded by the climate control module. The HV bus voltage is normal at the heater input terminals. What is the most likely cause of the reduced power draw?

A. The 12V auxiliary battery voltage is too low affecting the heater command signal accuracy from the climate controller module

B. The hybrid control module has failed and is providing incorrect commands to the PTC heater control unit during normal operation

C. The cabin air temperature sensor has failed and is providing incorrect signals to the climate control module during operation

D. Aging of the PTC heating elements has increased their effective resistance reducing the power draw at the given voltage level

38. A hybrid vehicle's electric A/C compressor draws power from the HV bus through a dedicated relay controlled by the hybrid control module. The technician finds the relay coil is energized as commanded but the compressor is not operating during the test. What test should be performed first to diagnose this condition?

A. Replace the compressor with a new unit and observe whether the operation improves after replacement in the service bay area

B. Replace the relay with a new factory unit since the coil is energized but the contacts are not closing properly during operation

C. Test the relay output (load side) for proper voltage when commanded to determine if the relay contacts are actually closing

D. Reprogram the hybrid control module with the latest software calibration to address the operating issue during the diagnosis

39. A hybrid vehicle's HV system uses a "high-voltage interlock loop" (HVIL) that monitors all HV connectors throughout the vehicle. The technician finds the HVIL circuit reads open at the inverter through diagnostic testing. The technician inspects the inverter connector and finds it properly seated with no visible damage. What is the most likely next diagnostic step?

A. Test the HVIL continuity through the inverter using a multimeter to identify the specific break location inside the inverter

B. Replace the inverter assembly since the HVIL fault indicates internal inverter component failure has been detected during testing

C. Clear the HVIL DTC and observe whether it returns during the next vehicle drive cycle in normal operation in customer service

D. Reprogram the inverter with the latest available software calibration to address the HVIL communication issue during testing

40. A hybrid vehicle uses a 96-cell lithium-ion battery pack with each individual cell rated at 3.7V nominal voltage. What is the approximate nominal pack voltage at the standard rest state during normal operation?

A. 296 volts nominal pack voltage at standard rest state for the 96-cell lithium-ion battery pack during normal vehicle operation

B. 355 volts nominal pack voltage at standard rest state for the 96-cell lithium-ion battery pack during normal vehicle operation

C. 400 volts nominal pack voltage at standard rest state for the 96-cell lithium-ion battery pack during normal vehicle operation

D. 480 volts nominal pack voltage at standard rest state for the 96-cell lithium-ion battery pack during normal vehicle operation

41. A hybrid vehicle's drive motor has been replaced with a new factory unit. The technician notes that the new motor has been installed correctly but the inverter shows DTCs related to motor temperature sensor open circuit during the first test drive. The temperature sensor wiring continuity has been verified intact through testing. What is the most likely cause of the DTC?

A. The new motor temperature sensor has failed during initial installation requiring sensor replacement now before service completion

B. The hybrid control module needs reprogramming after motor replacement to recognize the new motor temperature sensor calibration

C. The temperature sensor connector was not fully engaged during motor installation creating an intermittent open circuit fault path

D. The motor temperature sensor uses a different resistance characteristic requiring scan tool calibration after install in the system

42. A hybrid vehicle's HV bus uses both X-capacitors and Y-capacitors in its EMI filter circuit. What is the typical location of X-capacitors compared to Y-capacitors in the filter network design used in modern hybrid vehicle electrical systems?

A. X-capacitors are connected between HV positive and chassis ground, while Y-capacitors are between HV negative and chassis ground

B. X-capacitors are connected only on the AC charging input while Y-capacitors are only on the DC bus output side during operation

C. X-capacitors are connected only on the DC bus output while Y-capacitors are only on the AC charging input during normal operation

D. X-capacitors are connected between HV positive and negative buses (line-to-line), Y-capacitors from each HV line to chassis ground

43. A hybrid vehicle is being diagnosed for a customer complaint of poor A/C cooling performance. During the inspection, the technician finds the cabin air filter is severely clogged with debris and dust accumulated over the service interval. What effect does this filter condition have on overall A/C system performance during normal operation?

A. Reduced airflow over the evaporator decreasing cooling capacity and possibly causing evaporator freeze-up during normal operation

B. Increased refrigerant pressure throughout the system due to the restriction in the cabin airflow path during A/C operation events

C. No effect on A/C system performance since the cabin filter only affects the air entering the cabin compartment after the evaporator

D. Increased compressor speed to compensate for the reduced airflow through the cabin air filter assembly during normal operation

44. A hybrid vehicle's regenerative braking system blends regen and friction braking during normal stopping events. The technician notes the system is providing less regenerative braking than expected during normal stops. The HV battery SOC is at 40% and within the normal operating range. The HV battery temperature is also normal at the time of testing. What is the most likely cause of this reduced regenerative braking?

A. Failed wheel speed sensor causing the system to default to friction braking for safety reasons during normal stopping events

B. Failed brake pedal stroke sensor causing the system to incorrectly interpret driver braking demand during normal stops on dry pavement

C. Failed temperature sensor in the HV battery causing the system to limit regenerative braking acceptance during normal stops in service

D. Failed regenerative braking motor causing the system to default to friction-only braking during normal stops in the customer service

45. A hybrid vehicle's HV battery pack uses internal cell heaters for cold-weather operation that operate directly from the HV bus voltage. The technician finds that one specific cell heater is drawing significantly less current than the other heaters in the pack. What is the most likely cause of this reduced current draw?

A. Normal manufacturing variation between individual cell heater resistance values during pack assembly at the factory production line

B. The HV battery management module has reduced power to that specific heater for cell balancing purposes during normal operation

C. Aging or partial degradation of the affected heater element has increased its resistance reducing current draw at the given voltage

D. The cell adjacent to that heater is at a higher state of charge requiring less heating from the cold-weather heater during operation

FULL ANSWER KEY WITH EXPLANATIONS — PRACTICE EXAM 22

1. D — Any fluid leak from an HV battery pack is a stop-work condition until the source and fluid type are confirmed and contained. Battery coolant leaks can lead to insulation breakdown if the coolant contacts HV components, and the leak source must be identified to determine whether internal cell damage is involved. Containing and diagnosing the leak first protects both the technician and the vehicle.

2. C — State of Health describes capacity loss relative to the original rated capacity, while State of Function combines SOH with internal resistance and other metrics to assess actual deliverable performance. Together they provide the complete picture of cell condition needed for service decisions. SOC and DOD describe instantaneous charge state, not aging condition.

3. A — Switched reluctance motors produce torque only when the stator phases are switched in sequence to attract rotor poles, which creates inherent torque pulsations between switching events. Sophisticated control algorithms and careful inverter design are used to smooth out this torque ripple and reduce audible noise. The trade-off is design complexity in exchange for a robust rotor with no magnets or windings.

4. B — Isolation amplifiers transmit the current sensor signal across an isolation barrier (typically optical, magnetic, or capacitive) without any direct electrical connection between HV and LV sides. This galvanic isolation protects the low-voltage controller from HV exposure and prevents HV faults from propagating into vehicle electronics. The isolation is the primary safety function, not amplification or filtering.

5. D — Mechanical thermal expansion valves rely on precise internal pin and seat geometry to meter refrigerant flow accurately. Moisture in the system can freeze at the valve seat or carbon deposits and metal debris from compressor wear can lodge in the mechanism, binding it in a partial position. The valve must be replaced if it fails internally because field repair is not feasible.

6. A — The steering angle sensor must be calibrated whenever its mechanical mounting reference is disturbed, including any steering column replacement. The OEM scan tool initiates the learn routine that defines straight-ahead as the center reference position. Without this calibration, the EPS module receives incorrect angle data and assist behavior is unpredictable.

7. C — ISO 26262 is the international standard for functional safety of electrical and electronic systems in road vehicles, including the rigorous hazard analysis, safety integrity levels, and software development processes used in EV and hybrid systems. The standard defines how systems must be designed and verified to ensure they fail safely. J1772, D120, and NFPA 70E address different topics entirely.

8. B — Prismatic cells are rectangular and pack tightly together with minimal wasted space between cells, producing higher volumetric energy density than cylindrical cells of equivalent total capacity. The rectangular form also allows direct surface cooling and structural integration into the pack housing. The trade-off is higher manufacturing complexity compared to standardized cylindrical cells.

9. D — Copper has approximately 60% lower electrical resistivity than aluminum, so copper rotor bars produce less I^2R heating during operation. The reduced rotor losses translate directly into higher motor efficiency and lower operating temperatures, especially at high loads. The trade-off is higher manufacturing cost and slightly higher rotor mass compared to aluminum bars.

10. C — Megohmmeter isolation resistance testing applies a known DC voltage between the HV bus and chassis ground to measure any leakage current path. If Y-capacitors have aged, leaked, or developed internal faults, the measured isolation resistance drops below specification. This is the standard quantitative test for HV isolation health and identifies Y-capacitor degradation directly.

11. A — POE and PAG oils are not miscible and contaminate each other when mixed, reducing the dielectric strength critical for electric compressor motor protection. Retrofitting requires complete recovery of refrigerant, mechanical flushing of all accessible components to remove the original oil, and refilling with the new compatible oil. Mixing the oils causes premature compressor failure.

12. B — The de-energization sequence is engineered so each step reduces a specific electrical hazard: PPE protects against contact, ignition off prevents startup commands, 12V disconnect drops contactor coil holding power, service plug removal opens the HV pack internally, and zero voltage verification confirms safe condition. Following the steps in order ensures no hazard remains active when the next step is performed. Reordering skips protections and increases risk.

13. C — Pouch cells use flexible aluminum-polymer laminate packaging that visibly deforms when internal gas generation occurs from cell degradation or thermal events. Swelling, bulging, or pouch deformation is an immediate visual indicator of internal cell failure that may not be detectable through electrical measurements alone. Any swollen pouch cell must be replaced before further service.

14. D — Ferrite (ceramic) magnets have significantly lower magnetic flux density than rare-earth neodymium magnets, so motors using ferrite must be physically larger to produce equivalent torque output. The trade-off is far lower material cost and no rare-earth supply chain dependency. This makes ferrite an attractive alternative when size constraints allow the larger motor envelope.

15. A — IGBT junction temperatures inside the inverter are always higher than the surrounding coolant temperature because heat flows from the active devices through the heat sink into the coolant. A 35°C difference between internal IGBT temperature and coolant temperature is within normal operating range. The temperatures rising in tandem confirms the cooling system is functioning as designed.

16. B — Metallic debris in refrigerant oil indicates internal mechanical wear of compressor components such as scrolls, bearings, or valve plates. This contamination has likely circulated throughout the refrigerant system and will damage the new compressor unless the system is flushed and the drier replaced. The compressor must be replaced and the system fully decontaminated to restore reliable operation.

17. C — The backup hydraulic system relies on a physical mechanical linkage between the brake pedal and the master cylinder to apply braking pressure directly when electronic systems fail. If this mechanical linkage has failed, no backup braking can occur regardless of electrical commands. The mechanical fallback is a fundamental safety feature that must be verified mechanically.

18. D — Modern megohmmeters include automatic discharge circuits that engage at the end of each test to safely bleed any voltage that may remain on the device under test. This protects the user from exposure to a stored charge that would otherwise be at the megohmmeter's test voltage. Older meters required manual shorting of the test leads before disconnection.

19. B — Damaged service plug contacts create high-resistance connections that overheat under load and can cascade into welded contacts or arcing damage during operation. Cleaning cannot restore the contact surface integrity, and the plug is a critical safety component for HV isolation. Replacement with a new OEM plug is the only acceptable repair.

20. A — Coolant contamination of motor windings is not field-repairable because coolant penetrates the insulation system and conducts current paths that lead to phase-to-phase or phase-to-ground shorts. Drying alone cannot restore the dielectric strength of the affected insulation. The motor must be replaced to ensure reliable and safe operation.

21. C — Current equals power divided by voltage, so 2000W ÷ 360V ≈ 5.56A, which rounds to approximately 6A. This is the input current required to deliver 2 kW of output assuming high converter efficiency. In practice, actual input current is slightly higher because of internal converter losses, but 6A is the closest approximation.

22. D — Elevated compressor discharge temperature can result from low refrigerant charge, restricted condenser airflow, restricted expansion valve, or other system issues that affect heat transfer or refrigerant flow. The technician must perform additional diagnosis to differentiate between these possibilities. None of the individual causes can be confirmed from the discharge temperature reading alone.

23. A — The proper donning sequence places the rubber insulating gloves directly against the skin, with the leather protectors worn over them to prevent mechanical damage to the rubber. Other PPE such as the face shield follows after the gloves are in place. This sequence ensures the dielectric barrier is intact and protected before any other equipment is positioned.

24. B — Post-fire HV batteries can experience delayed thermal runaway hours or even days after the initial fire, even when no flames are visible. OEM emergency procedures define safe storage, monitoring, and disposal practices required to manage this risk. Extended monitoring in an outdoor area away from structures is typically required before final handling.

25. C — Yokeless and segmented armature designs eliminate the iron back-yoke and use modular stator segments, dramatically reducing mass while increasing torque per kilogram. The disc-shaped axial-flux geometry provides high torque density in a compact form factor that fits well in EV applications. The trade-off is more complex manufacturing of the segmented stator assembly.

26. D — The CCS (Combined Charging System) connector adds two large DC pins below the AC pins of the J1772 or Type 2 connector to handle the high-current DC charging flow during DC fast charging. The AC pins remain unused during DC fast charging, while the DC pins deliver the full charging current directly to the HV battery through the onboard contactors. This combined design uses one inlet for both AC and DC charging.

27. A — Slightly low pressures on both sides with confirmed correct refrigerant charge and a functioning compressor point to a restriction at the metering device. A partially blocked expansion valve or orifice tube reduces refrigerant flow into the evaporator, lowering both pressures and impairing heat absorption. Inspecting the metering device is the appropriate next diagnostic step.

28. B — An insulation resistance reading below OEM specification indicates an active leakage path that must be located and repaired to restore safe operation. Documenting and ignoring the result is unsafe, and clearing DTCs or reprogramming modules does not address the physical leakage source. The technician must isolate and repair the source before returning the vehicle to service.

29. D — A first-fault tolerant design ensures that any single component failure in the HV system results in a safe state rather than a hazardous condition. The pack may lose some functionality, but it cannot create a shock, fire, or other hazard from a single fault. This design philosophy is fundamental to safety-critical automotive electrical systems.

30. C — Wye configuration provides higher torque at low speeds because the windings see higher voltage per turn, while delta configuration extends the speed range by reducing back-EMF at high speeds. The switchable design lets the motor optimize for both operating regions without requiring an oversized inverter or motor. This dual-mode operation maximizes the usable performance envelope.

31. A — Bidirectional charging allows energy to flow from the vehicle battery back into the grid (V2G) or to external loads (V2L), providing backup power during outages and grid support during peak demand events. The vehicle becomes a mobile energy storage resource available for both transportation and stationary applications. This capability is a key feature of modern EV platforms.

32. B — Bidirectional scan tool control commands the compressor directly to verify operation independent of the vehicle's normal control logic. This isolates compressor and inverter response from sensor, climate module, and command signal issues that might otherwise mask the actual fault. It is the most direct test for confirming compressor functionality without removing the unit.

33. D — Even minor damage to an HV cable jacket can compromise the dielectric and EMI shielding properties that protect the system and the technician. Field repairs with tape or heat shrink are not approved because they cannot restore the original cable's certification or specifications. The cable assembly must be replaced as a complete unit to maintain safety integrity.

34. A — Closing the main contactor directly onto discharged bus capacitors creates a near-short condition that draws thousands of amperes of inrush current for a brief moment. This inrush can weld the contactor contacts shut and damage the capacitors, the contactor, and connected components. The pre-charge sequence is essential to limit this inrush to safe levels.

35. C — A vibration analyzer measures vibration amplitude across the frequency spectrum and identifies the rotational frequency components characteristic of rotor imbalance. Imbalance produces a vibration peak at the motor's rotational frequency and its harmonics. This is the standard diagnostic tool for distinguishing imbalance from other vibration sources such as bearing wear or alignment issues.

36. B — Shoot-through occurs when both the upper and lower IGBT of a phase leg conduct simultaneously, creating a direct short across the DC bus that produces destructive current spikes. Deadtime is a short delay programmed between switching events to ensure one IGBT fully turns off before the other turns on. This protection is essential to inverter reliability and prevents catastrophic failure.

37. D — PTC heating elements increase in resistance as they age due to gradual changes in the ceramic material structure. With normal HV bus voltage applied to a higher-resistance element, the current draw and resulting power output drop proportionally. The heater still functions but at reduced capacity, eventually requiring replacement when output falls below acceptable levels.

38. C — A relay coil being energized does not confirm the contacts have actually closed. Testing the load-side output for proper voltage when commanded verifies whether the contacts are physically closing and conducting current. If voltage is absent on the load side despite coil energization, the contacts have failed open and the relay must be replaced.

39. A — An open HVIL at the inverter with the connector properly seated points to a break in the interlock circuit somewhere inside the inverter or in its wiring. Continuity testing through the inverter with a multimeter identifies whether the break is internal to the inverter or in the external harness. This pinpoints the repair location before any component replacement.

40. B — Pack voltage equals the cell count multiplied by the nominal cell voltage, so 96 × 3.7V = 355.2V, approximately 355V. This nominal voltage rises slightly above this value at full charge and falls below it at low SOC. Most modern hybrid and EV lithium-ion packs are designed around this 96-cell, 355V nominal configuration.

41. C — A common installation error is incomplete engagement of small electrical connectors during motor installation, especially temperature sensor connectors that can require firm pressure to seat fully. Verified wiring continuity through the connector pins does not guarantee proper mechanical engagement at the connector body. Reseating the connector typically resolves the open-circuit DTC.

42. D — X-capacitors are connected between the HV positive and negative buses (line-to-line) to filter differential-mode noise, while Y-capacitors are connected from each HV bus to chassis ground to filter common-mode noise. The two capacitor types handle different EMI modes and operate at different voltage stresses. This is the standard EMI filter topology used in HV automotive electrical systems.

43. A — A clogged cabin air filter restricts airflow over the evaporator, reducing heat transfer from the cabin air into the refrigerant. With limited airflow, the evaporator surface temperature drops below freezing and ice forms on the fins, further blocking airflow and creating a positive feedback loop. Replacing the filter restores normal A/C performance.

44. B — With SOC and battery temperature both normal, the most likely cause of reduced regenerative braking is incorrect interpretation of the driver's braking demand by the brake control module. A failed or drifting brake pedal stroke sensor sends inaccurate pedal position data, causing the system to underestimate the demanded braking force and apply less regen than appropriate. Verifying the stroke sensor signal is the appropriate diagnostic step.

45. C — PTC heating elements increase in resistance as they age, and aging affects individual heater elements differently across the pack. The aged heater draws less current at the same applied voltage, producing less heat than the other heaters in the pack. Replacing the affected heater restores uniform heating performance across the pack assembly.