PRACTICE EXAM 5: ASE L3 SIMULATION (45 Questions)

1. A technician is diagnosing a Toyota Prius that will not enter READY mode when the power button is pressed. The 12V auxiliary battery measures 12.6V, no DTCs are stored in any module, and HV system isolation reads 10 megohms. What should the technician check next?

A. Replace the hybrid vehicle control module with an updated factory replacement unit

B. Perform a forced HV pre-charge sequence through the dealer-level scan tool function

C. Check the smart key system and immobilizer for proper authentication signal exchange

D. Disconnect and reconnect the HV battery service plug to reset all powertrain modules

2. A NiMH hybrid battery pack uses voltage monitoring at the module level rather than at the individual cell level. What is the principal limitation of this monitoring strategy in service?

A. Individual cell failures inside a module can go undetected until module voltage finally drops

B. The monitoring system requires significantly more wiring than equivalent individual cell monitoring

C. Module-level monitoring cannot detect any thermal management issues in the pack assembly area

D. NiMH cells cannot be monitored at the module level without specialized dealer scanning equipment

3. A three-phase AC drive motor in a hybrid vehicle shows phase-to-phase resistance readings of U-V = 0.18 Ω, V-W = 0.18 Ω, and U-W = 0.36 Ω at the motor terminals. What does this resistance pattern indicate?

A. All three phase windings measure within normal specification and the motor needs no service

B. The motor has a shorted winding across all three phases of the stator core lamination stack

C. The motor's three-phase windings are completely open requiring full motor assembly replacement

D. Phase W has an open winding so U-W current must flow through both U and V phase coils in series

4. The inverter on a hybrid vehicle uses an isolation monitoring circuit to detect HV leakage to chassis ground. What method does this circuit typically use to detect insulation degradation?

A. AC ripple voltage measured across the HV battery terminal post connections during operation

B. Low-level AC test signal injected onto the HV bus that is then monitored for chassis return

C. Continuous high-voltage DC test signal applied during all vehicle operating modes for testing

D. Resistance measurement performed only during initial vehicle startup before contactor closure

5. An electric A/C compressor on a hybrid has failed with an internal motor short to ground. After replacement, which additional component should also be considered for replacement to prevent contamination of the new compressor?

A. The A/C system receiver/drier or accumulator that may have absorbed burnt-oil contaminants

B. The condenser cooling fan motor since it operates continuously during compressor failure events

C. The high-pressure cutoff switch which may have been damaged by overpressure during the failure

D. The thermal expansion valve only if the system showed evidence of significant high-pressure events

6. A hybrid vehicle's electric power steering system is integrated with the 12V auxiliary electrical system. The driver reports the steering becoming very heavy during low-speed parking maneuvers. The DC-DC converter output is steady at 14.0V. What is the most likely cause?

A. Low refrigerant level in the A/C system loading the engine during steering input events from driver

B. A failed HV battery cell module reducing available current during peak demand operating conditions

C. A failing 12V auxiliary battery causing voltage drop under peak EPS motor current draw conditions

D. A misadjusted steering position sensor providing incorrect steering angle data to the control unit

7. Two technicians are discussing high-voltage system safety procedures. Technician A says that removing the service plug is sufficient to make the HV system safe to service immediately. Technician B says that

capacitor discharge time and zero-voltage verification are still required after removing the service plug. Who is correct?

A. Technician A only is correct based on standard HV safety procedure

B. Technician B only is correct based on standard HV safety procedure

C. Both Technician A and Technician B are correct on this safety topic

D. Neither Technician A nor Technician B is correct on this safety topic

8. A lithium-ion HV battery cell shows 0.0V during testing while the surrounding cells in the same module each read 3.7V. What condition does this 0.0V reading most likely indicate in the affected cell?

A. Normal cell behavior during an active deep-discharge protection cycle activated by the BMS

B. Cell balancing circuit drawing current from this cell to feed adjacent lower-voltage cells

C. A voltage sense wire fault providing a false reading even though the cell itself is healthy

D. Internal cell failure with permanent damage requiring module replacement to restore function

9. A permanent magnet AC drive motor in a hybrid vehicle uses neodymium magnets bonded to the rotor assembly. What temperature condition can permanently degrade the magnetic flux of these magnets?

A. Operating temperatures above approximately 150°C can cause permanent demagnetization of magnets

B. Sub-zero temperatures below approximately minus 30°C cause permanent flux loss in the magnets

C. Temperatures above 200°C reduce torque temporarily but do not permanently degrade the magnets

D. Operating below 0°C improves magnet performance with no risk of any permanent damage to flux

10. The boost converter on a Toyota Prius uses an inductor, IGBT switch, and freewheeling diode to step up battery voltage. If the freewheeling diode fails in a shorted condition, what is the most likely symptom?

A. The boost converter output voltage will be slightly higher than the value commanded by the control module

B. A short-circuit current path will exist when the IGBT switches on causing high-current DTCs to be set

C. The boost converter will operate in buck mode reducing voltage instead of boosting it as designed

D. The DC-DC converter will overheat from compensating for the failed boost converter output behavior

11. A NiMH hybrid battery cooling system uses cabin air drawn through an inlet filter. The technician finds the filter completely clogged with dust and debris. What problem is most likely to develop if this condition is not corrected promptly?

A. Cabin air conditioning capacity will decrease noticeably causing customer comfort complaints

B. The HV battery management module will trigger a coolant flow restriction DTC at high loads

C. Battery modules will overheat under load leading to capacity loss and pack-related DTCs being set

D. The HV battery will fail to charge during regen braking because of high-temperature charge limits

12. A hybrid drive motor uses a resolver to provide rotor position feedback to the inverter. The vehicle exhibits rough operation in READY mode and a "Motor Position Sensor" DTC is stored. Which test should be performed first in the diagnostic procedure?

A. Replace the resolver assembly with an updated factory replacement part from the dealer

B. Reprogram the motor control unit with the latest available software calibration file

C. Check the motor stator windings for shorts or open conditions using a calibrated megohmmeter

D. Check the resolver signal harness for damage, shielding integrity, and connector contact condition

13. A hybrid vehicle is brought into the shop following a moderate front-end collision. The HV system did not trigger any safety isolation event during the impact. Before any service work begins, what is the most appropriate first step?

A. Test drive the vehicle to verify that the HV system is functioning normally after the impact event

B. Clear all crash-related DTCs and reset the supplemental restraint system module before service

C. Perform a complete HV system inspection following the manufacturer's specified post-collision procedure

D. Replace the HV battery pack as a precaution since any physical impact can cause hidden cell damage

14. A technician is preparing to replace a single failed module in a NiMH hybrid battery pack with the pack still installed in the vehicle. To safely service the pack in place, what additional precaution is required beyond standard HV de-energization?

A. Use insulated tools and physical barriers to prevent shorting adjacent module bus bar connections

B. Drain all electrolyte from surrounding modules using an approved acid evacuation pump assembly

C. Disconnect the battery cooling fan motor before opening the battery enclosure for any service work

D. Reset all hybrid control module learned values before opening the battery pack housing for access

15. A DC-DC converter on a hybrid vehicle is being tested. With the vehicle in READY mode and the headlights turned on, the DC-DC output measures 13.2V at the 12V battery terminal posts. The specification is 14.0V. What is the most likely cause?

A. The 12V auxiliary battery has reached full charge and is rejecting additional DC-DC converter current

B. The HV battery state of charge is at maximum so the DC-DC converter operation is being limited

C. The hybrid vehicle control module has entered a default mode due to a thermal protection event

D. Internal degradation of the DC-DC converter or a fault in its output regulation control circuitry

16. Two technicians are discussing inverter cooling systems on hybrid vehicles. Technician A says inverters always use the same coolant loop as the internal combustion engine cooling system. Technician B says many hybrids use a dedicated low-temperature coolant loop separate from the engine cooling system. Who is correct?

A. Technician A only is correct on hybrid inverter cooling system design

B. Technician B only is correct on hybrid inverter cooling system design

C. Both Technician A and Technician B are correct on this topic

D. Neither Technician A nor Technician B is correct on this topic

17. A hybrid vehicle displays a "Charge Mode" message during driving along with reduced power output. The scan tool shows the HV battery SOC dropping below 30% even though the engine and DC-DC converter are operating normally. What does this condition indicate?

A. The HV battery has reached end-of-life condition and requires immediate complete replacement

B. The hybrid control module software requires updating to the latest available calibration release

C. The system is unable to maintain SOC against load possibly from a high-resistance pack condition

D. The 12V auxiliary battery is severely discharged and is pulling power from the HV system circuits

18. A hybrid vehicle uses individual cell-level voltage monitoring with small bleed resistors for passive cell balancing. What is the function of these balance resistors during normal pack operation?

A. They bleed small amounts of charge from higher-voltage cells to allow lower cells to catch up

B. They provide a controlled discharge path for emergency rapid pack de-energization during faults

C. They limit current flow between cells during initial pack assembly and factory commissioning only

D. They prevent any current flow between adjacent cells during all normal driving and charging events

19. A Toyota Hybrid Synergy Drive transaxle uses two motor/generators connected through a single planetary gear set assembly. During electric-only "EV mode" driving at low speed, which component provides primary propulsion torque to the wheels?

A. MG1 provides primary propulsion torque through its connection to the planetary sun gear

B. MG2 provides primary propulsion torque through its connection to the planetary ring gear

C. The internal combustion engine cycles on briefly to provide momentary boost torque on demand

D. Both MG1 and MG2 share the propulsion load equally through the planetary gear set output

20. The IGBT modules in a hybrid inverter are typically switched at carrier frequencies between 5 kHz and 15 kHz during operation. What is the primary reason for using these specific switching frequencies?

A. Lower frequencies below 5 kHz reduce switching losses but cause excessive heat in motor windings

B. Higher frequencies above 15 kHz are required to achieve adequate torque output from the drive motor

C. Audible noise is minimized while balancing switching losses against acceptable motor current ripple

D. Switching frequencies are determined entirely by the AC frequency the drive motor requires to spin

21. A hybrid vehicle is brought in with a complaint that the engine runs continuously even at idle in warm weather with no electrical load. The HV battery SOC reads 65%, and there are no stored DTCs. What is the most likely cause of this condition?

A. The HV battery has reached end-of-life condition and is rejecting energy from the engine charging

B. The 12V auxiliary battery is internally shorted and is loading the DC-DC converter very heavily

C. The hybrid vehicle control module needs reprogramming with current software calibration releases

D. The A/C compressor or another high-voltage load is preventing the engine from cycling off at idle

22. A hybrid vehicle's HV battery pack has an internal main contactor with a pre-charge resistor and pre-charge contactor circuit. What is the primary purpose of this pre-charge circuit during system startup?

A. Limit inrush current to the inverter's bulk DC bus capacitors when the main contactor closes

B. Discharge the inverter capacitors during system shutdown to make the HV system safe to service

C. Provide auxiliary power to the 12V system before the DC-DC converter activates after startup

D. Heat the battery cells to operating temperature before main contactor closure in cold weather

23. A hybrid drive motor exhibits a grinding noise during operation that varies with vehicle speed. The technician suspects the motor bearings are the source of the noise. Which test would best confirm this diagnosis?

A. Measure resistance between each phase winding terminal and the motor case ground point

B. Check the resolver alignment using the dealer-level scan tool special function menu options

C. Spin the motor by hand with the transaxle drained of fluid and listen for any bearing noise

D. Replace the motor cooling pump assembly and then observe whether the noise condition improves

24. The high-voltage system on a hybrid vehicle uses interlock loop wires to detect open service panels and disconnected HV connectors. What happens when this interlock loop is opened while the vehicle is operating?

A. The hybrid control module ignores the interlock signal during normal driving condition operation

B. The main HV contactors open immediately disconnecting the battery from all downstream HV loads

C. The 12V auxiliary system shuts down to prevent further damage to system components and wiring

D. The vehicle continues to operate in a reduced power mode until the ignition is cycled off and on

25. A hybrid vehicle equipped with a heat pump A/C system can provide cabin heating without using the internal combustion engine as a heat source. How does the heat pump A/C system achieve this heating function?

A. The system reverses refrigerant flow direction so the evaporator becomes the heat-releasing condenser

B. An electric resistive heater element in the cabin air ducts provides supplemental heat to the cabin

C. Engine coolant from the HV battery cooling system is routed through the cabin heater core matrix

D. The heat pump uses waste heat from the inverter cooling loop to warm cabin air through a heat exchanger

26. A hybrid vehicle's regenerative braking system blends regenerative and friction braking automatically. During light braking on a slippery surface, the ABS module detects wheel slip. What action does the brake control module take in response?

A. Increases regenerative braking force to maximize the energy capture event during the wheel slip detection

B. Maintains the existing regenerative braking force while activating ABS friction brake modulation on top

C. Engages four-wheel friction braking aggressively while keeping regenerative braking fully active at the same time

D. Reduces or eliminates regenerative braking and applies controlled friction braking through the ABS module

27. A technician is using a megohmmeter to test insulation resistance on a hybrid vehicle's HV components. What is the typical minimum acceptable insulation resistance reading per most OEM specifications for these tests?

A. 1 ohm of resistance between the HV component and chassis ground reference point on the vehicle

B. 100 ohms of resistance between the HV component and chassis ground reference point on the vehicle

C. 1 megohm of resistance between the HV component and chassis ground reference point on the vehicle

D. 100 megohms of resistance between the HV component and chassis ground reference point on the vehicle

28. A NiMH hybrid battery is being conditioned through a dealer-level service procedure. What is the primary purpose of this conditioning process when performed on an aging pack?

A. Permanently restoring lost capacity to cells degraded by manufacturing defects from initial production

B. Re-balancing cell voltages and restoring temporary capacity loss caused by cell-to-cell imbalance

C. Recalibrating the battery management module to learn new pack characteristics after cell replacement

D. Discharging the pack completely to allow for safe long-term storage when the vehicle is parked

29. A hybrid drive motor's three-phase stator windings are tested with a megohmmeter at 500V DC. The technician measures 0.8 megohms from phase U to the motor case ground. The OEM specification is "greater than 10 megohms." What does this reading indicate about the motor?

A. The motor passes the insulation test with adequate margin for continued normal vehicle operation

B. The reading is borderline and an additional insulation test should be performed at a higher test voltage

C. The reading is acceptable for short-term vehicle operation but requires future monitoring at service intervals

D. The motor has degraded insulation in phase U that requires motor service or complete replacement of the unit

30. A boost converter is generating excessive heat during normal driving conditions. The cooling system is operating correctly with proper flow rate and the coolant temperature is within specification. What component failure is most likely causing this excessive heat condition?

A. IGBT switching transistor degradation causing increased conduction and switching losses during operation

B. The HV battery's main contactor has high contact resistance reducing current flow into the converter input

C. The 12V auxiliary battery is degraded and is pulling additional current through the DC-DC converter circuit

D. The drive motor's stator windings have shorted causing electrical back-feed into the boost circuit topology

31. A heat pump A/C system on an EV is not providing adequate cabin heat at outside ambient temperatures below freezing. What system limitation is most likely causing this concern from the customer?

A. The refrigerant charge is overcharged and the system is pressurized beyond the proper operating level

B. The cabin interior temperature sensor is reading incorrectly to the climate control module input circuit

C. Heat pump thermal efficiency drops significantly at very low ambient temperatures as a system limitation

D. The electric A/C compressor has reduced mechanical output at low ambient operating temperature conditions

32. A hybrid vehicle's brake vacuum assist system uses an electric vacuum pump rather than relying on engine intake manifold vacuum. The driver reports a hard brake pedal feel and the scan tool shows the pump running continuously. What is the most likely cause of this condition?

A. The brake master cylinder has internal piston seal leakage requiring complete master cylinder replacement

B. A vacuum leak in the brake booster assembly or a failed check valve in the vacuum pump output circuit

C. The brake pedal stroke simulator has failed mechanically and is providing false pedal position feedback

D. The HV battery is fully charged and is rejecting energy from the regenerative brake control module output

33. A hybrid vehicle's HV system uses Y-capacitors connected between the HV positive and negative buses and chassis ground. What is the primary function of these capacitors in the HV electrical system?

A. Filter high-frequency electrical noise from the HV bus to prevent EMI from affecting other vehicle systems

B. Provide a controlled discharge path for the HV system during emergency shutdown events caused by faults

C. Store backup electrical energy in case of brief HV battery disconnection events during normal driving conditions

D. Monitor the insulation resistance of the HV bus to chassis ground continuously during all operating times

34. A lithium-ion HV battery pack has experienced a thermal event in one cell module. After complete cooling and inspection, the technician finds no visible external damage to the pack housing. What action is required before returning the vehicle to service?

A. Reset the battery management module fault codes and return the vehicle to service for normal customer use

B. Replace only the single affected cell module within the larger pack assembly housing as a localized repair

C. Run a complete battery conditioning cycle to recover any capacity that was lost during the thermal event

D. Replace the entire battery pack assembly since any thermal event compromises overall pack structural integrity

35. Two technicians are discussing motor/generator function in hybrid vehicles. Technician A says hybrid motor/generators can only generate electricity during regenerative braking events. Technician B says they can also generate electricity when driven by the internal combustion engine in series hybrid configurations. Who is correct?

A. Technician A only is correct in this motor/generator discussion topic

B. Both Technician A and Technician B are correct in this discussion topic

C. Technician B only is correct in this motor/generator discussion topic

D. Neither Technician A nor Technician B is correct in this discussion topic

36. A DC-DC converter on a hybrid vehicle uses a high-frequency transformer to provide galvanic isolation between the HV bus and the 12V auxiliary system. Why is this isolation important for overall vehicle safety?

A. It prevents HV potential from appearing on the 12V system and chassis if insulation breakdown occurs

B. It allows the DC-DC converter to operate at lower switching frequencies for improved overall efficiency

C. It enables the converter to function as a backup power source for the main HV battery during faults

D. It provides additional voltage gain through the transformer turns ratio for charging the 12V battery

37. An electric A/C compressor uses three-phase AC at varying frequencies controlled by an inverter. As the commanded compressor speed increases, what changes in the inverter's output signal to the compressor motor windings?

A. Voltage decreases proportionally to compressor speed while the AC frequency remains at a fixed value

B. AC frequency increases proportionally to the commanded compressor operating speed for higher output

C. DC current is supplied in pulsed form rather than continuous three-phase AC current at higher speeds

D. The phase relationship between U, V, and W shifts from 120 degrees apart to 90 degrees apart at speed

38. A hybrid vehicle's electric power steering motor is drawing excessive current causing the 12V system voltage to sag during parking-lot maneuvers. The DC-DC converter is operating normally. Which component is most likely the cause of the excessive current draw?

A. The DC-DC converter is failing to provide adequate output current during peak EPS load events on the system

B. The HV battery state of charge is too low to support full DC-DC converter output current under steering load

C. The 12V auxiliary battery has reduced capacity from age and cannot absorb the dynamic load from the EPS unit

D. The EPS motor has shorted stator windings or worn internal bearings causing excessive current draw during use

39. A hybrid vehicle is brought in with a customer concern of poor fuel economy. The scan tool shows the HV battery state of charge cycling normally between 40% and 80%. The engine appears to run more often than expected during driving. Which condition could cause this symptom?

A. Excessive HV battery internal resistance limiting power delivery from the pack to the drive motor circuit

B. Failed boost converter unable to provide adequate motor bus voltage during normal EV operation events

C. Worn internal combustion engine components causing reduced engine efficiency and increased engine runtime

D. The DC-DC converter is overcharging the 12V battery and wasting energy from the hybrid drive system power

40. A NiMH hybrid battery pack temperature sensor is providing an incorrect reading to the battery management module. The actual battery temperature measured with an infrared thermometer is 35°C, but the scan tool displays 65°C. What is the most likely effect on hybrid system operation?

A. Reduced charge and discharge current limits because the system believes the pack is overheating from load

B. The battery cooling fan motor will operate at low speed because of the apparent temperature mismatch detected

C. The HV main contactor will not close because the apparent temperature reading is outside the allowed range

D. Charging current will increase to compensate for the apparently elevated battery pack temperature condition

41. The inverter on a hybrid vehicle contains current sensors on each phase output to the drive motor. If one of these current sensors fails with its signal stuck at a fixed value, what is the most likely effect on motor operation?

A. The motor will operate at full power continuously without any feedback control from the inverter assembly

B. The motor will continue normal operation since current sensing in the inverter is fully redundant by design

C. The motor will produce a continuous audible warning tone to alert the driver of the sensor fault condition

D. The motor will likely operate roughly or shut down completely with current monitoring DTCs being stored

42. A hybrid vehicle's electric A/C compressor refrigerant system has been opened for major component service. After the repair is complete, what is the correct procedure for ensuring system cleanliness before recharging with refrigerant?

A. Add a flushing solvent through the high-side service port and crank the compressor briefly to circulate it

B. Evacuate the system with a vacuum pump for an extended period to remove all moisture from the lines

C. Disconnect the compressor and back-flush the entire system using compressed dry nitrogen gas at pressure

D. Run the engine with the A/C clutch engaged to circulate any residual oil and moisture through the system

43. A hybrid vehicle's 12V auxiliary battery is being jump-started from another vehicle after being left discharged. What special precaution applies when jump-starting a hybrid vehicle from another vehicle?

A. Never use the hybrid as the donor vehicle and follow OEM jump-starting procedures exactly as specified

B. Disconnect the HV battery service plug before connecting any jump-starting cables to the 12V battery terminals

C. The engine must be running on the donor vehicle to avoid damaging the receiver vehicle's HV system parts

D. Jump-starting hybrid vehicles is not permitted under any circumstances by any of the major manufacturers

44. A hybrid transaxle uses a planetary gear set to combine engine and motor power. During hard acceleration, MG2 contributes additional torque to the transaxle output shaft. What sound or operating characteristic might a driver notice during this acceleration condition?

A. A high-pitched whining noise from MG1 spinning at very low speeds in the opposite direction during accel

B. A pulsing vibration through the steering wheel from the planetary gear engagement events during acceleration

C. A subtle change in engine RPM behavior since engine speed is decoupled from vehicle speed by the CVT action

D. A clicking sound from the HV main contactors cycling rapidly during the heavy acceleration demand event

45. Two technicians are discussing HV battery storage procedures for vehicles that will be out of service for extended periods. Technician A says the HV battery should be fully discharged before long-term storage to prevent thermal runaway. Technician B says the HV battery should be fully charged before long-term storage to prevent cell damage. Who is correct?

A. Technician A only is correct on this hybrid battery storage discussion topic

B. Both Technician A and Technician B are correct on this hybrid battery storage discussion topic

C. Technician B only is correct on this hybrid battery storage discussion topic

D. Neither Technician A nor Technician B is correct on this hybrid battery storage discussion topic

FULL ANSWER KEY WITH EXPLANATIONS – PRACTICE EXAM *5*

1. C — Smart key authentication is required before the hybrid control module will allow READY mode. With a healthy 12V battery, no DTCs, and confirmed HV isolation, the electrical and high-voltage systems all check out, pointing to a security or authentication failure. The immobilizer must recognize the key before any contactor closure is permitted.

2. A — Module-level monitoring averages voltage across multiple cells, so a single weak cell can be masked by healthier cells in the same module. The fault is only detected once degradation is severe enough to pull the entire module reading down. This delayed detection allows individual cell problems to progress further than they would under per-cell monitoring.

3. D — In a delta-wound motor, an open winding forces current to travel through the series combination of the two intact windings to reach the third terminal. With U-V and V-W reading the expected 0.18 Ω, the U-W measurement of 0.36 Ω is exactly the sum, indicating the direct U-W winding is open. Current must travel through the long series path through V.

4. B — HV isolation monitoring injects a low-level AC test signal onto the HV bus and watches for any return current through chassis ground. Any return path indicates insulation has broken down between the HV system and the body, triggering isolation faults. This active monitoring identifies leakage long before it becomes a shock hazard.

5. A — The receiver/drier or accumulator contains desiccant that absorbs moisture and acid byproducts from a burned compressor. Leaving the original drier in place would immediately contaminate the new compressor with debris and corrosive material. Replacing the drier is required to protect the new unit and restore proper system cleanliness.

6. C — Electric power steering motors draw very high transient current during low-speed maneuvers, which the 12V battery must buffer because the DC-DC converter cannot respond instantly to peak demands. A weak battery sags under load even with healthy DC-DC output, reducing voltage at the EPS motor and producing heavy steering. The battery acts as the capacitor that supports peak loads.

7. B — Removing the service plug isolates the battery but does not discharge the inverter and converter capacitors, which store lethal energy. Manufacturer-specified wait times allow internal bleed resistors to bring capacitor voltage down, after which the technician must verify zero voltage before any contact. Skipping verification creates an electrocution risk.

8. D — A lithium-ion cell reading 0.0V indicates an internal short circuit or copper plating from over-discharge, both of which are irreversible. The damaged cell creates thermal runaway risk and cannot be recovered through any service procedure. The affected module must be replaced to restore pack safety and capacity.

9. A — Neodymium magnets begin permanent demagnetization at sustained temperatures around 150°C and above. Once flux is lost, the rotor permanently produces less torque for the same stator current, reducing motor power and efficiency for the life of the motor. This is why hybrid drive motors require dedicated cooling and thermal protection.

10. B — The freewheeling diode normally blocks current during the IGBT's on-time so that switched current flows only through the inductor. A shorted diode creates a direct short-circuit path each time the IGBT switches on, causing destructive current spikes and overcurrent protection trips. This typically results in immediate inverter shutdown and DTCs.

11. C — Blocked cooling airflow causes pack temperature to climb during sustained loads, and NiMH cells degrade rapidly above 40°C. Sustained thermal stress causes permanent capacity loss and triggers temperature-related DTCs as sensors exceed their thresholds. Long-term operation under these conditions shortens overall pack life.

12. D — Wiring and connector integrity must be verified before condemning a sensor or control module. Resolver signals are low-amplitude analog feedback that is highly sensitive to harness damage, shield degradation, and corroded connector pins. Checking the harness first prevents unnecessary replacement of a functional resolver.

13. C — Manufacturer post-collision procedures specify the exact inspection sequence required to confirm HV system integrity after impact. Even without automatic isolation events, the collision may have damaged HV cables, shifted the pack, or compromised interlocks in ways DTCs alone cannot detect. Following the OEM procedure is required before any other service work.

14. A — Even after main de-energization, individual modules still carry significant voltage between their terminals. Insulated tools and physical barriers prevent shorting adjacent bus bars during module removal, protecting the technician from arc-flash burns. They also prevent damage to surrounding modules from accidental contact.

15. D — A DC-DC converter producing 13.2V instead of the specified 14.0V under normal load points to internal degradation. The HV input and command targets are healthy, so the converter itself is failing to regulate its output. Continued operation will leave the 12V battery undercharged and eventually cause no-start conditions.

16. B — Inverter coolant must operate at lower temperatures than engine coolant to keep IGBT junctions within safe limits. Many hybrids use a dedicated low-temperature loop with its own pump, radiator, and reservoir entirely separate from the engine cooling system. Shared loops would expose power electronics to engine-temperature coolant and risk thermal damage to the inverter.

17. C — When the system cannot maintain SOC despite normal engine and DC-DC operation, the HV battery itself is losing the ability to deliver and accept power. Elevated internal resistance causes large voltage sag under load, forcing the system to request continuous engine charging that still cannot keep up. The "Charge Mode" message reflects the BMS attempting to recover SOC against a degraded pack.

18. A — Passive balancing uses small bleed resistors that slowly discharge cells with higher voltage, allowing the rest of the pack to equalize during charging and at rest. Without balancing, total pack capacity is limited by the weakest and strongest cells because the system must protect against over-discharge and overcharge. The bleed resistors keep all cells at matching SOC.

19. B — In Toyota Hybrid Synergy Drive, MG2 connects directly to the planetary ring gear, which drives the final output to the wheels. During EV-mode operation, MG2 provides all propulsion torque while MG1 spins in reaction and the engine remains off. This arrangement enables pure electric driving without engaging the internal combustion engine.

20. C — Switching frequency selection balances audible noise, switching losses, and current ripple. Frequencies below 5 kHz fall into the human hearing range and produce annoying whine, while frequencies above 15 kHz dramatically increase IGBT switching losses and heat. The 5–15 kHz range optimizes these competing factors for hybrid drive motor control.

21. D — High-voltage loads such as the electric A/C compressor draw continuous power from the HV battery, which the system compensates for by keeping the engine running and charging. In warm weather the A/C pulls significant power, preventing the engine from cycling off even at idle. Disabling the A/C typically allows normal engine cycling to resume.

22. A — The pre-charge resistor limits inrush current when the main contactor closes onto the inverter's discharged DC bus capacitors. Without this circuit, the empty capacitors would draw thousands of amps for an instant, welding contactor contacts together and damaging the bus. Pre-charge brings capacitor voltage up to battery voltage gradually before the main contactor closes.

23. C — Spinning the motor by hand with the transaxle drained allows the technician to feel and hear bearing condition directly without gear and fluid noise masking the symptoms. Bearing damage typically produces gritty rotation, audible grinding, or roughness most apparent during slow manual rotation. This is the most direct confirmation before disassembly.

24. B — The HV interlock loop signals the control module that all service covers and HV connectors are properly secured. When the loop opens during operation, the module immediately commands the main contactors to open, removing power from the HV bus to protect anyone from electrocution. This is a fundamental safety function of the high-voltage system.

25. A — A heat pump A/C system uses a reversing valve to swap the roles of the evaporator and condenser. In heat mode, refrigerant releases heat at the cabin heat exchanger that normally serves as the evaporator during cooling. This provides cabin heat without engine waste heat, which is critical for EV operation and pure-electric driving modes.

26. D — When the ABS module detects wheel slip during braking, the brake control module reduces or eliminates regenerative braking and shifts to friction braking modulated by ABS. Regen requires consistent wheel rotation to work properly and cannot pulse fast enough for slip control. ABS-modulated friction braking can independently manage each wheel to maintain traction.

27. C — Most OEM specifications cite a minimum acceptable insulation resistance of approximately 1 megohm between HV components and chassis ground. Readings below this threshold indicate insulation breakdown that creates shock hazards and triggers HV isolation DTCs. Higher readings are preferred, but 1 megohm is the typical published minimum.

28. B — NiMH battery conditioning rebalances cell voltages and recovers temporary capacity loss caused by cell-to-cell imbalance and memory effect. The procedure typically involves controlled deep discharge followed by full charge to allow weaker cells to equalize with the rest of the pack. It cannot reverse permanent chemical aging but does restore usable capacity that was masked by imbalance.

29. D — A reading of 0.8 megohms against a spec of greater than 10 megohms indicates significant insulation breakdown in phase U. The degraded insulation creates a leakage path to chassis ground, triggers HV isolation faults, and creates shock hazards. In-vehicle repair of internal stator insulation is not possible, so the motor must be serviced or replaced.

30. A — IGBT degradation increases both conduction losses through higher saturation voltage and switching losses through slower transitions. With cooling system operation confirmed normal, the source of additional heat must be increased losses inside the power switches themselves. Continued operation accelerates the degradation toward outright IGBT failure.

31. C — Heat pump efficiency drops sharply at low ambient temperatures because there is less thermal energy in the cold outside air to transfer into the cabin. Coefficient of performance approaches 1:1 near 0°F, meaning the system delivers roughly the same energy it consumes with no multiplier benefit. This is a fundamental limitation of heat pump physics, not a fault condition.

32. B — A continuously running vacuum pump indicates the system is losing vacuum as fast as the pump produces it. This typically points to a vacuum leak in the booster diaphragm, hoses, or a failed check valve allowing vacuum to bleed back through the pump. The hard pedal reflects the loss of vacuum-assisted braking from the leak.

33. A — Y-capacitors filter high-frequency electrical noise generated by IGBT switching, preventing EMI from coupling onto the HV bus and radiating into other vehicle systems. They provide a low-impedance path for noise to bypass to chassis ground rather than propagating through the harness. EMI filtering is essential because high-power switching circuits can disrupt sensitive electronics throughout the vehicle.

34. D — A thermal event in any cell of a lithium-ion pack indicates thermal runaway protection has been challenged and adjacent cells have experienced damaging conditions. Cells that appear undamaged may have hidden internal degradation that creates future failure risk, and the pack's overall safety margin is compromised. Manufacturers require full pack replacement to ensure long-term safety.

35. C — In series hybrid configurations, the internal combustion engine drives a generator to produce electricity for the battery and drive motor independent of any braking event. Motor/generators generate whenever they are mechanically driven, not only during regenerative braking. Series and series-parallel hybrids depend on this engine-driven generation capability.

36. A — Galvanic isolation through the high-frequency transformer ensures the HV side and 12V side share no electrical connection. If HV insulation breaks down elsewhere, the chassis remains at 12V potential rather than becoming energized at hundreds of volts. This isolation is the primary safety barrier protecting occupants and technicians from HV shock through the low-voltage system.

37. B — In AC motor control, speed is directly proportional to the frequency of the supplied current. The inverter increases output frequency to spin the compressor faster, with voltage scaled proportionally to maintain torque through V/f control. Higher frequency produces higher compressor RPM and increased refrigerant flow.

38. D — Excessive current draw with a healthy DC-DC converter and 12V system points to a problem inside the EPS motor itself. Shorted stator windings or worn bearings increase the load required to produce the same steering assist, drawing more current than designed. The 12V voltage sag is the symptom of that excessive demand, not the cause.

39. C — Poor fuel economy with normal hybrid system operation and increased engine runtime points to reduced engine efficiency rather than a hybrid-side fault. Worn injectors, spark plugs, compression loss, or fouled sensors decrease fuel-to-power conversion. The engine must run longer and burn more fuel to maintain the same SOC and meet power demand.

40. A — A falsely high temperature reading causes the battery management module to derate charge and discharge currents to protect a battery it believes is overheating. The result is reduced regen capability, reduced assist power, and overall reduced hybrid system performance even with the actual pack at safe temperature. The system always errs on the side of protection based on sensor input.

41. D — A current sensor stuck at a fixed value provides false feedback to the motor control loop, causing it to misregulate phase currents and produce torque ripple, vibration, or shutdown. Modern inverters monitor current sensor signals for plausibility and set DTCs when readings are inconsistent with commanded operation. The result is rough motor operation or complete shutdown depending on the control logic.

42. B — Extended vacuum evacuation is essential because POE refrigerant oil is highly hygroscopic and any residual moisture reduces its dielectric strength. A long pump-down at deep vacuum removes water vapor that cannot be flushed mechanically. Failure to evacuate properly contaminates the new oil and can cause electric compressor motor insulation failure.

43. A — Hybrid vehicles can typically be jump-started as the receiver but should never serve as the donor. The DC-DC converter is not designed to deliver the high cranking currents that conventional alternators provide, and using a hybrid to jump another vehicle can damage the converter. Following the OEM procedure ensures proper cable placement and protects both vehicles.

44. C — In a power-split hybrid, the planetary gear set decouples engine RPM from vehicle speed through MG1 acting as a continuously variable speed regulator. The driver may notice that engine RPM stays relatively constant or follows demand rather than tracking vehicle speed during acceleration, producing the characteristic CVT-like driving feel. This is normal operation, not a fault.

45. D — Neither technician is correct. Lithium-ion HV batteries should be stored at approximately 50% state of charge for extended periods, not fully charged or fully discharged. Full charge storage accelerates calendar aging while full discharge risks copper plating and over-discharge damage, so mid-SOC storage with periodic monitoring is the recommended practice.