

PRACTICE EXAM 7: ASE L3 SIMULATION (45 Questions)

1. A technician accidentally drops a Class 0 rubber insulating glove on the shop floor while preparing for HV service. The glove appears intact with no visible damage to the rubber surface. What is the correct action before continuing high-voltage work on the vehicle?

- A. Wipe the glove thoroughly with a clean shop towel and continue using it for HV service work
- B. Visually inspect the glove for damage and continue using it if no surface defects are found
- C. Pour talcum powder inside the glove and continue using it if the powder distributes correctly
- D. Perform an air-inflation leak test or remove the glove from service until laboratory re-testing

2. A technician is testing HV system isolation using a megohmmeter at 500V DC. The vehicle is fully de-energized, capacitors are confirmed discharged, and all HV connectors remain intact. From the HV positive bus to chassis ground, the meter reads 20 megohms. What does this reading indicate?

- A. Failed insulation that requires immediate HV component inspection and component replacement
- B. Acceptable HV bus isolation from chassis ground well within typical OEM specification limits
- C. Inverter capacitors have not fully discharged and the test must be repeated after a wait period
- D. The megohmmeter test voltage is insufficient and a 1,000V test must be performed for accuracy

3. A lithium-ion HV battery pack contains 96 cells in series with a nominal pack voltage of 355V. After a 30-minute drive cycle, one cell reads 4.05V while the surrounding cells all read 3.70V. What does this reading most likely suggest?

- A. A failed cell voltage sense wire reading falsely high or a cell with internal degradation issues
- B. Normal cell voltage variation during dynamic regenerative braking and acceleration driving events

- C. The battery management module has set incorrect cell voltage calibration parameters during use
- D. The cell balancing circuit is actively transferring charge into this high-voltage cell at present time

4. A Toyota Prius hybrid drive motor has an internal temperature sensor that monitors stator winding temperature. If this sensor circuit develops a short-to-ground fault, what is the most likely effect on hybrid system operation while driving?

- A. The motor will continue normal operation with no impact on hybrid system control module functions
- B. The motor will operate at reduced torque output for normal driving conditions only at low speeds
- C. The system will derate motor power output because the indicated temperature reading is too high
- D. The motor cooling pump will run continuously at maximum speed during all hybrid operating modes

5. A hybrid vehicle's inverter has an internal cooling fluid system separate from the engine cooling system. The technician notices coolant levels remain stable but the inverter coolant temperature reads 85°C while the engine coolant reads 95°C during normal driving. What is the most likely cause?

- A. Restricted coolant flow in the inverter cooling loop requiring immediate electric pump replacement
- B. Coolant cross-contamination between the engine and inverter loops affecting both system temperatures
- C. The inverter thermal management has been set higher than normal due to scan tool calibration override
- D. Normal operation since the inverter cooling loop is designed to operate at a lower temperature than engine

6. An electric A/C compressor on a hybrid vehicle is being checked. The compressor has three phase terminals labeled U, V, and W. The technician measures phase-to-phase resistance and obtains $U-V = 1.8 \Omega$, $V-W = 1.8 \Omega$, and $U-W = 1.8 \Omega$. What does this measurement pattern indicate?

- A. All three phase windings appear balanced within typical specification range for the compressor motor
- B. A phase-to-phase short circuit has developed inside the compressor housing requiring full replacement
- C. All three motor windings are completely open and the compressor motor cannot function at any speed
- D. The compressor requires additional phase rotation testing using a three-phase rotation test meter tool

7. A hybrid vehicle's 12V auxiliary battery is being replaced. After installation of the new battery, the vehicle exhibits a warning message about brake system initialization on the instrument cluster. What is the most appropriate next step for the technician?

- A. Drive the vehicle for 30 minutes to allow the brake control system to learn the new battery parameters
- B. Disconnect and reconnect the 12V battery negative terminal to clear all brake-related fault codes stored
- C. Perform the OEM-specified brake system initialization procedure using a dealer-level scan tool function
- D. Replace the brake control module since the warning indicates a failure in that component has occurred

8. A technician is removing an HV battery pack from a vehicle after the system has been properly de-energized and zero voltage confirmed. The pack must be transported to a separate service area for module replacement. Which transport method is most appropriate?

- A. Place the battery pack on a standard rolling shop cart for short-distance transport within the facility
- B. Use an OEM-approved battery lift table or hoist designed specifically for HV battery pack handling work
- C. Lift the battery pack manually using two technicians employing proper team lifting technique and posture
- D. Slide the battery pack along the shop floor on its protective shipping pallet base for safe transport

9. A NiMH hybrid battery shows the following individual module voltages after a controlled discharge test: Module 1: 7.8V, Module 2: 7.7V, Module 3: 6.9V, Module 4: 7.8V, Module 5: 7.7V. What does this voltage pattern indicate?

- A. Normal voltage variation between modules occurs during dynamic discharge testing of the entire pack
- B. All modules show high internal resistance indicating end-of-life pack replacement is required now
- C. The battery management module has incorrectly calibrated cell voltage readings during testing operation
- D. Module 3 has degraded capacity or elevated internal resistance and requires service or replacement now

10. A hybrid drive motor uses three Hall-effect sensors to provide rotor position feedback for low-speed motor control. If one of these Hall sensors fails with an open circuit, what is the most likely effect on motor operation?

- A. The motor will operate roughly at low speeds and may set position sensor DTCs from missing input data
- B. The motor will operate normally because the remaining two Hall sensors provide adequate redundancy
- C. The motor will not operate at all in any speed range without all three Hall sensors providing active signals
- D. The motor will operate normally but the resolver will set a calibration fault code in the inverter memory

11. A plug-in hybrid vehicle is connected to a Level 2 EVSE charging station but charging will not initiate. The dashboard display indicates the charging cable is connected. The HV battery shows 30% state of charge with no related DTCs stored. What is the most likely cause?

- A. The HV battery is discharged below the minimum allowed charge initiation voltage level threshold
- B. The Level 2 EVSE is providing AC power but the vehicle requires DC fast charging input to initiate
- C. A control pilot signal communication fault exists between the EVSE and the onboard vehicle charger
- D. The vehicle requires a software calibration update to enable Level 2 charging capability at this station

12. Two technicians are discussing electric A/C compressor service procedures. Technician A says POE oil from an electric A/C compressor can be used to service a conventional belt-driven A/C system without problems. Technician B says POE oil is specifically formulated for electric compressors and is not interchangeable with PAG oil. Who is correct?

- A. Technician A only is correct regarding refrigerant oil compatibility between the two compressor types
- B. Technician B only is correct regarding refrigerant oil compatibility between the two compressor types
- C. Both Technician A and Technician B are correct regarding the oil compatibility issues being discussed
- D. Neither Technician A nor Technician B is correct regarding compressor oil compatibility characteristics

13. A hybrid vehicle is brought in with a customer complaint of intermittent reduced power and a flashing MIL during operation. The scan tool retrieves one stored DTC but no freeze frame data is present. The DTC sets only intermittently during driving. What is the most appropriate diagnostic strategy?

- A. Replace the most commonly failed component associated with this DTC based on past repair history records
- B. Clear the DTC and return the vehicle to the customer to see if the fault returns within several drive cycles
- C. Replace the powertrain control module since intermittent codes without freeze frame data often indicate failure
- D. Use the scan tool data list to monitor relevant parameters during a road test that recreates the driving conditions

14. A hybrid battery service requires removing the service disconnect plug. After the plug is removed and held in the technician's hand, a small orange light remains illuminated on the battery pack housing label area. What does this illuminated light typically indicate?

- A. Residual HV capacitor charge is still present within the battery management module circuit despite plug removal
- B. The battery cooling system is still actively running to maintain pack temperature stability during the service event
- C. The pack still contains an active fault code that requires clearing before any further service work can begin
- D. Normal operation as this indicator light always remains illuminated regardless of disconnect plug status or position

15. A power-split hybrid uses two motor/generators (MG1 and MG2) in conjunction with a single planetary gear set. During steady highway driving at a constant 65 mph, the internal combustion engine provides primary propulsion. What is MG1 typically doing during this specific driving condition?

- A. MG1 acts as the primary drive motor delivering torque directly to the wheels through the planetary gearing
- B. MG1 spins freely with no electrical input or output from the hybrid control module side during this condition

C. MG1 acts as a generator absorbing engine power to control engine RPM and charge the HV battery as needed

D. MG1 remains stationary while only MG2 contributes to vehicle propulsion at this highway cruising speed level

16. A hybrid vehicle's 12V auxiliary battery uses an AGM (absorbed glass mat) design. During replacement, the technician must ensure proper battery type is installed. What is the primary reason hybrids require AGM batteries rather than conventional flooded lead-acid batteries?

A. AGM batteries provide higher peak voltage output for proper DC-DC converter regulation under various loads

B. AGM batteries are sealed and tolerate the vibration and deep-cycle discharge demands of hybrid vehicle operation

C. AGM batteries have lower internal resistance which allows faster cranking of the internal combustion engine

D. AGM batteries are required by OEM warranty terms for any battery replacement work on hybrid vehicles only

17. A boost converter on a hybrid vehicle has output voltage that fluctuates between 220V and 650V during normal driving. A technician questions whether this voltage variation is normal or indicates a fault. What is the correct interpretation of this voltage behavior?

A. The boost converter output varies based on motor demand and load conditions as part of normal operation

B. The output should remain at a constant 650V during all operating conditions and load levels on the vehicle

C. The output should remain at battery voltage of 220V during all operating conditions and load levels seen

D. The voltage fluctuation indicates a failing boost converter that requires immediate component replacement now

18. A hybrid vehicle technician is required to use Category III (CAT III) rated test equipment when working on high-voltage systems. What does the CAT III rating specifically signify on a multimeter being used for HV diagnostic work?

- A. The meter can read up to 1,000 amperes continuously without internal overload damage to its components
- B. The meter has been certified for use only by master-level automotive service technicians at dealerships
- C. The meter has frequency response capability up to 1,000 kHz for detailed signal analysis of HV waveforms
- D. The meter is rated for transient overvoltage protection appropriate to distribution-level electrical circuits

19. A lithium-ion HV battery in an EV is being load tested. At 80% state of charge, the pack voltage drops from 380V at rest to 340V under a 100A continuous discharge load. What does this voltage drop pattern indicate about the battery pack condition?

- A. Normal battery behavior with no concern for pack health or performance under load at this state of charge
- B. The battery management system has reached its maximum allowed continuous discharge current rate limit
- C. The pack internal resistance is elevated enough to warrant further investigation of pack condition and aging
- D. The voltage drop under load is excessive and the entire battery pack must be replaced immediately for service

20. A hybrid drive motor exhibits a fault code indicating "Motor Phase Current Sensor Correlation." What does this specific DTC most likely indicate about the inverter and motor system?

- A. The motor's rotor position resolver is reading out of calibration with system parameters established at the factory
- B. Two or more phase current sensor readings do not agree as expected by the inverter control unit logic
- C. The motor stator windings have shorted across two phases requiring complete motor replacement now
- D. The motor's thermal sensor has failed and is indicating excessive temperature in the stator coil assembly

21. A hybrid vehicle's electric cabin heater is integrated into the HVAC system and can provide cabin heat without engine operation. What type of heating element is most commonly used in this electric heater application?

- A. Positive temperature coefficient (PTC) resistive heating elements that self-regulate at their operating temperature
- B. Negative temperature coefficient (NTC) elements that increase resistance when heated up during normal operation
- C. Induction heating coils that generate heat through magnetic field interaction with metal core within the cabin
- D. Microwave emitter elements that excite water molecules in the cabin air to warm the interior temperature evenly

22. A technician is reviewing scan tool data on a hybrid vehicle. The "Hybrid Battery SOC" parameter shows 60% while the "Cell Voltage Min" parameter shows 3.2V and "Cell Voltage Max" shows 3.9V at the same time. What does this data pattern indicate?

- A. The pack is operating normally within typical state-of-charge and individual cell voltage ranges for the design
- B. The pack temperature has exceeded safe operating limits and requires immediate active cooling system response
- C. Significant cell imbalance exists in the pack which requires conditioning or service of the battery pack assembly
- D. The pack has insufficient SOC to support normal hybrid operation under load conditions and needs charging now

23. A technician is preparing to ship a damaged lithium-ion HV battery pack to a recycling facility. The pack experienced a thermal event during a vehicle accident but has cooled completely. What special precaution is required for shipping this damaged battery?

- A. Wrap the entire pack tightly in plastic sheeting to prevent moisture exposure during the long-distance transit
- B. Drain all coolant from the pack cooling system before placing the pack into the shipping container for transit
- C. Charge the pack to 100% state of charge to ensure safe storage during long transit time to the recycling facility
- D. Use approved hazmat shipping procedures and DOT-approved containers per all applicable hazardous materials regulations

24. A hybrid vehicle's inverter has experienced an internal short-circuit fault and has been replaced. Before returning the vehicle to service, what additional system check is most critical to perform on related components?

- A. Reset the hybrid control module adaptive memory and learned values stored in the module EEPROM memory
- B. Check insulation resistance of the HV bus and drive motor for shorts that may have been caused by the inverter event
- C. Replace the drive motor as a precautionary measure since inverter shorts can damage motor windings significantly
- D. Recharge the 12V auxiliary battery to full capacity before any further system testing or vehicle road testing

25. A Honda IMA (Integrated Motor Assist) system uses a single motor/generator located between the engine and transmission. What is the most likely driver-perceptible indication of a degraded motor assembly during normal driving?

- A. Lack of expected acceleration assist combined with reduced regenerative braking efficiency during deceleration events
- B. Increased engine RPM during light-throttle acceleration as the motor cannot provide assistance to the engine
- C. Unusual whining noise from the transmission during initial engagement of forward gear from a complete stop
- D. Excessive heat from the exhaust system due to richer fuel mixture caused by motor degradation effects on engine

26. Two technicians are discussing service procedures after a 12V auxiliary battery has been disconnected on a hybrid vehicle. Technician A says some hybrid vehicles require specific service procedures even after a routine 12V battery disconnect. Technician B says brake system relearn or steering position initialization is sometimes required after 12V power loss events. Who is correct?

- A. Technician A only is correct regarding the required post-12V-disconnect service procedures on hybrid vehicles

B. Technician B only is correct regarding the required post-12V-disconnect service procedures on hybrid vehicles

C. Both Technician A and Technician B are correct regarding post-12V-disconnect service procedure requirements

D. Neither Technician A nor Technician B is correct regarding post-12V-disconnect service procedure requirements

27. A hybrid vehicle's battery management module monitors individual cell voltages during operation. If one cell voltage drops below the minimum allowed value during a discharge event, what protective action does the BMM most likely take?

A. The battery cooling fan increases to maximum speed to lower the failing cell temperature and prevent damage

B. The vehicle enters a cell rebalancing mode that takes precedence over driver inputs during the discharge event

C. The DC-DC converter shuts down to protect the 12V system from any further damage during the discharge event

D. The system limits discharge current or shuts down hybrid operation to protect the affected cell from damage

28. The DC-DC converter in a hybrid vehicle is being tested by measuring output voltage under various loads. With no electrical load applied, the output is 14.0V. With headlights, blower fan, and rear defrost on, the output drops to 13.6V at the battery. What does this voltage behavior indicate?

A. Normal regulation behavior of the DC-DC converter under varying current load demand conditions during testing

B. The DC-DC converter is failing and is not able to maintain its commanded voltage under any peak load condition

C. The 12V auxiliary battery has internal damage and cannot accept the charging current being delivered properly

D. The HV battery state of charge is too low to support full DC-DC converter operation under heavy load conditions

29. A hybrid vehicle equipped with a heat pump A/C system uses CO₂ (R-744) refrigerant rather than conventional R-134a or R-1234yf refrigerants. What is the primary advantage of CO₂ refrigerant in heat pump applications for electrified vehicles?

- A. CO₂ refrigerant produces colder evaporator temperatures than conventional R-134a refrigerant during cooling operation
- B. CO₂ refrigerant maintains heat pump efficiency significantly better at low ambient outdoor temperatures during heating
- C. CO₂ refrigerant has zero internal pressure inside the system which requires no service safety equipment for techs
- D. CO₂ refrigerant can be added by the customer at home without any professional service equipment being required

30. A hybrid vehicle's regenerative braking system blends regen with friction brakes during normal stopping events. During moderate braking on dry pavement at normal road speeds, the driver feels a subtle change in pedal effort or pedal travel. What is the most likely cause of this sensation?

- A. Failed brake master cylinder requiring complete cylinder replacement and brake system bleeding after the repair
- B. Worn brake rotors causing pedal pulsation similar to conventional vehicle braking events on most rear-drive cars
- C. Normal brake blending transition between regenerative and friction braking systems during the brake application event
- D. ABS module activation due to an imminent wheel lock condition during the moderate brake application on dry pavement

31. A hybrid vehicle uses a CAN-bus network for inter-module communication between control units. The hybrid control module cannot communicate with the battery management module on the scan tool. The 12V power and ground at both modules check good. What is the next diagnostic step?

- A. Replace the hybrid control module with an updated factory replacement part assembly to restore communication ability
- B. Replace the battery management module with an updated factory replacement part assembly to restore proper communication

C. Reprogram both modules with the latest software calibration from the manufacturer before performing any further work

D. Check CAN bus wiring continuity, termination resistance, and proper bus voltage levels at the diagnostic connector

32. A lithium-ion HV battery pack uses liquid coolant for thermal management of the cell modules. The technician finds the coolant level low and adds the correct OEM coolant to bring the level to specification. After this service, the system continues to set "Battery Cooling Performance Low" DTCs. What additional service is required?

A. Bleed the cooling system following the OEM-specified procedure to remove any trapped air pockets from the system

B. Replace the battery cooling pump assembly with a new updated factory replacement unit to restore proper flow rates

C. Reset the battery management module adaptive memory using a dealer-level scan tool special function command

D. Replace the coolant with a different OEM-approved specification coolant to improve overall flow rate through the pack

33. A hybrid drive motor and transaxle assembly is being inspected after a customer reported unusual noises during driving. The technician drains the transaxle fluid and finds metallic debris suspended throughout the drained fluid. What is the most appropriate next step?

A. Drain the transaxle fluid completely, refill with fresh new OEM fluid, and return the vehicle to the customer

B. Disassemble the transaxle for thorough inspection of the bearings, gears, and motor rotor for damage and wear

C. Add a fluid additive that neutralizes metallic particles before they cause any further damage to the assembly

D. Replace only the transaxle filter element and continue using the vehicle if no DTCs are currently being stored

34. A hybrid vehicle's inverter uses six IGBT modules arranged in three half-bridge circuits to control three-phase motor operation. If one IGBT module fails in an open-circuit condition, what is the most likely effect on motor operation?

- A. The motor will continue to operate normally because of redundant switching paths designed into the inverter topology
- B. The motor will operate at reduced power but will maintain three-phase operation through software compensation strategies
- C. The motor will operate at twice the normal current draw to compensate for the failed IGBT in the affected phase leg
- D. The motor will not be able to produce normal torque output and will set inverter-related DTCs in the control module

35. A NiMH hybrid battery's individual modules require thermal management during high-load operation in summer conditions. If the battery cooling fan operates at full speed continuously even with the vehicle parked, ignition off, and the key removed, what is the most likely cause?

- A. Normal operation as the cooling fan runs continuously after shutdown to maintain pack temperature stability for cells
- B. The vehicle is in a programmed self-discharge mode that requires continuous fan operation for battery conditioning
- C. A failed temperature sensor reading falsely high or a sensor wiring short to ground in the harness near the battery
- D. The battery management module has failed completely and the cooling fan is operating in a default backup safe mode

36. A technician is performing HV system de-energization on a hybrid vehicle. After removing the service plug and waiting the specified time, the technician must verify zero voltage at the inverter input terminals. What test equipment is required for this measurement procedure?

- A. CAT III rated digital multimeter capable of measuring DC voltage up to 1,000V safely for high-voltage system work
- B. Analog voltmeter with rotating needle for accurate visual reading of HV DC voltage at the inverter input terminals

C. Clamp-on amperage meter set to AC mode to measure inverter input current behavior during the verification process

D. Oscilloscope equipped with a high-voltage isolation probe for measuring transient voltage spikes during the procedure

37. A hybrid vehicle has been in storage for six months with no battery maintenance. The 12V auxiliary battery is fully discharged and the HV battery shows reduced state of charge upon recovery. What is the recommended procedure to return the vehicle to service?

A. Connect a battery charger directly to the HV battery service ports to restore the HV pack state of charge first

B. Drive the vehicle for 30 minutes after jump-starting to allow the HV battery to recharge through normal operation

C. Replace both the 12V auxiliary battery and the HV battery since long-term storage typically damages both batteries

D. Charge the 12V auxiliary battery first, then start the vehicle and allow the HV system to self-manage charging

38. A hybrid drive motor's three-phase output is being measured at the inverter output terminals using an oscilloscope with proper HV isolation probes. The display shows three sinusoidal waveforms with peak voltage of 320V each. What does this peak voltage measurement indicate?

A. The HV battery voltage is 320V and the inverter is operating in pure DC mode bypassing all switching during this test

B. The inverter is producing modulated three-phase AC output at the motor's required peak voltage for normal operation

C. The motor windings have shorted internally causing excessive voltage to appear at the inverter output terminals

D. The boost converter has failed open allowing battery voltage to bypass the inverter and feed directly into the motor

39. A boost converter on a hybrid vehicle uses a large electrolytic capacitor bank for output voltage filtering. Over time, these capacitors can develop reduced capacitance from electrolyte loss. What symptom is most likely with degraded boost converter output capacitors?

- A. The boost converter output voltage will be higher than commanded at all operating times and conditions in the vehicle
- B. The HV battery state of charge will drop rapidly during regenerative braking operation due to capacitor degradation
- C. Increased voltage ripple on the DC bus possibly causing motor torque ripple, audible noise, or vibration symptoms
- D. The DC-DC converter will not be able to maintain stable 12V output during any period of peak load demand condition

40. An electric A/C compressor on a hybrid is being checked. The compressor receives three-phase AC from a dedicated compressor inverter. If the high-side refrigerant pressure becomes excessive during system operation, what protection mechanism is most likely to activate?

- A. The hybrid control module reduces the compressor inverter output frequency to lower compressor speed and pressure
- B. A mechanical pressure relief valve vents refrigerant to the atmosphere from the high-side service port automatically
- C. The compressor clutch disengages mechanically to immediately stop refrigerant compression and pressure buildup
- D. The thermal expansion valve fully opens to reduce the pressure differential across the A/C system rapidly during operation

41. A hybrid vehicle is brought in with multiple DTCs related to HV system isolation faults stored in the hybrid control module. The technician finds that all isolation faults occur simultaneously when accelerating after driving on a damp road in light rain. What is the most likely cause?

- A. Multiple HV component failures requiring complete HV system inspection and possible replacement of several major components
- B. Water intrusion into an HV component or connector causing transient isolation faults during damp driving conditions
- C. Software calibration error requiring reprogramming of the hybrid control module with the latest available calibration data

D. Normal operation of HV system isolation monitoring during damp weather driving events with no actual fault condition present

42. A lithium-ion HV battery pack uses a coolant heater system to warm cells in cold weather before charging is initiated. If this battery heater fails completely, what is the most likely effect on charging performance in cold ambient conditions below freezing?

A. The vehicle will not accept any charging input until the battery coolant heater is fully repaired or replaced by the technician

B. Charging will proceed normally but the battery will charge to a lower-than-normal final state of charge after the session

C. The HV battery will overheat during cold-weather charging due to inability to regulate temperature properly without the heater

D. Charging current will be limited or delayed to prevent damage from low-temperature lithium plating in the cell electrodes

43. A hybrid drive motor uses a sensorless control algorithm at higher motor speeds to determine rotor position without requiring a physical position sensor signal. What information does the inverter use to determine rotor position at high motor speeds during this sensorless control operation?

A. The HV battery voltage variation is continuously monitored to estimate motor position based on current demand patterns

B. The motor's stator winding temperature is used to calculate the rotor's relative angular position during operation periods

C. Back-EMF generated by the spinning motor windings provides accurate position information at higher motor speeds and loads

D. The 12V auxiliary battery voltage is used as a reference signal for the motor position estimation algorithm during operation

44. A hybrid vehicle's inverter assembly is being replaced after a confirmed internal IGBT failure. After installation of the replacement inverter, what calibration or initialization procedure is most commonly required before returning the vehicle to service?

- A. Resolver-to-motor offset calibration to align rotor position feedback with the inverter switching control reference angle
- B. Refrigerant charge calibration since the inverter assembly contains the electric A/C compressor control logic and software
- C. Brake system calibration since the inverter assembly manages regenerative braking integration logic with the brake module
- D. 12V battery state-of-charge reset since the inverter assembly contains the battery monitoring functions for the auxiliary battery

45. A hybrid vehicle's brake-by-wire system uses electric actuators to apply hydraulic brake pressure to the calipers during normal operation. The system must maintain hydraulic backup in case of complete electrical failure. How does the backup hydraulic braking system typically activate during an electrical failure event?

- A. The backup brake system requires the driver to press a separate emergency brake button mounted on the dashboard near the steering column
- B. A mechanical connection between the brake pedal and the master cylinder allows direct hydraulic application without electrical assistance
- C. A separate electric pump activates automatically when the primary brake system loses electrical power to maintain brake pressure
- D. The parking brake system extends to all four wheels providing emergency stopping capability when normal hydraulic braking fails

FULL ANSWER KEY WITH EXPLANATIONS – PRACTICE EXAM 7

1. D — A dropped HV glove must be air-tested or removed from service because micro-tears or stress damage from the impact can be invisible to the naked eye. Any pinhole defect destroys the dielectric protection rating and exposes the technician to electrocution risk. The air-inflation field test verifies integrity, and any suspect glove returns to a certified lab for re-testing before further use.

2. B — A reading of 20 megohms between the HV bus and chassis is well above the typical 1 megohm OEM minimum specification. The reading confirms the HV system is properly isolated from the vehicle chassis and meets safety requirements. Higher readings provide additional safety margin and indicate no leakage path to ground exists.

- 3. A** — One cell reading significantly higher than its neighbors typically indicates either a faulty voltage sense wire reading falsely high or a cell with internal degradation. A healthy pack should show all cell voltages within tens of millivolts of each other after operation. The technician should verify sense wire and connector integrity before condemning the cell itself.
- 4. C** — A short-to-ground on a temperature sensor circuit pulls the signal voltage to a level the control module interprets as maximum temperature. The hybrid system responds by derating motor power output to protect what it believes is an overheating motor. The actual temperature is fine, but the system always errs on the side of protection based on sensor input.
- 5. D** — Inverter cooling loops are designed to run at lower temperatures than engine cooling loops because IGBT junction temperatures must stay well below engine operating temperatures. A 10°C difference between the two systems is normal and reflects the separate temperature targets each loop maintains. This is normal hybrid cooling system behavior, not a fault.
- 6. A** — Balanced phase-to-phase resistance of 1.8 Ω across all three combinations indicates the three stator windings are equal and intact. Healthy three-phase motors always show approximately equal resistance between any two terminals because the wye-connected windings are symmetrical. No further winding service is required when all three measurements match within tolerance.
- 7. C** — Brake-by-wire systems on hybrid vehicles often require a formal initialization procedure after any 12V power interruption. The procedure recalibrates pedal position, accumulator pressure, and stroke simulator settings to restore proper pedal feel and braking response. The initialization must be completed using the OEM scan tool procedure before the warning will clear.
- 8. B** — Hybrid battery packs are heavy and contain stored chemical energy even after de-energization, making OEM-approved lift equipment mandatory for safe handling. Approved lift tables and hoists support the pack securely, prevent drops that could rupture cells, and protect technicians from injury. Standard shop carts and manual lifting are inadequate for the weight and risk involved.
- 9. D** — Module 3 reading 6.9V while the other modules read 7.7–7.8V indicates a degraded module with elevated internal resistance or reduced capacity. The 800–900 mV voltage gap under discharge is well beyond normal cell-to-cell variation in a healthy pack. The affected module requires replacement or further pack service before the pack can perform reliably.
- 10. A** — Hall sensors provide rotor position feedback used primarily during low-speed motor control before back-EMF becomes usable for sensorless operation. A failed Hall sensor causes inaccurate commutation at low speeds, producing rough operation, cogging, and position-related DTCs. The motor may still run but cannot operate smoothly without all three position signals at startup and low speeds.
- 11. C** — Charge initiation requires a control pilot signal handshake between the EVSE and the onboard charger to verify cable connection, current rating, and proper communication before AC power flows. When the cable shows "connected" but charging does not start, the most common cause is a pilot signal communication fault interrupting the handshake. Power transfer cannot begin until the handshake completes successfully.

12. B — POE oil is specifically formulated for electric A/C compressors and is not interchangeable with PAG oil used in conventional belt-driven systems. POE has high dielectric strength required to insulate the compressor motor windings inside the refrigerant circuit, while PAG is conductive and would cause electrical failure in an electric compressor. Cross-using these oils contaminates either system and causes premature failure.

13. D — Intermittent DTCs without freeze frame data require live data monitoring during conditions that recreate the fault. The data list shows real-time parameters that reveal the failing component when the fault occurs, allowing the technician to capture conditions and signal values at the moment of failure. Parts replacement based on guesswork wastes time and money when the cause is undocumented.

14. A — The orange warning light on the battery pack housing indicates residual HV charge is still present, typically in the battery management module's internal capacitors. The light remains illuminated until those capacitors discharge through their bleed resistors, providing a visual safety indication. The technician must wait for the light to extinguish before contacting any internal HV components.

15. C — During steady highway cruising with the engine providing primary propulsion, MG1 acts as a generator absorbing engine power to control engine RPM and recharge the HV battery. This is fundamental to the power-split design, where MG1 reacts against the planetary sun gear to set the engine's operating point independent of road speed. The arrangement allows the engine to run at its most efficient RPM during cruise.

16. B — AGM batteries are sealed, non-spillable, and tolerate the vibration and partial-discharge cycling that hybrid vehicles routinely subject the 12V battery to. The sealed construction prevents acid spills during cabin or trunk mounting common in hybrids and withstands frequent shallow discharge from key-off accessory operation. A flooded battery would not survive these conditions reliably.

17. A — The boost converter modulates its output voltage based on motor demand to optimize efficiency across the driving range. At low loads, the converter outputs near battery voltage to minimize switching losses, and at high loads it boosts to maximum bus voltage to support peak motor power. Variable output is the intended design, not a fault condition.

18. D — CAT III is an IEC 61010 rating defining transient overvoltage protection appropriate for distribution-level circuits, including building wiring and three-phase loads. CAT III meters have reinforced input protection designed to safely handle the transient spikes present on power circuits. The rating refers to safety against transient overvoltage events, not voltage range or current capacity.

19. C — A 40V drop under 100A load equals approximately 0.4 Ω of internal resistance, which is elevated enough to warrant investigation of the pack condition. Healthy lithium-ion packs of this size typically exhibit much lower internal resistance, and elevated resistance produces voltage sag, reduced power, and heat under load. The pack needs further evaluation before either dismissing or condemning it outright.

20. B — Phase current sensor correlation codes compare two or more current sensor readings against each other and against values calculated by the inverter control logic. When the readings do not agree within tolerance, the inverter sets the correlation DTC to flag the inconsistency. This is a sensor-to-sensor comparison fault, not a motor winding or resolver fault.

- 21. A** — PTC (positive temperature coefficient) heating elements increase in resistance as they heat up, naturally limiting their own current draw and self-regulating their maximum temperature. This makes them ideal for hybrid and EV cabin heaters where overheating protection is essential and engine waste heat is not always available. PTC heaters are reliable, efficient, and self-protecting against overheating.
- 22. C** — A 700 mV spread between minimum and maximum cell voltages represents significant imbalance that exceeds normal operating tolerance. Healthy packs maintain cell voltages within tens of millivolts of each other. This level of imbalance limits usable pack capacity and indicates the BMM cannot keep up with passive balancing, requiring service or conditioning.
- 23. D** — Damaged lithium-ion batteries are classified as Class 9 hazardous materials by DOT and IATA, requiring specialized shipping containers, labeling, and documentation. Improper shipping creates fire and chemical exposure risks during transit and violates federal hazmat regulations. Only certified hazmat shippers and approved containers may be used for damaged HV battery transport.
- 24. B** — An internal inverter short can drive damaging current through the connected motor windings before protection circuits trip. After inverter replacement, insulation resistance testing on the HV bus and motor verifies that no winding damage occurred during the short event. Failing to verify motor integrity risks immediate failure of the new inverter when the damaged motor is energized.
- 25. A** — In an IMA system, the single motor/generator provides both acceleration assist and regenerative braking through the same hardware. A degraded motor reduces both functions simultaneously because the same windings handle propulsion and regen. The driver typically reports both weak acceleration assist and reduced regen efficiency as parallel symptoms of the same root cause.
- 26. C** — Both technicians describe accurate post-12V-disconnect service requirements on hybrid vehicles. Some hybrids require specific procedures after 12V power loss, and brake system relearns or steering position initialization are common examples of those procedures. The two statements describe complementary aspects of the same correct service requirement.
- 27. D** — When a cell voltage drops below the minimum allowed threshold, the battery management module limits discharge current or stops it entirely to protect the cell from over-discharge damage. Continued discharge below minimum voltage causes permanent capacity loss, internal copper shunts in lithium-ion cells, and thermal runaway risk. Protection is the BMM's primary function in this scenario.
- 28. A** — A 0.4V drop under significant electrical load is within normal regulation tolerance for most automotive DC-DC converters. The slight voltage droop reflects the converter responding to increased current demand and is not indicative of a fault. Converters maintain tight regulation but cannot hold absolutely constant voltage across all load conditions.
- 29. B** — CO₂ (R-744) has a higher critical temperature and better heat transfer characteristics at low ambient conditions than R-134a or R-1234yf. Heat pumps using CO₂ extract heat from cold outdoor air more effectively, maintaining cabin heating capacity in winter conditions where conventional refrigerants lose efficiency. This makes CO₂ well-suited to EV heat pump applications.

- 30. C** — During moderate braking, the system transitions between regenerative braking and friction braking based on battery acceptance, vehicle speed, and pedal demand. These blending transitions can produce subtle changes in pedal effort or travel that drivers perceive as unusual but are entirely normal. The brake controller is balancing two systems and the transition feel is inherent to the design.
- 31. D** — Communication faults between modules sharing the CAN bus typically point to the bus itself rather than to either module. Checking bus wiring, the 120 Ω terminating resistors, and recessive/dominant voltage levels confirms whether the network is intact. Replacing modules before verifying the bus wastes parts and often does not solve the problem.
- 32. A** — HV battery cooling systems with liquid coolant must be properly bled after any service that introduces air into the loop. Air pockets cause flow restrictions, false low-flow DTCs, and inadequate cooling at the cells. The OEM bleeding procedure ensures all trapped air is removed so coolant circulates properly through every module passage.
- 33. B** — Metallic debris in transaxle fluid indicates significant internal wear that cannot be addressed by fluid replacement alone. Bearing failure, gear damage, or motor rotor contact with the stator can all produce metal contamination, and continued operation will spread debris and accelerate damage. Teardown inspection identifies the source and prevents catastrophic failure.
- 34. D** — Each IGBT in a three-phase inverter handles one half of one phase, so an open IGBT eliminates current flow in that direction on that phase. The motor cannot produce balanced three-phase torque with only five functional IGBTs, and the inverter sets DTCs related to phase current imbalance. Power output drops dramatically until the inverter is repaired.
- 35. C** — A cooling fan running continuously with the key off and the vehicle unattended is not normal and points to a temperature sensor providing a falsely high reading. A short to ground typically pulls the temperature signal toward the "hot" end of the scale, causing the BMM to command continuous full-speed cooling. Sensor circuit testing identifies the wiring fault and resolves the runaway fan operation.
- 36. A** — Zero-voltage verification on HV systems requires a CAT III rated digital multimeter capable of measuring up to 1,000V DC safely. The CAT III rating protects against transient overvoltage spikes, and the meter must be verified working on a known voltage source before and after the measurement. Lesser equipment puts the technician at risk of meter failure under HV conditions.
- 37. D** — The correct procedure is to charge the 12V auxiliary battery first, then allow the vehicle's onboard hybrid charging system to manage HV battery recovery during normal startup and operation. Connecting an external charger directly to the HV battery is not normally permitted and risks damage to the pack. The vehicle's own charging systems are designed to manage this recovery safely.
- 38. B** — A modern hybrid inverter outputs a modulated three-phase AC waveform with peak voltage corresponding to the motor's commanded operating point. The 320V peak waveforms indicate normal pulse-width-modulated AC output from a healthy inverter driving the motor at that voltage level. This is expected behavior, not a fault condition.

39. C — Output filter capacitors smooth the DC bus voltage by absorbing ripple from the inverter's switching action. As capacitance degrades, ripple increases on the bus, which the motor sees as additional voltage variation that translates into torque ripple, audible noise, and vibration. Degraded capacitors must be replaced to restore smooth bus voltage and quiet motor operation.

40. A — Electric A/C compressors do not have mechanical clutches, so high-pressure protection is achieved by the hybrid control module reducing the inverter output frequency to slow the compressor and lower discharge pressure. This electronic pressure management replaces the conventional clutch cycling and high-pressure cutoff switches of belt-driven systems. The system protects itself by modulating compressor speed.

41. B — Isolation faults that appear simultaneously during damp-road acceleration indicate water intrusion at an HV component or connector creating a leakage path to chassis ground. The combination of moisture and vibration during acceleration exposes the contaminated location, allowing current to flow through the water film. Locating and sealing the wet connector or component resolves the fault.

42. D — Cold lithium-ion cells cannot accept charging current at normal rates without risking lithium plating on the anode, which permanently damages the cell. When the battery coolant heater fails, the BMM limits or delays charging until cells reach a safe minimum temperature. This protection prevents catastrophic capacity loss and potential thermal runaway from plated lithium.

43. C — At higher motor speeds, back-EMF generated by the spinning rotor magnets in the stator windings is large enough for the inverter to calculate rotor position without a physical sensor. Sensorless control uses this back-EMF signal to time commutation accurately at high RPM. At low speeds, back-EMF is too small to use, which is why Hall sensors or resolvers are still required for startup and low-speed operation.

44. A — Resolver-to-motor offset calibration aligns the rotor's electrical zero position with the inverter's switching reference, ensuring current is applied at the correct angle for maximum torque. Without this calibration after inverter replacement, the motor may produce reduced torque, draw excessive current, or fail to operate smoothly. Most OEMs require this learning procedure following inverter or motor replacement.

45. B — Brake-by-wire systems retain a mechanical pedal-to-master-cylinder connection that activates when electrical assist fails, providing direct hydraulic application to the calipers as a failsafe. Pedal effort increases significantly because the driver must provide all the force without boost assistance, but the system continues to stop the vehicle. This mechanical fallback is required for safety certification of any brake-by-wire system.