PRACTICE EXAM 4: ASE L3 SIMULATION (45 Questions)

1. A technician is preparing to service the high-voltage battery pack on a hybrid vehicle. Which color of insulation on the cables identifies them as carrying high voltage?

A. Yellow

B. Orange

C. Red

D. Blue

2. Two technicians are discussing PPE for high-voltage hybrid work. Technician A says Class 0 rubber insulating gloves rated at 1000 volts AC are required. Technician B says leather protector gloves should always be worn over the rubber gloves. Who is correct?

A. Technician A only

B. Technician B only

C. Neither A nor B

D. Both A and B

3. Before opening the high-voltage battery pack on a hybrid vehicle, the most critical step the technician must perform is to:

A. Disconnect the 12-volt auxiliary battery negative terminal first

B. Turn off the ignition and remove the smart key from the vehicle area

C. Apply lockout/tagout to the service disconnect handle position

D. Remove the service plug and verify zero voltage with a CAT III meter

4. Regenerative braking on a hybrid vehicle converts the kinetic energy of the vehicle into:

A. Electrical energy stored in the high-voltage battery

B. Hydraulic pressure stored in the brake accumulator

C. Heat energy dissipated through the friction brakes

D. Mechanical energy returned to the drive wheels

5. During acceleration of a parallel hybrid, MG2 (the larger motor-generator) primarily operates as a:

A. Generator that charges the high-voltage battery pack

B. Starter that cranks the internal combustion engine

C. Motor that provides propulsion torque to the wheels

D. Resistor that dissipates excess electrical energy

6. The DC-to-DC converter in a hybrid electric vehicle is responsible for:

A. Converting AC current from the generator to DC for battery charging

B. Inverting DC battery voltage into three-phase AC for the drive motor

C. Stepping down high-voltage DC to charge the 12V auxiliary battery

D. Boosting low-voltage DC up to match the inverter bus voltage

7. Power flow from the high-voltage battery to the rest of the HV system is interrupted when the technician:

A. Disconnects the 12-volt negative battery cable from the chassis

B. Removes the service plug (service disconnect) from the battery pack

C. Opens the driver door which triggers the safety interlock circuit

D. Turns the ignition key to the OFF position and removes it from the slot

8. After removing the high-voltage service disconnect on a hybrid vehicle, how long should the technician wait before testing for residual voltage at the inverter capacitors?

A. At least 5 minutes to allow bus capacitors to bleed down

B. Approximately 30 seconds for the contactors to fully open

C. A full 60 minutes to ensure complete battery isolation

D. No wait is required if the service plug has been removed

9. The high-voltage battery pack in most first-generation hybrid vehicles is cooled by:

A. Engine coolant routed through internal battery passages

B. Refrigerant from the vehicle's air conditioning evaporator

C. A dedicated liquid loop with its own electric water pump

D. Cabin air drawn through ducts by an electric cooling fan

10. A vehicle sets a DTC indicating an open in the high-voltage interlock loop (HVIL). The most likely cause is:

A. A failed high-voltage battery contactor stuck in the open position

B. A shorted insulated gate bipolar transistor inside the inverter assembly

C. A disconnected HV service connector or unseated orange cable end

D. A blown 12-volt fuse for the hybrid control module power feed

11. A technician is performing an insulation resistance test on a hybrid drive motor. The proper instrument to use is a:

A. Megohmmeter applying 500 volts DC between the windings and case

B. Digital multimeter set to the highest available ohms scale setting

C. Clamp-on ammeter measuring current draw through the motor leads

D. Capacitance tester verifying stator winding insulation breakdown

12. The orange high-voltage cable running between the inverter and the transaxle on a hybrid vehicle is:

A. A three-phase AC cable supplying the drive motor stator windings

B. A two-wire DC cable carrying battery current to the converter input

C. A low-current signal cable for the rotor position resolver feedback

D. A coolant return line wrapped in orange insulating heat shielding

13. Technician A says a hybrid vehicle's 12-volt auxiliary battery can be jump-started using a conventional jumper pack. Technician B says the high-voltage battery pack should never be jump-started using an external charger or pack. Who is correct?

A. Technician A only

B. Both A and B

C. Neither A nor B

D. Technician B only

14. During a road test of a hybrid vehicle, the internal combustion engine refuses to start when commanded. The most likely cause within the hybrid system is:

A. A failed exhaust gas recirculation valve sticking in the closed position

B. An open thermostat preventing engine coolant from reaching temperature

C. A clogged fuel injector restricting flow to the cylinder head intake port

D. A failed MG1 motor-generator unable to crank the engine through the PSD

15. A hybrid vehicle's high-voltage battery state of charge stays pegged at full and the engine runs constantly. The technician should first suspect:

A. A failed 12-volt auxiliary battery causing reduced control module function

B. A clogged engine air filter restricting airflow to the throttle body opening

C. A failed regenerative braking circuit unable to send energy back to the pack

D. A leaking head gasket allowing coolant to enter the cylinder during operation

16. Two technicians are discussing electric A/C compressors used on hybrid vehicles. Technician A says they use the same conventional PAG refrigerant oil as belt-driven systems. Technician B says they require a specific non-conductive POE oil to prevent shorts in the windings. Who is correct?

A. Technician A only

B. Technician B only

C. Both A and B

D. Neither A nor B

17. A hybrid vehicle will not power up when the start button is pressed, and the 12-volt battery tests low. Before attempting any high-voltage diagnostics, the technician should:

A. Remove the service plug to isolate the high-voltage battery pack from the system

B. Recharge or replace the 12-volt auxiliary battery and retest the power-up sequence

C. Bypass the high-voltage interlock loop using a jumper wire at the service plug location

D. Disconnect the inverter to allow the bus capacitors to fully discharge before testing

18. The most likely consequence of contacting an exposed high-voltage bus bar inside a hybrid inverter with bare hands is:

A. Minor tingling sensation similar to a static electricity discharge from a carpet

B. A brief muscle twitch caused by stray electromagnetic interference from the bus

C. A first-degree burn requiring only basic first aid and over-the-counter treatment

D. Cardiac fibrillation or death from current passing across the chest and heart muscle

19. The 12-volt auxiliary battery in a hybrid vehicle is primarily used to:

A. Power the control modules and energize the HV system main contactors at startup

B. Crank the internal combustion engine through the conventional starter motor pinion

C. Supply current directly to the drive motor inverter during initial vehicle acceleration

D. Charge the high-voltage battery pack whenever the vehicle is parked and turned off

20. A hybrid vehicle's high-voltage battery has a single weak cell module. The most likely effect on system operation is:

A. The drive motor will lose all torque output and the vehicle will not move at all

B. The inverter will overheat and shut down within minutes of vehicle operation

C. The battery management system will limit pack output to protect the weak module

D. The 12-volt auxiliary battery will fail to charge whenever the vehicle is running

21. On a power-split hybrid, MG1 is most often used to:

A. Provide the primary drive torque to the wheels during heavy acceleration events

B. Power the electric air conditioning compressor and cabin heater elements directly

C. Drive the electric power steering pump for hydraulic assist at low vehicle speeds

D. Start the internal combustion engine and generate electricity to charge the HV pack

22. When the brake pedal is lightly applied at moderate speed on a hybrid vehicle, the brake system should:

A. Apply only the friction brakes since regen is disabled below highway speeds

B. Use regenerative braking primarily, blending friction brakes as needed for the demand

C. Apply maximum friction brake pressure and ignore regenerative braking entirely

D. Disable both systems and use only engine compression braking for vehicle slowing

23. A technician finds a hybrid drive motor stator winding has 0.3 megohms of resistance to ground. According to most manufacturers, this reading indicates:

A. A normal winding condition that needs no further service or component repair

B. A condition that can be corrected by drying the windings with shop compressed air

C. Degraded insulation that typically requires motor or stator assembly replacement

D. An expected reading for a new motor still within factory tolerance specification

24. Before opening any orange high-voltage connector on a hybrid vehicle, the technician must:

A. Disconnect only the 12-volt negative battery cable and wait two minutes for safety

B. Wear cotton work gloves and use insulated tools rated for 600 volts AC service work

C. Disable the HV system per service procedure and verify zero voltage with a CAT III meter

D. Start the engine and let it idle for several minutes to discharge the system capacitors

25. A scan tool is used on a hybrid vehicle to retrieve DTCs from the hybrid control module. The technician should access:

A. The hybrid/EV-specific module list rather than only the generic OBD-II powertrain menu

B. The body control module exclusively since it stores all hybrid-related diagnostic codes

C. The transmission control module which contains all motor generator and inverter codes

D. The instrument cluster module which serves as the master gateway for all stored faults

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26. Two technicians are checking a hybrid HV battery pack. Technician A says cell module voltage should be measured at the BMS connector with the system live. Technician B says voltages should be measured at individual cell modules with the HV system safely disabled. Who is correct?

A. Technician A only

B. Technician B only

C. Both A and B

D. Neither A nor B

27. A hybrid inverter assembly contains a coolant loop separate from the engine coolant loop because the inverter and motor:

A. Require higher coolant temperatures than the internal combustion engine cylinders

B. Use conductive coolant that would cause shorts inside the engine block passages

C. Are mounted too far from the engine for shared coolant lines to reach effectively

D. Have lower maximum operating temperatures and require dedicated thermal control

28. A permanent magnet AC drive motor in a hybrid vehicle uses position feedback from a:

A. Resolver mounted on the motor shaft sensing rotor angular position

B. Crankshaft position sensor mounted on the engine block timing cover

C. Variable reluctance sensor reading flywheel teeth on the engine assembly

D. Hall-effect sensor mounted in the transaxle differential housing area

29. A plug-in hybrid (PHEV) connected to a Level 2 charger receives power at approximately:

A. 120 volts AC single-phase from a standard household receptacle outlet

B. 12 volts DC from the vehicle's onboard auxiliary battery charging port

C. 240 volts AC single-phase from a dedicated EVSE wall-mounted charger

D. 480 volts three-phase AC from an industrial commercial service supply

30. The IGBTs inside a hybrid vehicle's inverter assembly function as:

A. Mechanical relays that physically open and close the high-voltage circuit

B. Resistive elements that dissipate excess electrical energy as waste heat

C. Capacitive storage devices that smooth the high-voltage DC bus voltage

D. Solid-state switches that convert DC bus voltage to three-phase AC output

31. A technician is about to perform repairs on a hybrid's high-voltage system. The technician must verify that the personal protective equipment to be used is:

A. Manufactured within the last five years from the date stamped on the equipment

B. Rated for the maximum nominal pack voltage of the specific vehicle being serviced

C. Stored in a sealed plastic bag whenever the equipment is not actively being used

D. Within its current test/inspection date and visually inspected for damage before use

32. During light-to-moderate deceleration on a hybrid vehicle, the brake pedal feel may seem slightly different from a conventional vehicle because:

A. The master cylinder uses a smaller bore that requires more pedal pressure to apply

B. The brake-by-wire system blends regen and friction braking with simulated pedal feel

C. The vacuum booster is undersized and provides reduced power assist during stopping

D. The brake fluid type is incompatible with normal pedal travel from full release

33. A technician is inspecting Class 0 rubber insulating gloves before use. The most important visual check is for:

A. Pinholes, cuts, or cracks revealed by rolling and inflating each glove with air

B. Faded color on the cuff area where the manufacturer's logo is normally printed

C. Excessive talc powder coating on the inner liner surface from extended storage

D. Worn fingertips that show through the outer surface of the rubber from daily use

34. Cell balancing within a hybrid HV battery pack is necessary because:

A. Different cell modules use different chemistry that requires varied charge voltages

B. The pack monitor wire harness inserts a small voltage drop into the lowest cells

C. Manufacturing tolerances and aging cause cells to drift to different states of charge

D. Regenerative braking only charges the cells nearest to the positive output terminal

35. A hybrid vehicle sets a P0A80 — "Replace Hybrid Battery Pack" code. Before condemning the battery pack, the technician should:

A. Replace the inverter assembly first since it commands the battery contactors directly

B. Check freeze frame data, module voltage history, and related codes for the root cause

C. Replace the 12-volt auxiliary battery and clear all hybrid system codes from the module

D. Drive the vehicle for at least 100 miles at highway speed to recalibrate the system

36. When servicing a hybrid vehicle, the technician notices the orange high-voltage cable has a small cut in the outer insulation. The proper action is to:

A. Replace the entire cable assembly per the manufacturer's service procedure requirements

B. Wrap the damaged area with electrical tape rated for at least 600 volts AC service

C. Apply liquid electrical insulation product and allow it to cure before returning the vehicle

D. Sand the area smooth and apply heat-shrink tubing over the damaged cable section

37. Electric power steering on a hybrid vehicle eliminates the need for:

A. Steering input position sensors in the column or rack assembly during operation

B. A torque sensor measuring driver input applied through the steering wheel rim area

C. Mechanical linkage between the steering wheel and the front wheel tie rod ends

D. A belt-driven hydraulic pump powered by the internal combustion engine crankshaft

38. Most newer hybrid vehicle high-voltage battery packs use cells with which chemistry?

A. Lead-acid because of its proven durability and low manufacturing production cost

B. Nickel-cadmium because of its excellent low-temperature performance characteristics

C. Lithium-ion because of its high energy density and improving long-term cycle life

D. Alkaline because of its wide availability and very low replacement service costs

39. Inside a Toyota-style power-split device (PSD), the planetary gear set connects:

A. Only the engine output shaft directly to the front drive axle through a single ratio

B. The engine, MG1, and MG2 so each can contribute torque or speed to the output shaft

C. Only MG1 and MG2 together so the engine remains mechanically isolated from the wheels

D. The friction brakes mechanically to the regenerative system through a clutch pack assembly

40. On a stop-start hybrid, when the vehicle comes to a stop at a traffic light, the engine shuts off but the following continues to operate normally:

A. Climate control, instrument cluster, and power accessories from the HV and 12V systems

B. The mechanical hydraulic power steering pump driven by the engine crankshaft pulley

C. The conventional belt-driven A/C compressor cycling on engine vacuum reserve pressure

D. The crankshaft-driven alternator charging the 12-volt auxiliary battery during the stop

41. A series hybrid drivetrain differs from a parallel hybrid in that:

A. The engine and the electric drive motor are mechanically coupled to the wheels together

B. There is no high-voltage battery pack because the engine directly powers the drive motor

C. The engine is not mechanically connected to the wheels and only drives a generator

D. Regenerative braking energy is sent through the engine flywheel to the transmission unit

42. A Level 1 EVSE (Electric Vehicle Supply Equipment) supplies a plug-in hybrid with:

A. 240 volts AC at up to 80 amps from a dedicated wall-mounted home charging unit

B. 400 volts DC fast-charge current through a CCS Combo or CHAdeMO charging connector

C. 480 volts three-phase AC at up to 100 amps from a commercial industrial service drop

D. 120 volts AC at approximately 12 amps from a standard grounded household receptacle

43. A hybrid HV battery pack cooling fan runs at high speed continuously while the vehicle is being driven. The most likely cause is:

A. A failed 12-volt auxiliary battery causing all hybrid system fans to default to high speed

B. A high battery pack temperature caused by blocked intake vents or a failed temperature sensor

C. A failed inverter coolant pump causing the cabin HVAC blower to compensate by running fast

D. A normal condition for any plug-in hybrid operating in warm weather with the A/C system on

44. After completing repairs to a hybrid vehicle's high-voltage system, the technician should road test the vehicle to verify:

A. Smooth transitions between EV mode, engine assist, regen braking, and engine-only operation

B. That the 12-volt auxiliary battery voltage remains exactly the same as before the repair work

C. That the high-voltage battery state of charge climbs continuously and never decreases at all

D. That the engine runs continuously to keep the high-voltage battery fully charged at all times

45. A hybrid manufacturer specifies a CAT III or CAT IV rated digital multimeter for high-voltage measurements because:

A. CAT III meters have a built-in megohmmeter function for insulation resistance tests

B. The category rating indicates the meter has a faster response time for transient signals

C. The category rating reflects the meter's ability to safely handle high-energy transients

D. CAT III meters are the only meters that can read AC and DC voltage in the same range

ANSWER KEY — PRACTICE EXAM 4 (Q1–Q45)

1. B — Orange is the industry-standard color designating high-voltage cables on hybrid and electric vehicles. SAE and OEM service literature specify orange insulation so technicians can immediately identify HV circuits and avoid accidental contact. Yellow indicates intermediate voltage on some platforms, but orange is the universal HV identifier.

2. D — Class 0 rubber insulating gloves rated at 1000 V AC are the standard PPE for hybrid HV work, and leather protector gloves must always be worn over them to prevent punctures or abrasion that would compromise the dielectric rubber. Both technicians describe required practice per OSHA 1910.137 and OEM service procedures. Skipping the leather protector exposes the rubber to mechanical damage that defeats its insulating value.

3. D — The only reliable way to confirm the HV system is de-energized is to remove the service plug and verify zero voltage at the HV bus with a CAT III rated meter. Disconnecting the 12 V battery or turning off the ignition drops control power but does not by itself guarantee the HV capacitors and bus bars are safe to contact. Meter verification is the live-dead-live step that protects the technician from a stored or stuck high-voltage condition.

4. A — Regenerative braking uses the drive motor as a generator, converting the vehicle's kinetic energy into electrical energy that recharges the high-voltage battery. This recovers energy that would otherwise be lost as friction heat in conventional brakes. The recovered charge is what allows hybrids to deliver fuel-economy gains in stop-and-go driving.

5. C — Under acceleration, MG2 (the larger motor-generator coupled to the output side of the transaxle) supplies traction torque to the drive wheels. When the system needs more energy than the battery alone can provide, the engine and MG1 contribute as well, but MG2 is the primary drive motor. Identifying MG2 as the propulsion device is essential for diagnosing torque-related driveability complaints.

6. C — The DC-to-DC converter steps the HV battery's nominal DC voltage down to roughly 14 V to charge the 12-volt auxiliary battery and run conventional accessories. It replaces the alternator found on conventional vehicles. A failed DC-DC converter results in a discharged 12 V battery and module shutdown, which mimics a dead battery complaint.

7. B — Removing the service plug (manual service disconnect) physically opens the HV battery pack's internal series circuit and isolates the pack from the rest of the HV system. Turning off the ignition only opens the main contactors via software command, which can fail; the service plug provides a mechanical guarantee. This is why service procedures require service plug removal before any HV work.

8. A — Most OEMs specify a minimum waiting period of at least 5 minutes after removing the service disconnect to allow the inverter's bus capacitors to bleed down through internal discharge resistors. Touching the bus before the capacitors have discharged can deliver a fatal shock even after the battery is isolated. The exact time varies by model, but 5 minutes is the typical minimum, followed by meter verification.

9. D — Most first-generation hybrid battery packs (such as the Gen 1–3 Prius) use a forced-air cooling system that draws cabin air through ducts and across the modules with an electric fan. Cabin air is used because it is already conditioned to a moderate temperature range, helping keep cell temperatures within their operating window. Blocked vents or a failed fan cause rapid temperature rise and BMS-induced power derating.

10. C — The HVIL is a low-voltage safety loop routed through every orange HV connector; an open in the loop almost always points to a connector that is unseated, removed for service, or damaged. The HVIL exists specifically to detect HV cable disconnection and command the contactors open before a technician can contact live conductors. Tracing the loop physically along orange cables typically locates the fault quickly.

11. A — A megohmmeter applying 500 V DC between the motor windings and the case is the proper tool for testing the insulation resistance of a hybrid drive motor. A standard DMM cannot apply the high test voltage needed to reveal insulation breakdown that only manifests under stress. Insulation testing detects developing motor failures before they cause an HV leak to chassis ground.

12. A — The cable between the inverter and the transaxle carries three-phase AC current that drives the stator windings of the traction motor. The inverter converts the DC bus voltage from the battery into three-phase AC; this AC output must reach the motor over three orange conductors. Identifying this cable as three-phase AC, not DC, is critical when interpreting waveforms and choosing test procedures.

13. B — The 12-volt auxiliary battery on a hybrid can be jump-started using a conventional 12 V jumper pack, exactly like a non-hybrid 12 V system. The high-voltage battery, however, cannot be jump-started — it can only be recharged by the vehicle's own systems or specialized OEM equipment, and improper external charging can damage cells or cause fires. Both technicians' statements reflect standard service practice.

14. D — On a Toyota-style power-split hybrid, MG1 acts as the engine starter, spinning the ICE up to combustion speed through the planetary gear set. If MG1 fails, the engine cannot be cranked even though the 12 V battery and conventional starter are unrelated to that function. This is a classic hybrid-specific no-start cause that would not exist on a conventional vehicle.

15. C — When SOC remains pegged at full and the engine runs constantly, the regenerative braking circuit can no longer accept charge from MG2 during deceleration, forcing the system to dump kinetic energy as friction heat. The continuously running engine reflects the system's inability to use the stored HV energy normally. A failed inverter regen path, contactor, or BMS limit can produce this pattern.

16. B — Electric A/C compressors on hybrid vehicles must use a non-conductive polyolester (POE) oil specifically formulated for HV electric compressors. Conventional PAG oil is electrically conductive and would create a short path to ground through the motor windings, potentially causing an HV isolation fault or compressor failure. Using the wrong oil during service is one of the most common ways to ruin an electric A/C compressor.

17. B — A weak 12-volt auxiliary battery is a common cause of hybrid no-start because the 12 V system powers the HV contactor coils, the hybrid control module, and the start-up sequence. Until the 12 V battery

is verified good, any HV-level diagnosis is premature. Restoring 12 V and retesting power-up resolves a high percentage of "won't ready" complaints.

18. D — Contact with an energized HV bus can drive current across the chest, inducing ventricular fibrillation and death within seconds. Hybrid HV systems typically operate at 200–650 V DC, well above the threshold for lethal cardiac effects. This is why service disconnect removal, capacitor bleed-down time, and meter verification are non-negotiable before any HV system work.

19. A — The 12-volt auxiliary battery supplies the control modules, instrument cluster, body electronics, and — critically — the coil current that closes the HV main contactors during start-up. Without 12 V power, the HV system cannot be commanded on, and the vehicle will not enter ready mode. This is why a weak 12 V battery causes hybrid no-start complaints that look like HV failures.

20. C — The battery management system continuously monitors per-module voltage and limits the pack's charge and discharge current to protect any cell or module operating outside acceptable limits. A single weak module forces the BMS to derate the entire pack to prevent over-discharge or overheating of the weak cell. The customer typically reports reduced power, more frequent engine operation, or a check hybrid lamp.

21. D — In a Toyota-style power-split hybrid, MG1 is connected to the sun gear of the planetary set and is used both to start the ICE and to act as a generator that converts engine output into electricity for MG2 or for charging the HV battery. Its role is fundamentally different from MG2, which is the primary drive motor. Confusing the two functions leads to misdiagnosis of motor-related driveability codes.

22. B — Under light-to-moderate braking, the system uses regenerative braking as much as possible to recapture energy, blending in friction brakes only as needed to meet the driver's deceleration request. At very low speeds or with the battery near full SOC, regen becomes ineffective and the system shifts toward friction braking. Smooth blending without driver-perceptible transitions is a key design goal.

23. C — A reading of 0.3 megohms between a stator winding and the motor case indicates significantly degraded insulation; most OEMs specify a minimum of 1 megohm or higher (often 10 megohms or more). Once insulation drops to this level, the motor is no longer safe to operate in an HV system and replacement is the standard remedy. Drying or cleaning is not a reliable repair for insulation breakdown caused by aging or contamination.

24. C — Opening any orange HV connector requires that the HV system be disabled per the manufacturer's published de-energization procedure and then verified de-energized with a CAT III rated meter. PPE alone or partial disconnection is not sufficient because residual capacitor charge or a stuck contactor can leave the bus live. The verify-zero-voltage step is what makes the connector safe to open.

25. A — Hybrid-specific diagnostic codes — motor, inverter, battery, and HV system faults — are stored in the hybrid/EV-specific module list rather than only in the generic OBD-II powertrain menu. Scanning only the generic powertrain menu misses the majority of hybrid-specific codes and freeze frame data needed to diagnose the system. A scan tool capable of accessing all hybrid modules is essential.

26. B — HV battery cell module voltages must be measured with the HV system safely disabled and the service plug removed, never on a live pack at the BMS connector. Measuring live exposes the technician to lethal voltages and is not the prescribed service procedure on any OEM. Technician B's procedure reflects standard published practice.

27. D — Power electronics and traction motors have lower maximum continuous operating temperatures (typically around 65–75 °C) than the internal combustion engine's coolant (often 90–110 °C). Sharing the engine's coolant loop would expose the inverter and motor to temperatures that would damage IGBTs and motor windings. A dedicated lower-temperature loop with its own pump and radiator preserves component life.

28. A — Permanent magnet AC drive motors require precise knowledge of rotor angular position so the inverter can commutate the stator currents in synchronization with the rotor magnets. A resolver mounted on the motor shaft provides this position feedback as a high-resolution analog signal. Without accurate resolver input, the motor will not produce smooth torque and may not start at all.

29. C — Level 2 EVSE for plug-in hybrids supplies 240 V AC single-phase from a dedicated wall-mounted charger, typically at 16–40 A. This delivers roughly 3–10 kW depending on the unit, allowing a PHEV to recharge in a few hours. Level 1 uses 120 V AC, and DC fast charging uses much higher DC voltages.

30. D — Insulated gate bipolar transistors (IGBTs) are high-speed solid-state switches that the inverter pulses on and off thousands of times per second to synthesize three-phase AC from the DC bus. They are the heart of the inverter and the most thermally stressed components in the HV system. A failed IGBT typically produces a phase imbalance, a no-drive condition, or an inverter overcurrent code.

31. D — High-voltage PPE such as Class 0 rubber gloves must be within its periodic test/inspection date and visually inspected immediately before each use for cuts, cracks, ozone damage, or contamination. OSHA 1910.137 requires rubber insulating gloves to be electrically tested every six months. Using out-of-date or damaged PPE defeats its purpose and exposes the technician to lethal voltage.

32. B — Hybrid brake systems use a brake-by-wire architecture in which the pedal commands a target deceleration, and a controller blends regenerative and friction braking to meet that demand while feeding a simulated pedal feel back to the driver. Because the pedal is decoupled from the master cylinder under normal operation, the feel can differ slightly from conventional hydraulic systems. Drivers may report a soft or non-linear pedal that is normal for the design.

33. A — The required visual inspection of Class 0 rubber gloves includes rolling and inflating each glove with air to reveal pinholes, cuts, or cracks that would otherwise be invisible. Even a microscopic hole compromises the dielectric barrier and can deliver lethal voltage to the hand. This test is part of every OEM and OSHA-aligned HV work procedure.

34. C — Cells and modules within a pack drift apart in state of charge over time due to small manufacturing tolerances, temperature gradients, and aging differences in internal resistance. Without balancing, the weakest cell limits the pack's usable capacity and life. The BMS uses passive or active balancing to bring cells back in line and keep the pack performing as designed.

35. B — A P0A80 code stored alone is not sufficient evidence to condemn a pack; freeze frame data, individual module voltage history, and any related codes (cell imbalance, isolation, or temperature) point to the underlying root cause. Replacing a pack without this analysis often misses the real problem and risks a comeback. OEM diagnostic procedures explicitly require this confirmation step.

36. A — Damaged HV cables cannot be spliced, taped, or otherwise field-repaired because the insulation system must maintain rated dielectric strength along the entire length. OEM service procedures require replacement of the complete cable assembly when the orange jacket is cut or compromised. Improvised repairs may pass visual inspection but fail under load and cause an HV leak to chassis ground.

37. D — Electric power steering uses an electric motor to provide steering assist, eliminating the need for the belt-driven hydraulic pump, hydraulic lines, and reservoir found on conventional power steering. This is essential on hybrids because the ICE may stop and start, and a belt-driven pump cannot provide assist when the engine is off. The change also reduces parasitic load and improves fuel economy.

38. C — Lithium-ion has become the dominant battery chemistry for newer hybrid and plug-in hybrid designs because of its high energy density, lighter weight, and acceptable cycle life when properly managed. Earlier hybrids used nickel-metal hydride, which is still found in service, but new platforms increasingly use lithium-ion. The chemistry matters because charging profiles, balancing strategies, and service safety procedures differ.

39. B — The Toyota-style PSD uses a single planetary gear set with the engine driving the planet carrier, MG1 connected to the sun gear, and MG2 (and the output) connected to the ring gear. This arrangement lets the engine, MG1, and MG2 each contribute torque or speed to the output in continuously variable proportions. Understanding this kinematics is essential to diagnosing power-flow concerns.

40. A — During an auto stop, the climate control fan, instrument cluster, lighting, and other accessories continue to operate normally because they are powered by the 12 V system, which is fed from the HV battery through the DC-DC converter. Belt-driven accessories such as conventional hydraulic power steering pumps or belt-driven A/C compressors would stop with the engine, which is why hybrids use electric versions of these accessories. Maintaining cabin comfort through auto stop is a key design goal.

41. C — In a series hybrid, the internal combustion engine drives only a generator and has no mechanical connection to the wheels; all wheel torque comes from the electric drive motor. The engine functions purely as a range extender that recharges the battery or supplies the inverter directly. This differs from parallel and power-split designs, where the engine can drive the wheels mechanically.

42. D — Level 1 EVSE provides 120 V AC at approximately 12 A from a standard grounded household receptacle, delivering roughly 1.4 kW. This is the slowest charging level and is typically used for overnight charging of plug-in hybrids with small batteries. Higher charging rates require Level 2 (240 V AC) or DC fast charging.

43. B — Continuous high-speed operation of the battery cooling fan indicates that the BMS is reading a high pack or module temperature, most often caused by blocked intake vents, a clogged filter, or a faulty temperature sensor reporting an inflated value. The BMS commands the fan to maximum airflow to bring temperature back down. Ignoring the condition risks long-term cell damage and pack derating.

44. A — A post-repair road test on a hybrid must verify that the system transitions smoothly between EV-only operation, engine assist, regenerative braking, and engine-only modes under varying loads. Rough transitions point to remaining issues with the motor, inverter, battery, or control software calibration. This functional verification confirms the repair restored proper hybrid system operation, not just the absence of stored codes.

45. C — CAT III and CAT IV ratings describe a meter's ability to safely handle high-energy voltage transients on circuits with substantial source impedance and stored energy, such as those inside a hybrid HV system. A meter without the proper category rating can arc internally during a transient, exposing the technician to the full bus voltage. The category rating is a safety specification, not a feature or accuracy claim.