PRACTICE EXAM 9: RED SEAL 310S SIMULATION (125 QUESTIONS)

1. Under provincial occupational health and safety legislation in Canada, a worker who believes a task is unsafe has the right to:

A. Continue working under the supervisor's direction while reporting the concern through written channels

B. Walk off the job permanently without notifying the employer about the safety concern

C. Refuse the work only after the supervisor has personally tested the conditions

D. Refuse the unsafe work, with the employer obligated to investigate before disciplining or assigning others

2. When climbing a portable ladder, the worker must maintain:

A. Two hands gripping the ladder rails with feet on the rungs at all times during climbing

B. A safety harness attached to a separate anchor point during the ascent

C. Three-point contact — two hands and one foot, or two feet and one hand — with the ladder throughout climbing

D. A spotter holding the ladder base while a second worker climbs

3. A fall arrest anchor point used in shop work must be rated to support at least:

A. 22.2 kN (approximately 5,000 lb) of static load per worker attached to the anchor

B. 1.5 kN (approximately 340 lb) of static load per worker attached to the anchor

C. The body weight of the worker plus 50% as a safety factor during the fall

D. The weight of all tools and equipment the worker will be using at height

4. Most provincial occupational health regulations set the permissible 8-hour time-weighted average noise exposure limit at:

A. 65 dBA, the level of normal office conversation in the workplace

B. 85 dBA, above which hearing protection is generally required

C. 110 dBA, the level inside a typical machine shop during operation

D. 140 dBA, the peak level at which sudden hearing damage can occur

5. Prolonged use of pneumatic impact wrenches can cause hand-arm vibration syndrome (HAVS), characterized by:

A. Improved grip strength and circulation in the hands from regular use

B. Skin discoloration that resolves quickly after each work shift ends

C. Joint flexibility increase from frequent vibration exposure during work

D. Numbness, tingling, and reduced grip strength from chronic vibration nerve and circulatory damage

6. A workplace joint health and safety committee (JHSC) is typically required when:

A. The workplace involves any use of compressed air tools regardless of size

B. The workplace has more than five mechanics on duty at any single time

C. The workplace has a specified minimum number of workers (varies by province, often 20+), with both worker and employer representatives

D. The workplace has been issued a citation by the provincial OHS authority

7. A job safety analysis (JSA) or job hazard analysis (JHA) is performed to:

A. Record incidents that have already occurred during job operations for archives

B. Identify hazards in a specific task, before the work begins, and develop controls for each step of the task

C. Document the supervisor's performance evaluation of each worker during a job

D. Calculate the time required to complete a specific work task accurately

8. When mounting and dismounting heavy equipment (trucks, hoists, elevated platforms), the safest practice is to:

A. Maintain three points of contact with the equipment (two hands and one foot, or two feet and one hand) while ascending or descending

B. Jump from the platform to the ground to avoid prolonged climbing time

C. Use only the equipment's automatic lift system without manual contact

D. Climb backwards facing away from the equipment for better visibility

9. Pre-shift safety meetings (toolbox talks) in a shop are designed to:

A. Replace formal safety training programs for new and current workers

B. Provide the supervisor an opportunity to discipline workers for unsafe behaviour

C. Document attendance at the workplace for payroll and labour records

D. Brief workers on hazards, recent incidents, or specific tasks expected during the shift, with worker participation encouraged

10. On a 4-stroke engine, "bore" refers to:

A. The total swept volume of the cylinder during one complete piston cycle

B. The distance the piston travels from TDC to BDC during one stroke

C. The diameter of the cylinder, while "stroke" is the distance the piston travels from TDC to BDC

D. The number of compression strokes the engine completes per revolution of the crankshaft

11. The displacement of one cylinder in an engine is calculated as:

A. $(\pi/4) \times \text{bore}^2 \times \text{stroke}$, with the result giving the swept volume of one cylinder

B. $(\pi \times \text{bore} \times \text{stroke}) \div 2$, with the result giving the swept volume of one cylinder

C. The bore added to the stroke, with the result giving the swept volume of one cylinder

D. The bore divided by the stroke, with the result expressed in cubic centimetres

12. A wet cylinder sleeve differs from a dry cylinder sleeve because:

A. The wet sleeve is sealed without coolant contact, while the dry sleeve contacts coolant directly

B. The wet sleeve is in direct contact with engine coolant, while the dry sleeve is pressed into the block with no coolant contact

C. The wet sleeve is permanently bonded to the block, while the dry sleeve is removable

D. The wet sleeve is used on diesel engines exclusively, while the dry sleeve is used on gasoline engines

13. Connecting rod bearing "crush" refers to:

A. The interference fit between the bearing and the journal during normal operation

B. The crushing of contaminant particles by the bearing during engine break-in

C. The compression of the bearing oil clearance to less than specification value

D. The slight protrusion of each bearing half above the rod parting line, ensuring tight seating when the cap is torqued

14. Balance shafts in an inline 4-cylinder engine are designed to:

A. Increase the engine's compression ratio by adjusting the crankshaft balance

B. Reduce engine RPM during cruising conditions to improve fuel economy

C. Cancel the inherent secondary vibrations of the inline-4 by spinning at twice crank speed in opposite directions

D. Synchronize the timing chain with the crankshaft and camshaft positions

15. A roller-lifter camshaft, compared to a flat-tappet camshaft, typically offers:

A. Reduced friction between cam and lifter, allowing aggressive lobe profiles and longer service life

B. Lower production cost due to simpler lifter and cam machining processes

C. Higher engine RPM capability through lighter valve train components

D. Improved cold starting through reduced cranking resistance from the lifters

16. A hydraulic roller lifter differs from a mechanical (solid) roller lifter because:

A. The hydraulic version uses electronic actuation through a solenoid

B. The hydraulic version maintains zero valve lash automatically using engine oil pressure inside the lifter body

C. The mechanical version requires the engine to be hot before valve operation begins

D. The mechanical version uses a synthetic polymer bearing in the roller wheel

17. A pushrod (overhead valve, OHV) engine differs from an overhead camshaft (OHC) engine because:

A. The pushrod design uses no camshaft, relying on rocker arms only for valve actuation

B. The OHC design operates at lower RPM than equivalent pushrod engines

C. The pushrod design always uses fuel injection, while the OHC design always uses carburetors

D. The pushrod design has the camshaft inside the block, with pushrods operating rocker arms above the head

18. On a modern GDI engine, piezoelectric injectors differ from solenoid injectors because:

A. Piezoelectric injectors use a crystal stack that expands under voltage, opening faster with finer control

B. Piezoelectric injectors operate at lower fuel pressures than solenoid injectors during normal operation

C. Piezoelectric injectors require less electrical voltage to operate than solenoid injectors

D. Piezoelectric injectors inject fuel into the intake port instead of the combustion chamber

19. A compression test performed with the engine cold and dry shows 85 psi on one cylinder; adding a small amount of oil through the spark plug hole and retesting shows 145 psi. This indicates:

A. The cylinder head gasket has failed at that specific cylinder location

B. The valve seats are worn and not sealing during the compression stroke

C. Worn piston rings, since the added oil temporarily seals the ring gap and restores compression

D. A burned exhaust valve at the cylinder, with the oil providing minimal sealing improvement

20. A steady but low engine vacuum reading (10-15 in.Hg) at idle on a healthy-rotating engine typically indicates:

A. A normal vacuum reading for any engine at idle regardless of condition

B. Late ignition timing, an exhaust restriction, or worn piston rings affecting cylinder sealing

C. A failing fuel pump that has reduced fuel delivery to all cylinders during idle

D. Excessive carbon deposits on the intake valves restricting airflow at idle

21. An Intake Manifold Runner Control (IMRC) system uses butterfly valves inside the intake runners to:

A. Increase intake manifold pressure when the throttle is open at high RPM

B. Cool intake air during high-speed operation through the runner valves

C. Redirect exhaust gases back through the intake manifold to reduce emissions

D. Vary intake runner length or generate tumble/swirl for improved combustion at different RPM ranges

22. On a modern diesel engine, "active" DPF regeneration differs from "passive" regeneration because:

A. Active regeneration injects extra fuel (post-injection or in-exhaust) to raise DPF temperature high enough to burn off accumulated soot

B. Active regeneration occurs during cold-start operation when the DPF is below operating temperature

C. Active regeneration is performed manually by the technician at every service interval

D. Active regeneration requires the engine to be shut off while regeneration completes

23. On a modern diesel engine with SCR aftertreatment, the DEF dosing rate as a percentage of fuel consumption is typically:

A. 0.5% — much less than fuel consumption regardless of engine load

B. 50% — about half of the fuel consumption during normal operation

C. 2-5% — depending on engine load and the NOx reduction required

D. 100% — equal to fuel consumption during all operating conditions

24. A piezoelectric knock sensor is mounted on or near the engine block to:

A. Measure engine vibration directly from the crankshaft thrust bearings

B. Detect specific high-frequency vibrations characteristic of engine knock (pre-ignition or detonation), allowing the PCM to retard timing

C. Generate a knock-cancelling signal that prevents detonation during operation

D. Monitor exhaust gas frequency to detect lean operation in the cylinders

25. A vehicle has a rattle from the front of the engine that is loudest at cold start and quiets after a few seconds. The most likely cause is:

A. A loose accessory belt that tensions correctly after the engine has been started

B. A worn engine mount that resonates during the first seconds of operation

C. A broken exhaust manifold heat shield rattling against the manifold housing

D. A failing hydraulic timing chain tensioner that has lost oil pressure during shutdown, allowing chain slack at startup

26. The SCR (Selective Catalytic Reduction) catalyst on a diesel engine requires:

A. A minimum operating temperature (typically above 200°C) before DEF dosing begins, to ensure the chemical reaction reduces NOx effectively

B. A maximum operating temperature below 100°C to prevent the SCR from overheating

C. The same operating temperature as the DPF (about 600°C) for the system to function

D. No temperature requirement; the catalyst operates at any exhaust temperature

27. An engine oil pressure warning lamp typically illuminates when oil pressure drops below approximately:

A. 30-40 psi, well above the threshold for engine bearing damage

B. 15-20 psi, near the minimum operating pressure at hot idle

C. 5-7 psi (varies by manufacturer), indicating dangerously low oil pressure

D. 0 psi only, requiring complete loss of oil pressure to activate

28. A Manifold Absolute Pressure (MAP) sensor is used by the PCM to:

A. Measure ambient atmospheric pressure outside the vehicle during operation

B. Measure intake manifold pressure (absolute, referenced to vacuum), allowing the PCM to calculate engine load

C. Measure the pressure of exhaust gases at the catalytic converter during operation

D. Measure the fuel pressure at the rail before injection into the cylinders

29. On a speed-density fuel-injection system that uses a MAP sensor without a MAF sensor, engine load is calculated from:

A. Throttle position alone, with the PCM adjusting injection accordingly

B. Crankshaft position alone, with the PCM calculating airflow from RPM

C. Exhaust oxygen sensor feedback alone, with the PCM closing the loop continuously

D. MAP, RPM, and intake air temperature, with the PCM calculating airflow mathematically from the speed-density formula

30. A failed PCV (positive crankcase ventilation) valve that has stuck closed typically produces:

A. Elevated crankcase pressure, pushing oil past seals (gasket leaks, dipstick) and increasing blow-by accumulation

B. Increased intake manifold vacuum at idle through the unfiltered crankcase

C. Reduced oil consumption due to better crankcase containment

D. Improved fuel economy from reduced crankcase ventilation flow

31. A failed Intake Air Temperature (IAT) sensor that reports a colder-than-actual reading typically causes:

A. The PCM to lean out the fuel mixture, possibly causing misfire and damage

B. The PCM to retard ignition timing significantly under all operating conditions

C. The PCM to enrich the fuel mixture (assuming denser air) and possibly retard timing, reducing fuel economy

D. No symptoms because the IAT sensor is for diagnostic purposes only

32. A modern vehicle gateway module's primary function is to:

A. Disconnect the OBD-II port when unauthorized access is detected

B. Route messages between different network protocols and bus segments, enforcing security and message filtering

C. Power up all modules simultaneously during the start-up sequence

D. Replace the OBD-II port on vehicles with no diagnostic access requirements

33. A short to ground on the CAN-H wire alone (with CAN-L intact) on a high-speed CAN bus will typically:

A. Cause no observable symptoms because the differential signalling compensates automatically

B. Cause all modules to enter sleep mode and prevent any communication on the bus

C. Cause one specific module to enter bus-off, with the rest operating normally

D. Disable the bus's differential signalling; modules may try fault-tolerant single-wire operation if supported, or the bus fails

34. OBD-II Mode 06 (service $06) is used to retrieve:

A. On-board monitoring test results, including the specific values measured during monitor tests and the limits used

B. Permanent DTCs that cannot be cleared by a scan tool reset operation

C. Real-time data from the PCM through the OBD-II protocol stream

D. The VIN, calibration ID, and other vehicle identification through Mode 09 only

35. After installing a used module from a salvage vehicle, the new vehicle sets a network DTC for the module. The most likely cause is:

A. The salvage module's hardware is incompatible with the new vehicle's network

B. The salvage module's CAN transceiver has failed during the removal process

C. The salvage module needs only a battery disconnect to "learn" the new vehicle

D. The salvage module is programmed with the original vehicle's VIN and security code; reflashing and reconfiguration is required

36. A "calibration update" on a PCM differs from a "firmware update" because:

A. The calibration update changes the hardware design of the PCM

B. The firmware update changes only emission control behaviour without other effects

C. The two terms are interchangeable and refer to the same process

D. Calibration updates change operating parameters (timing/fuel maps) within the same firmware; firmware updates change the underlying software code

37. A J2534 pass-through device allows a technician to:

A. Bypass the vehicle's OBD-II security access for unauthorized changes

B. Connect a computer to the vehicle's network and run OEM software for diagnostics, reprogramming, and module setup

C. Read DTCs only from older OBD-II vehicles built before 2008 model year

D. Charge the vehicle's 12V battery during reprogramming through the OBD-II port

38. A wireless (Bluetooth) scan tool dongle plugged into the OBD-II port:

A. Transmits diagnostic data via Bluetooth to a separate device (phone, tablet, laptop), letting the technician work away from the vehicle

B. Charges the vehicle's 12V battery through the OBD-II port during diagnosis

C. Replaces the need for any wired connection to the vehicle for all reprogramming

D. Operates the vehicle's wireless features (Wi-Fi hotspot, telematics) during operation

39. A modern vehicle's telematics module enables features like remote start, vehicle location, and emergency call services by:

A. Using the vehicle's OBD-II port to upload data to the cloud during driving

B. Connecting to the customer's home Wi-Fi network when parked in the garage

C. Using an embedded cellular modem with a SIM card to communicate with the manufacturer's servers

D. Operating only when the vehicle is connected to a wired diagnostic station

40. When two CAN modules attempt to transmit at the same time, the message with the lower numerical CAN-ID:

A. Is delayed by a fixed timeout before retransmission attempts

B. Wins arbitration and transmits first; the other module waits and retransmits

C. Triggers a network reset to clear the collision condition

D. Is discarded entirely, with both modules retrying simultaneously

41. An open in one of the two CAN wires (with the other intact) on a high-speed CAN bus typically:

A. Has no effect because the bus uses differential signalling to compensate

B. Disables all communication on the entire bus immediately

C. Causes only the module nearest the open wire to lose communication

D. Disables differential signalling; the bus may fall back to single-wire fault-tolerant mode if supported, otherwise communication fails

42. Before reprogramming a PCM, the technician must:

A. Maintain stable battery voltage with a battery maintainer/stabilizer, and avoid disturbing connections during the flash

B. Disconnect the battery to prevent any voltage variation during the flash operation

C. Disable all other modules on the network to ensure adequate bandwidth for the flash

D. Run the engine at fast idle to maintain charging system output during the flash

43. A scan tool "snapshot" or "movie" feature is used to:

A. Capture a photograph of the vehicle's engine bay for the customer's records

B. Take a still image of the scan tool display at one moment in time

C. Record PCM data parameters continuously during a road test, for later review of intermittent faults

D. Save the scan tool's settings before a software update

44. A clutch with a worn throw-out (release) bearing typically produces:

A. Slipping during heavy acceleration with no other symptoms during operation

B. A whining noise that occurs only during deceleration in any gear

C. Chatter or shudder during clutch engagement at low speeds

D. A noise present only when the clutch pedal is depressed, disappearing when the pedal is released

45. The diaphragm spring fingers of a clutch pressure plate:

A. Provide the friction surface that contacts the clutch disc during engagement

B. Act on the throw-out (release) bearing to disengage the pressure plate from the disc when the clutch pedal is depressed

C. Hold the flywheel bolts in place during normal engine operation

D. Damp engine vibrations from reaching the transmission input shaft

46. A flywheel with worn or chipped ring gear teeth typically produces:

A. A grinding or clattering sound during cranking only, with normal engine operation after start

B. A whine that increases with engine RPM during normal operation

C. A vibration that increases with vehicle speed at all engine RPM

D. Increased clutch pedal effort with no noise during operation

47. A failing transmission mount typically allows:

A. The transmission to rotate excessively around the input shaft axis

B. The driver to feel transmission vibration only during reverse gear operation

C. The transmission to shift its position under torque application, causing a clunk on accel/decel transitions and vibration at idle

D. The transmission fluid to leak past the rear seal during operation

48. On a long-wheelbase RWD or 4WD vehicle with a two-piece driveshaft, the center support bearing's purpose is to:

A. Lubricate the driveshaft splines from a remote oil reservoir during operation

B. Apply tension to the front and rear sections of the driveshaft for balance

C. Engage and disengage the rear driveshaft section during 4WD operation

D. Support the middle of the driveshaft for balance over a long span, isolated from the body with rubber

49. A wet dual-clutch transmission (DCT) differs from a dry DCT because:

A. The wet DCT operates only on AWD vehicles, while the dry DCT operates only on FWD vehicles

B. Wet DCTs bathe the clutch packs in transmission fluid for cooling and lubrication; dry DCTs use friction clutches without fluid

C. The wet DCT uses a single clutch, while the dry DCT uses two clutches

D. The wet DCT operates at higher RPM than the dry DCT for all driving conditions

50. During a torque converter stall test (brake firmly applied, transmission in drive, throttle to wide open), an engine that revs significantly higher than the specified stall speed indicates:

A. A failed internal clutch pack or band, slipping beyond what the torque converter normally provides

B. A failed torque converter that has locked permanently in lock-up mode

C. A failed engine that produces excessive power for the converter to absorb

D. A normal result for any vehicle with an automatic transmission

51. A "torque converter shudder" felt at light cruise (around 60-80 km/h) on a modern automatic typically indicates:

A. A failed transmission output speed sensor signal during cruise operation

B. A failed transmission filter restricting fluid flow at light throttle

C. A worn lock-up clutch friction surface inside the torque converter, slipping during partial lock-up engagement

D. A failed engine ignition coil causing misfire only at cruise speed

52. A vehicle has ATF dripping from the front of the transmission bell housing. The most likely source is:

A. A failed transmission cooler line at the radiator location

B. A failed front pump seal or torque converter seal, allowing fluid to leak from the front of the transmission case

C. A failed transmission pan gasket leaking from the bottom

D. A failed rear extension housing seal at the rear of the transmission

53. A restricted transmission cooler (e.g., debris-clogged radiator-mounted cooler) typically causes:

A. Elevated transmission fluid temperature, possibly triggering an over-temp DTC and accelerating fluid breakdown

B. Lower transmission fluid pressure at all operating conditions

C. Hard shifts during cold start that improve as the transmission warms up

D. Excessive transmission fluid foaming during normal operation

54. A manual transmission that "pops out" of a specific gear during deceleration is most likely caused by:

A. A failed clutch slave cylinder allowing the clutch to partially engage

B. Worn synchronizer rings on that specific gear only

C. A low transmission lubricant level affecting that gear engagement

D. A worn shift fork, worn detent, or worn gear dog teeth, failing to hold the gear under load reversal

55. In a manual transmission, reverse gear is typically engaged through:

A. A direct splined connection that bypasses all other gear sets

B. An idler gear inserted between two gears to reverse the direction of rotation

C. The same gear set as 1st gear with a switching mechanism for direction

D. A separate hydraulic clutch pack used only for reverse operation

56. Pinion gear runout in a differential is measured to:

A. Verify the ring and pinion teeth count for the correct final drive ratio

B. Determine the pinion preload torque before assembly is complete

C. Verify the pinion gear shaft is true (not bent or eccentric) before installation

D. Adjust the pinion depth shim during the differential assembly procedure

57. Changing the final drive ratio from 3.42:1 to 4.10:1 (numerically higher ratio) will:

A. Increase engine RPM at any vehicle speed and improve acceleration, while reducing top speed and possibly affecting speedometer accuracy

B. Decrease engine RPM at any given vehicle speed and improve fuel economy

C. Have no effect on engine RPM, only changing the driveshaft rotational speed

D. Increase top speed and reduce acceleration response from any gear

58. During driveshaft inspection, a U-joint that "binds" when manually rotated through its full range indicates:

A. The U-joint is fully lubricated and operating normally during inspection

B. The U-joint has excessive end-play and must be replaced as a unit

C. The U-joint cross has been bent from heavy load operation

D. The U-joint's needle bearings are dry, damaged, or seizing; replacement of the U-joint is required

59. A clutch hydraulic system that fails to fully release the clutch (clutch drags during gear engagement) after the slave cylinder has been verified to extend properly typically has:

A. Air in the hydraulic line that requires bleeding to restore proper engagement

B. A flywheel or pilot bearing that has worn and is binding the clutch disc to the input shaft

C. A failed clutch master cylinder seal that requires replacement

D. A wrong type of brake fluid in the clutch hydraulic reservoir

60. An automated manual transmission (AMT) differs from a conventional automatic transmission because:

A. The AMT uses an automatic-style torque converter to multiply engine torque

B. The AMT cannot operate in fully automatic mode and always requires driver shifting

C. An AMT uses a conventional manual gearbox with electric or hydraulic actuators replacing the driver's clutch and shift inputs

D. The AMT uses a CVT-style belt instead of conventional gears

61. On an alternator, the carbon brushes:

A. Make sliding electrical contact with the rotating slip rings, supplying current to the rotor field winding through the regulator

B. Apply mechanical pressure against the stator core during operation

C. Generate the alternator's output current through their movement

D. Provide the alternator's mechanical bearing surface for the rotor

62. A failed diode (one of the six rectifier diodes) in an alternator typically causes:

A. Complete loss of alternator output, with the warning lamp on at all RPM

B. Excessive output voltage that damages connected electronics

C. The alternator to charge only at high RPM with no output at idle

D. Reduced output capacity and visible AC ripple in the DC output, often observable on a scope at the battery terminal

63. Battery "sulfation" — the buildup of hard lead sulfate crystals on the battery plates — typically results from:

A. Frequent deep cycling of the battery to nearly fully discharged

B. Leaving the battery discharged or at low state of charge for an extended period

C. Overcharging the battery at excessively high voltage during operation

D. Operating the battery in a vehicle with a properly functioning charging system

64. An AGM (absorbed glass mat) battery differs from a flooded lead-acid battery because:

A. The AGM uses a different chemistry; flooded uses lead-acid while AGM uses nickel-metal hydride

B. The AGM uses a gel electrolyte that solidifies between the plates

C. The AGM absorbs the liquid electrolyte into fiberglass mats between the plates, allowing higher discharge rates, better vibration resistance, and spill-proof operation

D. The AGM is rebuildable in the shop, while the flooded battery must be replaced

65. A modern vehicle's voltage regulator typically maintains charging system voltage in the range of:

A. 13.5-14.7 V under normal operating conditions, depending on battery state of charge and temperature

B. 16-18 V to ensure the battery is charged rapidly under all conditions

C. 11-12 V to prevent overcharging in any condition

D. 24-28 V on a standard passenger vehicle 12V electrical system

66. A "maxi-fuse" in a vehicle's underhood fuse box differs from a standard mini-blade fuse because:

A. The maxi-fuse uses ceramic insulation while the mini-fuse uses plastic

B. The maxi-fuse must be replaced with a fuse of any higher rating during emergency repair

C. The maxi-fuse can be reset by hand after blowing during operation

D. A physically larger blade fuse rated for higher current (typically 20-100 A) on main circuits like alternator or cooling fan

67. Standard ISO automotive relays use terminal numbering where the coil terminals are:

A. 30 (power input) and 87 (load output), connected by an internal coil

B. 85 and 86, with the coil between them; energizing the coil closes the high-current contacts (30 to 87)

C. 30 and 87a, with the relay in its normally-open position

D. 1 and 2, identical numbering for all relay terminals regardless of function

68. Canadian vehicles built after 1990 must be equipped with daytime running lights (DRL) that:

A. Activate automatically when the engine is running and the headlight switch is in the off or auto position, illuminating the front of the vehicle

B. Replace the function of the headlights for night driving operations

C. Operate only during cold-weather months for visibility in winter conditions

D. Activate only when the driver manually selects the DRL function from the dash

69. An "adaptive headlight system" steers the headlight beams in response to:

A. The vehicle's headlamp washer being activated during operation

B. The ambient light level sensor reading inside the cabin during driving

C. The vehicle's speed only, with beam adjustment proportional to RPM

D. Steering wheel angle (and sometimes speed and yaw), aiming the beams into corners as the driver steers

70. A vehicle's rain-sensing wipers use a sensor mounted on the windshield that:

A. Detects the temperature of the windshield, activating wipers when temperature drops

B. Measures the volume of water collected in a small reservoir during driving

C. Uses infrared light reflection from the windshield glass: when water disturbs the reflection, the BCM activates the wipers at an appropriate speed

D. Activates the wipers only when the driver presses a manual override switch

71. The backup camera image displayed on the infotainment screen includes overlaid guide lines that:

A. Are physical decals applied to the camera lens during manufacturing

B. Are software-generated by the camera or infotainment module, with the lines projected based on steering angle and vehicle parameters

C. Are projected by lasers mounted near the camera onto the ground

D. Are generated by the rear parking sensors and projected onto the windshield

72. A USB-C Power Delivery (PD) port in a modern vehicle differs from a standard USB-A port because:

A. The USB-C PD port can negotiate higher voltage and current (up to 100W in some implementations), fast-charging compatible devices

B. The USB-C PD port uses a different cable but delivers the same 5V/2A power as USB-A

C. The USB-C PD port is only for data transfer and cannot charge devices at all

D. The USB-C PD port operates only when the engine is running, while USB-A operates at any time

73. A "kick to open" or "hands-free" power liftgate uses a sensor that detects:

A. The vehicle's speed dropping to zero, automatically opening the liftgate

B. The driver's voice command spoken near the rear of the vehicle

C. A foot or leg motion under the rear bumper (typically capacitive sensors or radar), with the key fob verified nearby

D. The driver's hand placed on the rear license plate area during proximity detection

74. A keyless entry (PEPS) door handle's capacitive sensor detects:

A. The exterior temperature of the vehicle at the door handle area

B. The customer's grip strength applied to the handle during entry

C. The change in capacitance when a hand approaches the handle, triggering the BCM to wake and verify the key fob before unlocking

D. The barometric pressure change as the door is being opened during operation

75. A trunk release switch on the driver's door panel that has failed (no response from button press) is diagnosed by:

A. Replacing the entire driver's door panel to access the new switch

B. Testing the switch for continuity when pressed (or measuring voltage at the BCM input), then verifying the BCM receives the signal

C. Replacing the BCM because trunk-related circuits are integrated

D. Bypassing the BCM with a direct power feed to the trunk release motor

76. A heated steering wheel circuit uses a heating element wrapped around the wheel rim, powered through:

A. A slip ring or spring contact in the steering column that maintains electrical continuity as the wheel rotates

B. A wireless inductive power transfer system that requires no electrical contact

C. The same wires as the airbag clock spring, sharing the connection

D. A separate battery installed in the steering wheel hub assembly

77. An automatic climate control system that includes air quality sensing uses a sensor mounted in the fresh air intake to:

A. Measure the temperature of outside air for climate calibration

B. Measure the humidity of outside air during recirculation

C. Detect carbon monoxide from the vehicle's own exhaust during operation

D. Detect odours, pollutants, or smog, switching the air intake to recirculation mode when contaminants are detected

78. On vehicles with self-leveling HID or LED headlamps, the system uses:

A. A camera mounted on the roof to verify headlamp aim during operation

B. The vehicle's speed sensor to estimate body angle during driving

C. Ride height sensors that detect vehicle attitude, with the BCM adjusting headlight aim motors to keep beams properly aimed

D. The driver's manual adjustment knob, with no automatic correction

79. A heated wiper park area (commonly an electrically-heated strip in the windshield at the base where the wipers rest) is designed to:

A. Increase windshield washer fluid temperature during cold weather operation

B. Prevent ice from binding the wiper blades to the windshield during cold weather, allowing the wipers to free and operate normally

C. Defrost the entire windshield through conducted heat from the strip

D. Replace the standard front defroster on vehicles with this feature

80. A 12V-to-120V power inverter installed in a vehicle:

A. Converts the vehicle's DC battery voltage into household-style AC, allowing the operation of small AC-powered devices through a standard outlet

B. Increases the vehicle's electrical system voltage from 12V to 120V permanently for all operations

C. Replaces the vehicle's alternator with an electronic equivalent during operation

D. Charges the vehicle's battery from an external 120V AC source for grid integration

81. A vehicle's power window with auto-down (one-touch down) feature stops moving immediately if reversed:

A. After the window has reached the full down position only

B. After a fixed time delay regardless of window position during operation

C. When the BCM detects that the engine is no longer running

D. When an obstruction is detected (through motor current or Hall pulse rate), reversing direction immediately to prevent injury

82. A typical heated rear window (defroster grid) circuit operates on a timer that automatically shuts off after:

A. 30 seconds, the typical time to clear a frosted rear window

B. 2 minutes, sufficient for most light frost conditions during the morning

C. 10-15 minutes, after which the system shuts off automatically to prevent battery drain and overheating

D. 60 minutes, the maximum allowed by transport regulations during operation

83. To determine whether a vehicle's charging fault is at the alternator or the battery, the technician should:

A. Replace the battery first to rule it out as the cause of the problem

B. Test the battery independently (load test) and the alternator under load, isolating each component before replacement

C. Replace the alternator first because alternators fail more often than batteries

D. Run the engine at high RPM with all accessories on for 10 minutes to "burn in" the system

84. A brake bleeder screw that is rounded or seized typically requires:

A. Penetrating oil, careful re-machining with a bleeder extractor, or replacement of the caliper/wheel cylinder as a last resort

B. Heating the bleeder screw to red-hot temperature with an oxyacetylene torch

C. Applying maximum force with an adjustable wrench until the screw breaks free

D. Drilling out the bleeder screw with a high-speed drill bit and tapping new threads

85. A parking brake equalizer is the component that:

A. Maintains equal hydraulic pressure between the left and right rear brakes

B. Distributes brake fluid evenly between the front and rear brake circuits

C. Connects the parking brake cable to the ABS modulator for electronic engagement

D. Ensures equal cable tension between the left and right rear parking brake cables when the lever is applied

86. A brake combination valve (also called proportioning valve on older systems) typically performs which functions?

A. Pressurizes the brake fluid by acting as a hydraulic pump during braking

B. Limits hydraulic pressure to the rear brakes proportional to deceleration, preventing rear lockup; may include metering and warning functions

C. Routes brake fluid between the master cylinder and ABS modulator only

D. Reduces the brake fluid temperature during heavy braking through internal cooling fins

87. A drum brake's hold-down springs and pins serve to:

A. Apply pressure between the brake shoes and the drum surface during braking

B. Connect the wheel cylinder to the brake shoes for fluid pressure transmission

C. Hold the brake shoes against the backing plate while allowing them to move outward against the drum during braking

D. Provide the parking brake's mechanical force during application

88. A wheel speed sensor that has set a "low signal amplitude" DTC may be restored by:

A. Cleaning the sensor and the tone ring of metallic debris and contamination, then verifying air gap (if adjustable) per specification

B. Replacing the sensor's electrical connector with a generic replacement

C. Increasing the sensor's input voltage with an aftermarket booster circuit

D. Replacing both the sensor and the brake rotor at the same time

89. When tightening a brake caliper banjo bolt, the technician must:

A. Hand-tighten until snug, with no need for torque specification compliance

B. Heat the banjo bolt to 100°C before tightening for proper seal compression

C. Apply a generous amount of anti-seize compound to the bolt threads before installation

D. Install new copper sealing washers on both sides of the banjo fitting and torque to specification

90. Brake fluid colour testing:

A. Is a reliable measure of brake fluid moisture content in modern systems

B. Provides a general indication of fluid age and contamination, but is not a substitute for boiling point or moisture testing

C. Is required by provincial regulation before any brake service can begin

D. Is performed by adding a colour-change reagent to the fluid reservoir

91. A vehicle that has sagged below its specified ride height on one corner typically has:

A. A failed shock absorber on that corner only of the suspension system

B. A failed strut top bearing on that corner only of the suspension system

C. A weakened or broken coil spring on that corner, requiring spring replacement (and typically replacement of the opposite spring at the same time)

D. A failed wheel bearing on that corner causing the vehicle to sag down

92. A shock absorber that shows visible oil residue on its body but functions normally during a bounce test:

A. Has an early-stage seal leak; the shock will progressively lose damping ability and should be replaced

B. Is functioning normally because the bounce test passed without issues

C. Has been over-filled with oil at the factory; the oil is normal seepage

D. Is in its break-in period; the oil residue will stop after 1,000 km of driving

93. A non-load-carrying (follower) ball joint is inspected for play by:

A. Supporting the lower control arm with a jack stand to unload the joint, then prying upward

B. Removing the joint and inspecting it on the bench for free movement

C. Driving the vehicle on the highway and observing handling under load conditions

D. With the suspension at normal ride height, prying or rocking the joint and observing any movement (since this joint carries no load)

94. A failing steering rack mounting bushing typically causes:

A. A whine from the power steering pump during low-speed maneuvers only

B. A clunk during steering input (left to right) and possibly a loose, vague steering feel as the rack shifts in its mounts

C. A loss of power steering assist during all driving conditions

D. A leak from the steering rack inner tie rod boots on both sides simultaneously

95. A power steering reservoir level check should be performed:

A. With the vehicle parked on a slope to drain fluid to one side of the reservoir

B. With the engine running at full RPM for 30 seconds to circulate fluid through the system

C. With the engine off and fluid at the marker's reference temperature (cold or hot), verifying fluid is between min and max

D. With the steering wheel held at full lock for 60 seconds before checking

96. When performing a four-wheel alignment, the technician should:

A. Use the manufacturer's published specifications for the specific vehicle (year, make, model, trim) and adjust to the centre of the acceptable tolerance range

B. Use the manufacturer's maximum tolerance values regardless of vehicle condition

C. Use generic specifications from any similar vehicle on the market

D. Use the customer's preferred values if the customer requests specific settings

97. Tire pressure specifications shown on the vehicle's tire placard (door jamb sticker) are based on:

A. The tire's hot pressure after a 30-minute highway drive at maximum load

B. The tire's pressure measured during operation at high ambient temperature

C. The tire's pressure at the maximum load specified by the tire manufacturer

D. The tire's "cold" pressure, measured before the vehicle has been driven (or after sitting for at least 3 hours) at the typical ambient temperature

98. Most tire manufacturers and provincial inspection programs recommend tire replacement when the tire reaches:

A. 2-3 years from the DOT date code, regardless of tread wear conditions

B. 6-10 years from the DOT date code, regardless of remaining tread, due to rubber compound aging

C. 15-20 years from the DOT date code, when the tire is approaching condemnation

D. There is no age-based replacement recommendation for any tire on the market

99. On a FWD vehicle with directional tires, the standard tire rotation pattern is:

A. Front-to-rear and side-to-side (X pattern) regardless of tire directional orientation

B. Side-to-side only on each axle (left to right swap front, left to right swap rear)

C. Front-to-rear on the same side only (left front to left rear, right front to right rear), maintaining directional orientation of the tires

D. Diagonal swap only (left front to right rear, right front to left rear)

100. When installing a new wheel stud from the rear of the hub by pressing or pulling it into place, the technician must:

A. Ensure the stud is fully seated by pulling it tight into the hub flange, typically using a lug nut and washers to press the stud's serrated section into the hub

B. Use a hammer to drive the stud through the hub from the rear toward the front

C. Apply thread sealant to the stud's outer threads before installation

D. Heat the hub to red temperature before pressing the stud into place

101. After installing a wheel and applying initial lug nut torque, the wheel should be:

A. Re-torqued every 1,000 km for the first 10,000 km of driving on the vehicle

B. Re-torqued only when the vehicle is brought in for any service after installation

C. Driven for at least 1,000 km before any torque verification is required

D. Re-torqued (or torque-verified) after approximately 50-100 km of driving, to confirm specification after seat-and-stud settling

102. A tire "bead seater" tool is used to:

A. Loosen a stuck tire bead from the wheel rim for tire dismounting

B. Apply lubricant to the tire bead area before mounting on the rim

C. Provide a rapid burst of compressed air around the bead area to force the tire bead onto the rim's seat during inflation

D. Hold the tire bead in place during the tire balancing procedure

103. A tire pressure monitoring system (TPMS) on a modern vehicle commonly uses:

A. A standard rubber snap-in valve stem identical to a non-TPMS valve stem

B. A metal valve stem with the TPMS sensor attached, secured with a clamp-in nut and o-ring seal at the rim

C. A plastic-only valve stem to prevent any electromagnetic interference

D. No valve stem; the TPMS sensor screws directly into the wheel rim

104. Direct TPMS sensors transmit their data to the vehicle's receiver using:

A. Low-frequency radio transmission (315 MHz in North America, 433 MHz in Europe), with each sensor's ID paired to a wheel position

B. Wired connection through the wheel speed sensor harness to the BCM

C. Bluetooth wireless transmission to the infotainment screen during operation

D. Optical infrared transmission from the wheel to a window-mounted receiver

105. A modern tandem master cylinder has two separate hydraulic chambers (primary and secondary) so that:

A. One chamber is used for braking and the other for clutch operation in a manual transmission vehicle

B. The two chambers can provide different fluid pressures to front and rear brakes simultaneously

C. The chambers can be alternately used to extend brake fluid life through circulation

D. A failure of one circuit (e.g., a leaking caliper) leaves the other circuit operational, maintaining partial braking capability for safety

106. Modern flexible brake hoses are typically replaced when:

A. Brake fluid color darkens to indicate hose contamination of the fluid

B. The hose shows any sign of dirt or road grime accumulation on its surface

C. The hose shows external cracking, swelling, weeping, or internal collapse symptoms; age-based replacement (6-10 years) is also recommended

D. The vehicle reaches 50,000 km on the original brake hoses regardless of condition

107. Body filler (Bondo, plastic body filler) should be applied:

A. Directly over rusted metal to seal the rust and prevent further deterioration

B. Over clean, sanded bare metal, in thin layers (typically less than 6 mm thick), with proper hardener mixing ratio

C. In one thick layer (up to 25 mm) to fill large dents at once

D. Without sanding the metal first, to preserve the underlying paint layer

108. Repair of modern high-strength steel (HSS) and ultra-high-strength steel (UHSS) body panels typically requires:

A. Heating the panel to red temperature to soften the steel for reshaping

B. Welding with maximum heat input to ensure full penetration

C. Sanding to thin the panel for easier hammer-and-dolly reshaping

D. Following manufacturer-specific procedures: no-heat repair, specified weld settings, and section replacement at approved cut locations — heat compromises HSS strength

109. Cloudy, oxidized headlight lenses are restored by:

A. Replacing the entire headlight assembly because plastic lenses cannot be restored

B. Polishing with toothpaste or generic household cleaners

C. Sanding the lens (progressive grits from coarse to fine) to remove the UV-degraded surface, then applying a UV-resistant clear coat

D. Soaking the lens in hot water for 30 minutes to remove the oxidation

110. Modern panel bonding adhesive used in collision repair:

A. Replaces or supplements welding for attaching certain body panels (e.g., quarter panels, roof skins), per manufacturer-specified procedures

B. Replaces all welding in modern collision repair regardless of vehicle make

C. Is applied as a paint coating over completed welds for corrosion protection

D. Is used only for trim attachment, not for structural panel bonding

111. A power window that has a "thunking" sound from the door and falls into the door when operated typically has:

A. A failed door lock actuator that is interfering with the window mechanism

B. A failed window regulator (broken cable or cracked plastic guide), letting the window detach and fall inside the door

C. A failed BCM that has lost coordination with the window motor

D. Worn door hinges that have allowed the window track to misalign

112. A power mirror that moves in only one direction (e.g., left/right works but up/down does not) typically has:

A. A failed mirror glass that has cracked invisibly during operation

B. A failed BCM affecting only the affected motor direction

C. A failed mirror switch wiring open circuit affecting all mirror functions

D. A failed motor (one of the two motors inside the mirror assembly, since each axis has its own motor) for the non-functional direction

113. A door check strap (also called a door limiter or door arrester) controls:

A. The door's swing during a side impact collision to protect occupants

B. The door's electronic lock function when the vehicle is in motion

C. The door's opening positions (typically intermediate hold positions and full-open stop), preventing the door from swinging too far or closing too fast

D. The door's seal compression against the body during closing

114. A vehicle's rear liftgate gas strut that no longer holds the liftgate fully open is replaced by:

A. Supporting the liftgate, releasing the strut's spring clips or ball-sockets, installing the new strut, and verifying it holds the liftgate fully open

B. Repairing the strut by adding compressed air through a valve fitting

C. Lubricating the strut's exterior shaft with grease to restore its function

D. Replacing the entire liftgate to ensure the new strut works properly

115. A vehicle's sunroof interior sunshade that has broken or torn requires:

A. Replacement of the entire sunroof assembly to access the sunshade for service

B. Removal of the headliner (or dropping the headliner) to access the sunshade's tracks and motor/cable mechanism, then replacing the sunshade

C. Cutting an access hole in the headliner to reach the sunshade directly

D. Replacement of the windshield to allow access to the sunshade tracks

116. A trunk lid gas strut (lift support) typically attaches at both ends with:

A. Welded brackets that must be cut off and re-welded for replacement

B. Bolts that require special tools to remove from the body

C. Threaded ends that screw into the trunk lid and body brackets

D. Ball-socket connectors with spring clips, removable by prying off the clips and pulling the strut from the ball studs

117. Active cell balancing in a high-end EV BMS works by:

A. Bleeding charge from higher-voltage cells through resistors until balanced

B. Using mechanical switches to physically reroute current around cells

C. Transferring charge from higher-voltage cells to lower-voltage cells through capacitor or inductor circuits, preserving the energy rather than dissipating it as heat

D. Allowing the highest-voltage cell to vent through a pressure relief valve

118. The high-voltage contactors in an EV battery pack:

A. Are large solenoid-operated switches that connect or disconnect the high-voltage battery from the rest of the vehicle, controlled by the BMS during start-up and shutdown

B. Are passive thermal fuses that melt to disconnect the battery in case of overheating

C. Are mechanical switches operated by the driver's keyless entry fob input

D. Are part of the air conditioning compressor circuit on hybrid vehicles only

119. After opening the high-voltage circuit on an EV (via MSD or contactor opening), the DC bus capacitors in the inverter:

A. Discharge immediately to zero volts within milliseconds of disconnection

B. May hold dangerous voltage for several minutes (varies by design); the manufacturer's specified wait time before measurement is mandatory before declaring the system de-energized

C. Discharge through the chassis ground continuously during operation

D. Require external resistors to discharge during normal service operations

120. An EV's insulation monitoring device (IMD) continuously measures:

A. The high-voltage battery state of charge during normal operation

B. The temperature of each battery cell within the pack during driving

C. The electrical isolation (insulation resistance) between the high-voltage system and the vehicle chassis, alerting the BMS if leakage develops

D. The vehicle's overall power consumption during driving operation

121. The High Voltage Interlock Loop (HVIL) on an EV is a:

A. A high-voltage DC circuit that powers the cabin heater elements during operation

B. The traction battery's main power conductor running through the vehicle chassis

C. A grounding system that connects the HV battery negative terminal to the chassis

D. A low-voltage loop running through every HV connector; if any connector is opened, the loop breaks and the BMS opens the contactors to de-energize the system

122. Vehicle-to-Load (V2L) capability on a modern EV allows:

A. The EV to receive a wireless charging signal from another vehicle's battery

B. The EV's battery to power the manufacturer's central servers during operation

C. The EV's HV battery to power external 120V AC or 240V AC devices (tools, appliances, another EV) through an integrated inverter

D. The driver to load digital media onto the infotainment system through Bluetooth

123. During AC charging at a Level 2 EVSE (Electric Vehicle Supply Equipment), the EV and EVSE communicate through:

A. Control Pilot (CP) and Proximity Pilot (PP) signals in the J1772 connector, negotiating charging current and verifying connection before energizing

B. A separate dedicated cellular connection to the manufacturer's servers

C. The OBD-II port through a dedicated wired connection to the charging station

D. The vehicle's wireless Bluetooth signal to the user's smartphone application

124. An EV's state of charge (SOC) calibration:

A. Is performed only at the factory during initial vehicle assembly procedures

B. Is refined during normal driving through cell voltage monitoring under known load conditions and during specific operating events (e.g., reaching full charge or near-full discharge), preventing SOC drift over time

C. Cannot be calibrated and always degrades over the vehicle's life

D. Is reset by the technician at every service interval using a scan tool procedure

125. At end-of-life, a typical EV traction battery is:

A. Disposed of in a regular landfill as standard automotive waste

B. Drained of its electrolyte before any disposal procedures occur

C. Recovered for reuse (second-life storage) or recycled through specialized processors that extract lithium, cobalt, nickel, and other valuable materials

D. Replaced with a 12V lead-acid battery and the EV converted back to gasoline operation

Practice Exam 9: Answer Key and Explanations

1. D — Provincial occupational health and safety legislation grants every worker the right to refuse work they reasonably believe is unsafe. The employer must investigate the concern before assigning the work to another or disciplining the refusing worker; this right is foundational to the internal responsibility system that underlies all workplace safety in Canada.

2. C — Three-point contact (two hands and one foot, or two feet and one hand) keeps the worker stable on the ladder even if one limb slips or releases. This is the standard recognized in provincial OHS regulations and ANSI ladder safety standards for portable ladder use.

3. A — Provincial OHS regulations and CSA fall arrest standards specify that anchor points must withstand at least 22.2 kN (5,000 lb) of static load per worker attached. This safety factor accommodates the dynamic forces generated during a fall arrest event, which significantly exceed the worker's static weight.

4. B — Most provincial OHS regulations set the 8-hour TWA noise exposure limit at 85 dBA (some provinces use 87 dBA), above which hearing protection and a hearing conservation program are required. Sustained exposure above this level causes permanent noise-induced hearing loss over time.

5. D — Chronic exposure to hand-arm vibration causes progressive damage to the small nerves and blood vessels in the hands. The classic HAVS symptoms are numbness, tingling, blanched fingers (Raynaud-like episodes), and reduced grip strength, all of which can become permanent if exposure continues.

6. C — Provincial OHS regulations typically require a JHSC at workplaces with a specified minimum number of regularly employed workers (often 20+, varies by province). The committee provides a structured channel for workers and management to identify and resolve workplace hazards together.

7. B — A JSA breaks a specific task into steps, identifies hazards at each step, and develops controls before work begins. The proactive approach prevents incidents that reactive analysis only captures after harm has occurred.

8. A — Three points of contact when mounting or dismounting heavy equipment prevents falls from a slip or loss of grip. Falls from equipment are a leading cause of serious workplace injury in the trades.

9. D — Toolbox talks are short pre-shift safety briefings that communicate task-specific hazards, recent incidents, and reminders relevant to the day's work. Worker participation makes them more effective than one-way announcements, and they supplement (not replace) formal training programs.

10. C — Bore is the inside diameter of the cylinder; stroke is the linear distance the piston travels between TDC and BDC. Together, bore and stroke determine the cylinder's displacement (swept volume) per power cycle.

11. A — Cylinder volume equals $(\pi/4) \times \text{bore}^2 \times \text{stroke}$, the standard formula for the volume of a cylinder of circular cross-section. Multiplying by the number of cylinders gives total engine displacement.

12. B — A wet sleeve has its outer surface exposed directly to engine coolant, providing efficient cooling and easy replacement; a dry sleeve is pressed into a finished block bore with no coolant contact. The terms describe how the cylinder liner interfaces with the cooling system.

13. D — Bearing crush is the slight excess height of each bearing shell above the rod cap parting line, designed so that torquing the cap seats the bearing firmly in the bore. Without crush, the bearing would spin in the rod under load, destroying the rod and journal.

14. C — Inline-4 engines have inherent secondary vibrations at twice crank speed because the pistons reach peak velocity at slightly different positions in each half-rotation. Balance shafts spinning at twice crank speed in opposite directions generate equal and opposite forces, cancelling these vibrations.

15. A — A roller follower rolls along the cam lobe rather than sliding, dramatically reducing friction and allowing more aggressive lobe profiles than a flat-tappet design. The reduced friction also extends service life and improves fuel economy under normal operation.

16. B — Hydraulic lifters use engine oil pressure inside the lifter body to extend a plunger that takes up all clearance in the valve train, maintaining zero lash automatically. Solid roller lifters require periodic adjustment because they have no internal compensation for wear or thermal expansion.

17. D — In a pushrod (OHV) engine, the camshaft sits inside the engine block and operates lifters and pushrods that travel up to the cylinder head, where rocker arms transfer the motion to the valves. In an OHC engine, the camshaft sits in the cylinder head and operates the valves directly or through short rocker followers.

18. A — Piezoelectric injectors use a stack of piezo crystals that expand by a few micrometres when voltage is applied, opening the injector pintle faster and with finer control than a solenoid-driven needle. The faster response time enables multiple precise injections per combustion cycle, important for emissions and combustion noise control.

19. C — When oil is added through the spark plug hole, it temporarily seals worn ring gaps and improves cylinder sealing during the compression stroke. The large pressure increase between dry and wet readings indicates the rings (not the valves or head gasket) are the leak path; valve and gasket leaks do not respond to oil sealing.

20. B — A steady but low vacuum reading indicates uniform poor cylinder sealing across all cylinders, with several common causes: late ignition timing reduces effective combustion pressure, an exhaust restriction back-pressures the cylinders, and worn rings allow blow-by past the pistons. The steady reading distinguishes these from valve or specific-cylinder problems, which fluctuate.

21. D — IMRC systems use butterfly valves inside the runners to either change the effective runner length (long at low RPM, short at high RPM for better cylinder filling) or to create swirl and tumble that promote combustion mixing. Both purposes improve volumetric efficiency and emissions across the RPM range.

22. A — Active DPF regeneration adds extra fuel through post-injection (or in some systems an in-exhaust fuel doser) to raise exhaust temperature to 600°C+, hot enough to oxidize accumulated soot to CO2. Passive regeneration relies on naturally high exhaust temperatures from heavy load operation and does not require additional fuel.

23. C — DEF dosing rate is typically 2-5% of fuel consumption, varying with engine load and the amount of NOx the SCR must reduce. The relatively low dosing rate is why DEF tanks are much smaller than fuel tanks but still require refilling at regular intervals.

24. B — A piezoelectric knock sensor generates a voltage signal proportional to vibration, and a band-pass filter inside the PCM (or the sensor itself) isolates the frequencies characteristic of detonation (typically 5-15 kHz). When the PCM detects these frequencies, it retards ignition timing to eliminate the knock and protect the engine.

25. D — A hydraulic timing chain tensioner is filled with oil under pressure during operation, keeping the chain tight. During engine shutdown the oil bleeds out; on cold start the tensioner momentarily lacks pressure, allowing chain slack and a rattle that quiets as oil pressure rebuilds.

26. A — SCR catalysts require a minimum operating temperature (typically above 200°C) for the chemical reaction between DEF (urea) and NOx to proceed efficiently. Below this threshold, DEF dosing is suspended because the urea would not decompose to ammonia or reduce NOx effectively, wasting reagent and risking DEF crystallization in the exhaust.

27. C — Most manufacturers set the oil pressure warning lamp threshold between 5 and 7 psi, well below normal operating pressure but indicating dangerously low pressure that will cause bearing damage if the engine continues to run. The lamp is a final warning, not a normal-low-pressure indicator.

28. B — A MAP sensor measures absolute pressure in the intake manifold (referenced to vacuum, not atmosphere). The PCM uses MAP along with RPM and IAT to calculate engine load and determine the correct fuel injection and ignition timing for each combustion cycle.

29. D — Speed-density fuel control calculates airflow mathematically from MAP, RPM, and IAT using the speed-density formula, which combines the ideal gas law and engine volumetric efficiency. This contrasts with mass-airflow systems that measure incoming air directly with a MAF sensor.

30. A — A PCV valve normally vents crankcase blow-by gases into the intake manifold while admitting filtered fresh air to ventilate the crankcase. When stuck closed, blow-by accumulates and pressurizes the crankcase, forcing oil past gaskets, seals, and dipstick tube into the engine bay or onto exhaust components.

31. C — A colder-than-actual IAT reading tells the PCM that the incoming air is dense, so it adds fuel for the assumed greater air mass and may retard timing to prevent imagined knock. The result is a rich mixture with reduced fuel economy, possibly black smoke or rough running, and slightly less power.

32. B — A gateway module routes messages between different vehicle networks (HS-CAN, LS-CAN, LIN, FlexRay, Ethernet) that operate at different speeds and protocols. It also enforces security by filtering which messages can cross between buses, an important defence against unauthorized access through the OBD-II port.

33. D — High-speed CAN relies on differential signalling between CAN-H and CAN-L; a short to ground on CAN-H pulls one side of the differential pair to 0V and destroys the voltage difference the receivers look for. If the network supports fault-tolerant single-wire fallback, communication continues at reduced rate; otherwise the bus fails entirely.

34. A — OBD-II Mode 06 retrieves the specific test results from each on-board emissions monitor, including the measured value, the minimum and maximum limits, and pass/fail status. Mode 06 is valuable for diagnosing borderline emissions faults before they set a confirmed DTC.

35. D — A used module carries its original vehicle's configuration data (VIN, options, security code), which mismatch the new vehicle and trigger network DTCs. Most modules must be reflashed with the new vehicle's calibration and reconfigured to match before they will function correctly in the recipient vehicle.

36. D — Firmware updates change the underlying operating software that runs the module (a major change requiring full reprogramming), while calibration updates change only the parameter tables (timing maps, fuel maps, shift schedules) within the existing firmware. Calibration updates are more frequent and address driveability or emissions tuning without rewriting the module's core code.

37. B — J2534 is a SAE-defined pass-through standard that allows a generic computer running OEM diagnostic software to communicate with a vehicle through a J2534-compliant interface device. The standard supports DTCs, data PIDs, bidirectional commands, and module reprogramming using each manufacturer's own software.

38. A — A Bluetooth scan tool dongle plugs into the OBD-II port and transmits diagnostic data wirelessly to a phone, tablet, or laptop running the scan tool's app. The wireless link lets the technician move around the vehicle during diagnosis or road test without dragging a cable.

39. C — Vehicle telematics modules contain an embedded cellular modem with a SIM card, communicating with the manufacturer's servers over the same cellular networks used by phones. The connection enables real-time features like remote start, vehicle location, eCall (automatic crash notification), and over-the-air software updates.

40. B — CAN arbitration is non-destructive: when two modules try to transmit simultaneously, the bus state during each bit reveals whose ID is lower (more dominant bits early in the ID). The lower-ID message wins and continues; the higher-ID module sees it has lost and waits for the bus to be idle before retrying.

41. D — Differential signalling on high-speed CAN requires both CAN-H and CAN-L wires to function; an open on either wire destroys the differential pair. Some networks fall back to single-wire fault-tolerant operation at reduced speed if the protocol and transceivers support it; otherwise communication on the bus fails until the open is repaired.

42. A — Module reflashing is sensitive to supply voltage variation: a brownout or interruption during the flash can leave the module in a partially-programmed, unrecoverable state. An approved battery maintainer/stabilizer holds the battery voltage steady through the entire flash, and disturbing any connection mid-flash can corrupt the module.

43. C — The snapshot function captures PCM data parameters continuously during a road test for review afterward. It is invaluable for intermittent faults that are hard to reproduce on the bench because

the technician can drive to recreate the symptom, then examine the parameter trace at the exact moment of fault.

44. D — The throw-out (release) bearing contacts the pressure plate diaphragm fingers only when the clutch pedal is depressed. Noise that appears with the pedal down and disappears with the pedal up isolates the wear to the release bearing rather than to the disc, pressure plate, or pilot bearing.

45. B — The diaphragm spring fingers in a modern clutch pressure plate provide the lever action that disengages the clutch when the throw-out bearing pushes against them. Pushing the fingers inward releases the spring's clamp force on the pressure ring, allowing the disc to separate from the flywheel.

46. A — A worn or chipped flywheel ring gear meshes poorly with the starter pinion during cranking, producing the characteristic grinding or clattering. Once the engine starts and the starter disengages, the noise stops because the ring gear no longer contacts anything during normal operation.

47. C — Transmission mounts isolate the powertrain from the body while resisting torque reactions during acceleration and deceleration. A failed mount lets the transmission shift in its mounts under torque load, producing the characteristic clunk on accel/decel transitions and vibration at idle when the mount cannot damp engine pulses.

48. D — A long driveshaft would whip and lose balance if supported only at its ends; the center support bearing provides a midpoint pivot that keeps the assembly straight at speed. The bearing carrier is mounted to the chassis through rubber to isolate driveline vibration from the body.

49. B — A wet DCT runs its clutch packs immersed in transmission fluid, providing cooling and lubrication suitable for high-torque applications. A dry DCT uses friction clutches without oil bath (like a manual transmission), which is simpler and lighter but limited to lower-torque applications.

50. A — A stall test holds the brakes firmly while applying full throttle in drive; the torque converter multiplies engine torque against the transmission's first-gear holding components (clutches and bands). Engine RPM that rises significantly above the specified stall speed indicates a clutch pack or band is slipping internally, allowing extra rotation beyond what the converter would normally produce.

51. C — A torque converter shudder felt at light cruise is the signature of a worn lock-up clutch friction surface that slips during partial engagement (electronic controlled capacity clutch mode). The shudder feels like driving over rumble strips and is most noticeable at light throttle in the lock-up RPM band.

52. B — ATF visible at the front of the transmission bell housing points to the front pump seal or the torque converter seal, both located at the very front of the transmission case where the converter passes through. Other transmission leak points (pan, rear seal, cooler lines) drip from their own respective locations on the case.

53. A — A restricted transmission cooler reduces heat rejection to the radiator (or ambient air), allowing ATF temperature to climb above its operating range. Sustained high ATF temperature accelerates fluid breakdown and can trigger an over-temperature DTC; severe cases damage internal friction materials.

54. D — A gear that pops out under load reversal has lost the mechanical engagement that holds it in place: a worn shift fork can no longer hold the gear's sliding collar fully engaged, a worn detent (notch and spring-loaded ball) lets the shift rail move, or worn dog teeth slip apart under deceleration load. Synchronizer wear causes grinding on shift but does not cause gears to pop out.

55. B — Reverse engagement uses an idler gear placed between the input and output gear sets; the extra gear in the train reverses the direction of output rotation. Because the idler is engaged only when reverse is selected, reverse gear in most manual transmissions has no synchronizer and must be selected only at a complete stop.

56. C — Pinion gear runout is measured to verify the pinion gear's main shaft is straight (not bent or eccentric from a previous impact) before assembly. A bent pinion produces irregular tooth contact, accelerated wear, and noise even after correct depth and preload setup.

57. A — A numerically higher final drive ratio (4.10:1 versus 3.42:1) means the driveshaft turns more times per wheel revolution, so engine RPM increases at any given vehicle speed. The change improves acceleration (more torque multiplication) but reduces top speed and makes the speedometer/odometer read inaccurately unless recalibrated.

58. D — A properly maintained U-joint rotates smoothly through its full range with light, even resistance; binding means the needle bearings inside the cap are dry, contaminated, brinelled, or seizing. U-joint replacement is the only repair; failure to replace results in driveline vibration and eventual driveshaft separation.

59. B — If the slave cylinder is extending correctly, the hydraulic system is functional and the clutch should release. Remaining drag must therefore be mechanical: a worn pilot bearing in the crankshaft (or flywheel bore) seizes the transmission input shaft to the crankshaft, dragging the disc even when the pressure plate has released.

60. C — An AMT is mechanically a conventional manual transmission, but the driver's manual clutch and shift inputs are replaced by electric or hydraulic actuators controlled by a TCU. The arrangement is simpler than a planetary automatic but lacks the smoothness of a torque-converter automatic or DCT during shifts.

61. A — Alternator brushes are spring-loaded carbon blocks that slide against the rotating slip rings on the rotor shaft, supplying current to the rotor's field winding. The brushes wear gradually over time and can produce intermittent or no-charge faults when worn out.

62. D — Each of the six rectifier diodes in a three-phase alternator handles one direction of one phase. A single failed diode does not stop the alternator entirely but reduces its current capacity by about one-sixth and lets significant AC ripple bleed through to the DC output, visible on a scope at the battery terminal.

63. B — Lead-acid battery sulfation occurs when the battery sits at low state of charge for extended periods; the lead sulfate formed during normal discharge crystallizes into a hard, electrically inactive coating on the plates. Recharging the battery promptly after discharge prevents the crystals from hardening, but established sulfation is largely irreversible.

64. C — AGM batteries hold the sulfuric acid electrolyte absorbed in fiberglass mat separators between the plates, eliminating free liquid. The construction enables higher peak discharge rates, greater vibration resistance, deeper cycling tolerance, and spill-proof operation in any orientation, at higher cost than equivalent flooded batteries.

65. A — A modern voltage regulator targets 13.5-14.7 V at the battery terminals, with the exact setpoint adjusted for battery state of charge and ambient/battery temperature. Voltage outside this band points to a regulator, wiring, or battery problem rather than normal operation.

66. D — Maxi-fuses (MAXI blade) are physically larger than standard mini-blade fuses and are rated for higher current values, typically 20 to 100 amps. They are used in main supply circuits like the alternator

output, ABS pump motor, cooling fan, and other high-current loads where mini-fuses would be overstressed.

67. B — Standard ISO automotive relays use terminals 85 and 86 for the coil and 30, 87, and 87a for the switched contacts. Energizing the coil (85 to 86) closes the high-current switch from 30 to 87, the basic switching action used throughout the vehicle.

68. A — Transport Canada has required DRL on all light-duty vehicles sold in Canada since 1990, ensuring vehicles are conspicuous on the road during daylight. DRL activates automatically whenever the engine is running and the headlight switch is off or in the auto position, illuminating either dedicated low-output lamps or dimmed headlamps.

69. D — Adaptive headlight systems use steering wheel angle (and often vehicle speed and yaw rate) to swivel the headlights into corners, illuminating where the driver is about to drive rather than straight ahead. The technology significantly improves visibility on winding roads at night without dazzling oncoming traffic.

70. C — Rain-sensing wipers use an optical sensor that emits infrared light into the windshield glass at an angle producing total internal reflection back to a photodiode. Water on the outer surface disturbs the reflection by absorbing or scattering the light, and the change in return signal triggers the wiper at an appropriate speed.

71. B — The guide lines overlaid on the backup camera image are generated by the camera module or infotainment system in software, projecting predicted vehicle path based on steering angle and known wheelbase and track dimensions. The dynamic lines update as the driver turns the wheel, helping the driver predict the vehicle's reverse path.

72. A — USB Power Delivery over USB-C uses a digital negotiation protocol between source and device to select a higher voltage (up to 20V) and current (up to 5A), supporting up to 100W in standard implementations. Standard USB-A is limited to 5V and typically 2.1A or less, insufficient for fast-charging modern phones and laptops.

73. C — Kick-to-open liftgates use capacitive proximity sensors (or short-range radar) under the rear bumper to detect a foot or leg motion. The system requires the key fob to be present in or near the vehicle as a security gate before opening; without the fob, the kick gesture is ignored.

74. C — A capacitive touch sensor in the door handle detects the change in capacitance produced when a hand approaches or touches the handle. This signal wakes the BCM, which initiates an exchange with the key fob over LF/UHF radio; if the fob authenticates as nearby, the door unlocks before the user has fully grasped the handle.

75. B — A non-responding switch is diagnosed by confirming the switch operates electrically (continuity or voltage change on actuation) and that the BCM receives the signal at its input pin. If both check good but the trunk does not release, the fault is downstream at the actuator or BCM output; if the signal is missing, the switch or wiring is the fault.

76. A — A heated steering wheel must conduct current to a component that rotates 360° or more, similar to the airbag and steering controls. A slip ring (or in some designs the same clock spring used for the airbag) maintains continuous electrical contact as the wheel turns, supplying current to the heating element in the rim.

77. D — An air quality sensor in the fresh air intake detects odours, hydrocarbons, NOx, and other pollutants in the outside air. When the sensor detects elevated contaminants (passing a smoking truck, in a tunnel), the climate control switches the air intake to recirculation mode automatically, then switches back to fresh when the air clears.

78. C — Self-leveling headlamps use ride height sensors (typically at the rear axle, sometimes front as well) to detect vehicle pitch under load. The BCM commands stepper motors inside the headlamp housings to tilt the beams up or down, keeping the cutoff line at the same point on the road regardless of cargo or trailer load.

79. B — The heated wiper park area is an electrically heated strip in the windshield at the bottom of the wipe arc, where the wipers rest. It prevents ice from binding the blades to the glass during cold weather, allowing the wipers to free themselves and operate normally on a frost-covered windshield.

80. A — A power inverter converts the vehicle's 12V DC battery output into 120V AC at the standard household frequency (60 Hz in North America). The output is provided through one or more standard AC outlets, allowing the user to operate small AC-powered tools, appliances, or chargers from the vehicle's electrical system.

81. D — Auto-down windows monitor motor current or Hall-sensor pulse rate (representing window speed) during travel. An abrupt change indicates an obstruction, and the BCM reverses the window immediately to prevent injury, as required by safety regulations for one-touch operation.

82. C — Rear window defroster grids draw significant current (typically 15-30 amps) and would drain the battery and overheat their connections if left on indefinitely. Most BCMs run the defroster on a 10-15 minute timer that turns it off automatically; the driver may re-enable it for additional cycles if needed.

83. B — Battery and alternator faults can produce similar symptoms (slow cranking, warning lamps, intermittent operation), so isolating each component independently is the diagnostic principle. The battery is load-tested after dissipating surface charge; the alternator is tested under load with a carbon pile or shop tester; only after isolating the failed component is replacement recommended.

84. A — A rounded or seized bleeder screw is approached progressively: penetrating oil and heat to break the corrosion bond, careful re-machining or extraction with a bleeder screw extractor tool, and as a last resort replacement of the caliper or wheel cylinder. Destructive methods (drilling, snapping) typically damage the threaded bore beyond simple repair.

85. D — The parking brake equalizer sits in the cable run between the lever (or pedal) and the two rear cables, dividing the applied force equally between the left and right rear wheels. Without the equalizer, slight differences in cable length or wear would apply the parking brake unevenly.

86. B — A combination valve (or older proportioning valve) reduces hydraulic pressure to the rear brakes proportional to vehicle deceleration, preventing rear wheel lockup during heavy braking when weight transfers forward and the rear wheels lose grip. Many combination valves also include metering and pressure differential warning functions in a single housing.

87. C — Hold-down springs and pins keep the brake shoes secured against the backing plate so they cannot tip outward or fall out of position. The pin passes through the shoe and engages a cup or retainer held by the spring; the arrangement allows the shoes to move radially against the drum during application while constraining axial movement.

88. A — Active wheel speed sensors produce a signal whose amplitude depends on the magnetic flux change at the sensor; metallic debris, grease, or contamination on the sensor or tone ring weakens the

signal. Cleaning both surfaces and verifying any specified air gap restores the signal amplitude, often resolving the DTC without replacement.

89. D — Banjo bolts seal against new copper washers (one on each side of the banjo fitting) that crush slightly when torqued to specification, forming a fluid-tight seal. Reusing crushed washers or omitting them produces brake fluid leaks; torque to specification ensures correct sealing without damaging the bolt or fitting.

90. B — Brake fluid colour darkens with age and contamination, providing a general clue that fluid replacement may be due. The colour test is not a reliable measure of moisture content or boiling point; an electronic moisture tester or boiling point tester is the proper measurement for service decisions.

91. C — A single corner sagging below ride height typically indicates the load-bearing spring on that corner has weakened or broken. Replacement of the failed spring is required, and most technicians replace the matched spring on the opposite side at the same time to maintain even ride height and handling.

92. A — Visible oil residue on a shock absorber body indicates the rod seal has begun to leak. Even if the shock still functions on a bounce test, the leak will progress, the shock will gradually lose oil and damping ability, and ride control will degrade; replacement is the correct service.

93. D — A non-load-carrying (follower) ball joint does not support the suspension weight, so it is inspected for play at normal ride height by prying or rocking the joint and observing any axial or radial movement. The load-bearing joint must be unloaded for proper inspection because its play is masked by the suspension weight when at ride height.

94. B — Steering rack mounting bushings hold the rack rigid in the chassis under steering input loads. Failed bushings let the rack shift in its mounts when the driver applies steering force, producing a clunk on initial steering input and a vague, loose feel as the rack rocks slightly during operation.

95. C — Power steering fluid level markings reference either cold or hot conditions (depending on the reservoir markings on the specific vehicle); fluid level rises with temperature, so the check must be done at the correct reference temperature with the engine off. Other conditions (RPM, full lock, slope) skew the reading.

96. A — Wheel alignment uses the manufacturer's specifications for the specific year, make, model, and trim, with adjustment targeted at the centre of the acceptable tolerance range. Using the centre value provides the maximum margin for tire wear, handling, and ride characteristics within the OEM's design intent.

97. D — Tire pressure placard specifications are based on the tire's "cold" pressure, measured before driving or after at least 3 hours of rest, at typical ambient temperature. Hot pressure readings (after driving) will be 3-6 psi higher than cold; adjusting hot tires to placard pressure leaves them underinflated when cold.

98. B — Tire rubber compounds age regardless of tread wear, with cracking, hardening, and loss of grip developing over time even on tires with adequate tread. Most manufacturers and provincial inspection programs recommend replacement at 6-10 years from the DOT date code, regardless of remaining tread depth.

99. C — Directional tires have a tread pattern designed to rotate in only one direction (marked by arrows on the sidewall). Side-to-side rotation would reverse the rotation direction and degrade wet-weather performance; the correct pattern is front-to-rear on the same side, maintaining each tire's directional orientation.

100. A — A new wheel stud must be fully seated by pulling it tight into the hub flange, which presses the stud's knurled or serrated section into the hub bore for a permanent secure fit. Using a lug nut and a stack of washers (or a dedicated stud-pulling tool) draws the stud in tightly without hammering, which could damage the hub bearing.

101. D — After wheel installation, the lug nuts settle slightly as the tapered seats, stud knurls, and wheel-to-hub mating surface conform under driving loads. Re-torque (or torque verification) at approximately 50-100 km confirms the lug nuts remain at specification, preventing wheel-loss accidents from progressive loosening.

102. C — A tire bead seater is a pressurized canister that releases a rapid burst of compressed air into the gap between the tire bead and the wheel rim during inflation. The burst expands the tire briefly so that the bead pops over the rim's hump and onto the bead seat, allowing the technician to inflate the tire normally afterward.

103. B — Direct TPMS sensors are usually integrated with a metal valve stem, secured to the wheel rim with a clamp-in nut and sealed with an o-ring. The metal stem provides a strong mount for the sensor's mass and antenna while resisting fatigue at the bend point that snap-in rubber stems cannot match.

104. A — TPMS sensors transmit at low frequency (315 MHz in North America, 433 MHz in Europe and many other markets) using each sensor's unique ID. The vehicle's receiver associates each sensor ID with a specific wheel position during the relearn procedure, enabling per-wheel pressure reporting.

105. D — A tandem master cylinder has two independent hydraulic chambers (primary and secondary) feeding separate brake circuits, typically split front-rear or diagonally. A failure in one circuit loses fluid in only that chamber, while the other chamber retains pressure and provides partial braking — a critical safety design.

106. C — Brake hoses are replaced when external inspection reveals cracking, swelling, weeping, or external damage, or when internal collapse symptoms (caliper drag, slow release) appear. Many manufacturers also recommend age-based replacement at 6-10 years because rubber degrades over time even without visible damage.

107. B — Body filler is applied over clean, sanded bare metal in thin layers (typically less than 6 mm thick) with the correct hardener mixing ratio. Thick layers retain heat during cure, crack, and shrink unevenly; rusty or contaminated substrate prevents proper adhesion and traps moisture that eventually breaks the repair from underneath.

108. D — High-strength and ultra-high-strength steels lose their engineered strength if heated above the manufacturer-specified threshold, so repair procedures are strict: no-heat (cold) straightening where possible, specified weld settings to minimize heat input, and panel section replacement only at approved cut locations. Manufacturer collision repair manuals must be followed exactly.

109. C — Headlight lens oxidation is a thin UV-degraded layer on the polycarbonate surface. Sanding with progressively finer grits removes the degraded layer; applying a UV-resistant clear coat afterward prevents the underlying clear plastic from oxidizing again, extending the life of the restoration.

110. A — Modern panel bonding adhesives are engineered to replace or supplement spot welding for certain body panels (quarter panels, roof skins, door skins) per manufacturer-specified procedures. The technique avoids heat damage to nearby panels and provides corrosion protection at the bond joint that spot-welded joints often lack.

111. B — A power window that thunks and falls into the door has typically suffered window regulator failure: the cable broke, the plastic guide cracked, or the lift mechanism failed and released the glass. The glass falls into the door cavity and must be retrieved before regulator replacement and reinstallation can complete the repair.

112. D — A power mirror assembly contains two motors (one for horizontal, one for vertical movement); each axis operates independently. Failure of one motor disables movement in only that axis, while the other motor and the rest of the circuit (switch, BCM, wiring) continue to operate normally.

113. C — A door check strap controls the door's opening positions, typically providing intermediate hold positions and a hard stop at full open. The mechanism prevents the door from swinging too far open (damaging the hinge or hitting nearby objects) and prevents wind from slamming it closed against a person or hand.

114. A — Liftgate strut replacement is straightforward but requires the liftgate to be supported in the open position while the strut is released from its mounts. The strut's spring clips (or ball-socket connectors) at each end are pried off, the new strut is snapped into place, and operation is verified before the support is removed.

115. B — Replacing a torn or broken sunroof sunshade requires access to the sunshade tracks and cable/motor mechanism hidden above the headliner. The headliner is dropped or removed (a major job involving trim and visor removal), the sunshade replaced, and the headliner reinstalled.

116. D — Trunk lid (and most underhood and rear hatch) gas struts attach with ball-and-socket connectors at each end, retained by spring clips. To remove, the technician pries off the clip with a small flat tool and pulls the strut socket from the ball stud; installation reverses the process by snapping the socket onto the stud.

117. C — Active cell balancing transfers charge from higher-voltage cells to lower-voltage cells through capacitor or inductor-based converter circuits, preserving most of the energy in the pack. The approach is more complex and expensive than passive balancing but loses less energy to heat, an advantage in large EV packs.

118. A — High-voltage contactors are large solenoid-operated switches inside the battery pack that connect or disconnect the battery from the rest of the vehicle. The BMS opens the contactors at

shutdown, during faults, or during service, providing the primary means of isolating the high-voltage system electrically.

119. B — Even after the HV contactors open or the MSD is removed, the DC bus capacitors in the inverter store energy and can hold dangerous voltage for several minutes (the exact time depends on the design and any discharge resistors fitted). The manufacturer's specified wait time must be observed and the voltage verified with a meter before declaring the system de-energized.

120. C — An insulation monitoring device continuously measures the electrical isolation resistance between the high-voltage conductors and the vehicle chassis. Loss of isolation could energize the chassis and create a shock hazard, so the IMD alerts the BMS, which alerts the driver and may open the contactors depending on severity.

121. D — The High Voltage Interlock Loop is a low-voltage circuit that runs through every HV connector and major component, providing continuity only when all HV connectors are fully seated. If any HV connector is opened or unplugged, the loop breaks, the BMS detects the break, and the HV contactors open to de-energize the system before exposed conductors can be touched.

122. C — Vehicle-to-Load capability uses an inverter built into the EV (or supplied via the charging port) to convert the high-voltage battery's DC output into 120V or 240V AC. The output powers external devices through standard outlets — tools at a job site, household appliances during a power outage, or another EV through a special adapter.

123. A — During Level 2 AC charging through a J1772 connector, the EV and EVSE communicate over the Control Pilot (CP) line using a PWM signal that the EVSE varies to advertise its maximum current capacity. The Proximity Pilot (PP) line verifies the cable is securely connected and (on portable EVSEs) signals the cable's current rating before energizing the charging contactors.

124. B — EV state-of-charge calibration uses cell voltage measurements under known load conditions and at definite reference points (fully charged at the end of a charge session, nearly empty at low SOC events). Combined with coulomb counting between these events, the BMS refines its SOC estimate continuously, preventing the gradual drift that pure coulomb counting would accumulate.

125. C — End-of-life EV traction batteries retain significant capacity (typically 70-80% of original) and value: many are recovered for "second life" use in stationary storage applications, and at true end-of-life

specialized recyclers extract lithium, cobalt, nickel, and other valuable materials. Landfill disposal is regulated against because of the hazardous and economic content of EV cells.